

A Relational Frame Account of the Development of Complex Cognitive Phenomena: Perspective-taking, False Belief Understanding, and Deception

Louise McHugh, Yvonne Barnes-Holmes*, and Dermot Barnes-Holmes

National University of Ireland, Maynooth, Ireland

ABSTRACT

Cognitive psychologists have devoted considerable attention to the complex skills described as perspective-taking, understanding false belief, and deception. Much of the available research on these phenomena has been driven by a conceptual approach referred to as 'Theory of Mind'. The current paper reviews the Theory of Mind account of perspective-taking, false belief and deception in terms of the development of increasingly complex levels of understanding the informational states of the self and others. In contrast, these phenomena have attracted little interest traditionally from behavioral psychologists, and the current paper presents conceptual and empirical evidence that this is changing. Specifically, an alternative approach to these skills from a functional behavioral framework is presented in the context of Relational Frame Theory, a modern behavioral account of human language and cognition. The paper describes the relational frame approach to perspective-taking, false belief and deception, and presents several recent studies that have investigated this approach. The results of the studies indicate the potential utility of this approach and also show considerable overlap with the results of Theory of Mind research.

Key Words: Perspective-taking, false belief, deception, theory of mind, RFT, behavioral approximations.

RESUMEN

Los psicólogos cognitivos han dedicado una atención considerable a las habilidades complejas como la toma de perspectiva, la comprensión de las falsas creencias y el engaño. Gran parte de la investigación en estas áreas se ha desarrollado bajo la aproximación conceptual conocida como "Teoría de la Mente". Este trabajo revisa las explicaciones de la toma de perspectiva, las falsas creencias y el engaño basadas en la Teoría de la Mente, en términos del desarrollo de niveles cada vez más complejos de comprensión de los estados informacionales de uno mismo y de los otros. Por otra parte, tradicionalmente estos fenómenos han despertado poco interés para los psicólogos conductuales, y el presente trabajo presenta evidencias de que esto está cambiando. Concretamente, se una aproximación alternativa a estas habilidades complejas desde un punto de vista funcional-conductual, desarrollada en el contexto de la Teoría de los Marcos Relacionales, una

* Correspondence should be directed to: Yvonne Barnes-Holmes, Department of Psychology, National University of Ireland, Maynooth, Co. Kildare, Ireland. (Email: Yvonne.Barnes-Holmes@may.ie).

reciente propuesta conductual que aborda el estudio del lenguaje humano y la cognición. El artículo describe esta aproximación a la toma de perspectiva, las falsas creencias y el engaño, a la vez que presenta diversas investigaciones recientes sobre estos temas, llevadas a cabo bajo este marco conceptual. Los resultados obtenidos apuntan a la potencial utilidad de esta aproximación, y muestran una similitud considerable con los resultados de investigaciones llevadas a cabo en el contexto de la Teoría de la Mente.

Palabras clave: toma de perspectiva, falsas creencias, engaño, teoría de la mente, RFT, aproximaciones conductuales.

Much of the mainstream research into perspective-taking and the related phenomena of false belief understanding and deception has focused on Theory of Mind (ToM) as a means of understanding these phenomena, particularly as they are found to be absent in autistic populations (see Baron-Cohen, Tager-Flusberg, & Cohen, 2000). Recent behavioral research has shown an interest in such phenomena under the rubric of Relational Frame Theory (RFT), a modern behavioral approach to language and cognition (see Hayes, Barnes-Holmes, & Roche, 2001). According to RFT, it is the relational frames of "I-YOU", "HERE-THERE", "NOW"-THEN", and logical NOT that are central to the development of these phenomena. The RFT-based research approach has been to abstract these relational properties from the concepts and techniques employed by ToM research and to target them directly for intervention. The current paper presents a review of cognitive perspective-taking skills followed by a relational frame account of these phenomena and the empirical evidence in support of the RFT approach. The paper compares the ToM and RFT approaches and suggests that the latter approach may provide a useful functional analytic account of phenomena previously beyond the remit of the behavioral tradition.

Complex cognitive skills such as perspective-taking, understanding false belief, and deception have attracted considerable attention from mainstream psychologists, particularly those with an interest in Autistic Spectrum Disorder (ASD), in which these skills are believed to be deficient (Baron-Cohen, 1995). Research in these areas has been dominated by cognitive psychologists, whose work is commonly referred to as ToM (Baron-Cohen & Hammer, 1997; Baron-Cohen, et al., 2000). The concept of ToM refers, at least in part, to the ability of an individual to understand the relationship between beliefs and behavior, and thus to know, for example, that beliefs can be false as well as true (Premack & Woodruff, 1978). According to ToM researchers, one of the most important sets of cognitive skills that individuals require in order to demonstrate a fully-developed ToM involves knowledge of the informational states of the self and others. In the language of ToM, these component skills consist of five levels of understanding that range from simple visual perspective-taking to acting on the basis of false belief (Howlin, Baron-Cohen & Hadwin, 1999). Only when all five levels of ability have been established, would ToM researchers suggest that an individual has competent ToM repertoires with regard to understanding information. Additional repertoires

concerning the understanding of emotional (as opposed to informational) states of the self and others would, of course, also have to be established. Only with both sets of repertoires in place, would an individual be deemed to possess a ToM. The current article will include a modern behavioral account of the five levels of development that cognitive researchers have suggested are involved in the understanding of informational states.

THEORY OF MIND

According to Howlin, et al. (1999), there are five levels in the development of an understanding of another's mind. Level 1 involves the concept of *simple visual perspective-taking*, and, once established, assumes that an individual can understand that different people can see different things. This skill is typically assessed or established by presenting a scenario along the following lines. A card with a different picture on each side (e.g., a dog on one side and a cat on the other) is placed between the child and the experimenter so that each person can see only one side of the card. The child is then asked to identify what the experimenter sees. This question assesses a simple form of visual perspective-taking in which the child is asked to adopt the perspective of another with regard to the visual environment.

During the complex visual perspective-taking characteristic of ToM Level 2, individuals are expected to understand that different people may see the same things differently. In a typical trial, the experimenter and the child are seated opposite one another, with a picture positioned face up on the table between them. Given this physical arrangement, the participant, for example, will see the picture the right way up, whereas the experimenter will see the picture upside down. In this task the child is asked to describe what s/he can see and what the experimenter can see. The ability to respond to these questions correctly is said to involve complex perspective-taking skills because both individuals are actually viewing the same item, yet each has a different perspective on it.

At Level 3 of understanding informational states, individuals are expected to understand the principle that 'seeing leads to knowing'. In a typical scenario, a child is presented with an empty box, and is asked to close his/her eyes while the experimenter places an unknown object inside the box. The child is then asked to guess what is inside the box, and in order to respond correctly, the child should indicate that s/he cannot know what is inside the box because s/he did not see what was put in there. In a subsequent part of the trial, the child is then shown inside the box, and is asked "How do you know what is inside the box?" A correct answer involves the child stating that s/he can now know what is inside the box because s/he has seen inside. In order to determine the child's ability to adopt the perspective of another with regard to this task, a similar scenario is reenacted with a doll, and the child is asked to adopt the perspective of the doll with regard to the same events.

According to ToM, Level 4 in the development of informational states involves the ability to predict actions on the basis of true belief. A typical scenario used to test this level of understanding is as follows. A child is presented with two play scenes. In

one scene, a doll is placed beside a toy car, and the child is told that the doll was placed there earlier that morning. In the second scene, an identical doll is similarly placed beside a toy plane, and the child is told that this arrangement took place later in the day. The child is then instructed as follows: "This morning, you saw the doll near the car but you did not see the doll near the plane. Where do you think the doll is?" In order to respond correctly, the child should indicate that the doll is near the car. If the child is then asked: "Why do you think the doll is near the car?" s/he should indicate that this is where the doll had been seen before. If the child is then asked: "Where would you go to find the doll?" a correct response would indicate that s/he would look near the car. If the child is then finally asked: "Why will you go to the car?" a correct response would involve indicating that this is where the doll had been seen previously. From a ToM perspective, responding correctly to these questions indicates the knowledge that a person can only know what has been seen, and will act on this basis (i.e., true belief).

Level 5 of ToM consists of predicting actions on the basis of a false (rather than true) belief. Specifically, understanding false belief involves knowing that a person's mental perspective has a causal impact on his/her actions, even when that perspective runs counter to reality, and cannot be derived from it (Harman, 1978; Woodruff & Premack, 1979). A typical false belief scenario may be described as follows. A child is presented with a sweet box and asked: "What do you think is inside the sweet box?" Having not seen inside the box, the child will likely suggest that it contains sweets. However, unbeknownst to the child, the box contains pencils and not sweets. At this point in the trial, the box is opened and the child is allowed to see the pencils inside. The child is then asked: "Before we opened the sweet box, what did you think was inside?" A correct response involves the child stating that s/he previously thought there were sweets inside. If then asked: "What was really inside?", a correct response should now involve stating that there are pencils inside. According to ToM, responding correctly to these questions indicates the understanding that a person can act on the basis of previous beliefs that are false, as well as on current beliefs that are true. A similar scenario is then presented from the perspective of another (e.g., a doll), and the same questions are posed in order to determine the child's ability to respond to these tasks in accordance with an alternative perspective.

Another widely used task for assessing an individual's understanding of false belief is the *Unexpected Transfer Test* (Wimmer & Perner, 1983). In this task, a protagonist places an object in a particular location (e.g., location A) and then leaves. In the absence of the protagonist, the object is unexpectedly transferred from location A to location B, and thus, upon return, the protagonist mistakenly believes that the object is still in location A. In order to assess false belief abilities, a child may be asked to identify where the protagonist thinks the object is. Perner, Leekam, and Wimmer (1987) found that three-year-old children almost universally failed this task by suggesting that the protagonist will look for the object in its actual location (i.e., location B). Alternatively, children aged four years and older correctly determined that the protagonist believed the object to be in the location in which it was first placed (i.e., location A). According to Perner, et al. (1987), younger children fail the Unexpected Transfer Test, and thus

fail to demonstrate an understanding of false belief, because they do not yet understand the representational capacity of the human mind.

An understanding of false belief is believed to develop in its most complex form into the skills of deception (Baron-Cohen, et al., 2000). As suggested by the five levels of understanding described above, the development of an understanding of false belief and deception would appear to require the presence of both perspective-taking (Levels 1 to 3) and understanding true belief (Level 4) as prerequisite skills (Baron-Cohen, et al., 2000). According to ToM, deception can be conceptualized as a complex type of false belief understanding because it involves knowing that beliefs can be false and that they can be manipulated. In the language of ToM, however, competent deception skills also require motivation with regard to obtaining the pay-off that is likely to result from making someone else believe something to be the case when it is not (Baron-Cohen, et al., 2000; Sodian, Taylor, Harris, & Perner, 1991).

One of the most widely used tools for assessing deception skills in children is the *Maxi Task*, which consists of an extended version of the Unexpected Transfer Test (Premack, 1990). The first part of the task is similar to the scenario described above for false belief, and involves a story about a character (Maxi), who puts chocolate into a cupboard (e.g., the red cupboard). In his absence, Maxi's mother relocates the chocolate from the red cupboard to the blue cupboard. As in the previous task, the child's understanding of false belief is determined by asking the question: "Where will Maxi look for the chocolate when he returns"? In the second part of the task, Maxi's brother is introduced. In the unfolding scenario, his brother wants to have the chocolate and asks Maxi to tell him where it is. In an attempt to deceive his brother and to avoid him getting the chocolate, Maxi (who still believes the chocolate is in the red cupboard) tells his brother that the chocolate is in the blue cupboard (where in fact it is). In order to determine the child's ability to understand this combination of false belief and deception, s/he is asked: "Where will Maxi tell his brother the chocolate is?" According to ToM, a correct answer to this question depends on the child's interpretation of Maxi's intention to deceive his brother by giving him information that he knows to be false.

The literature on ToM conceptualizes the skills of perspective-taking, understanding false belief, and deception in terms of levels of understanding of informational states with regard to the self and others. These skills require a progression in levels of cognitive complexity from simple visual perspective-taking to understanding false belief, and the latter skill in Level 5 forms the basis of the most complex understanding of informational states, deception. According to ToM, this progression most likely occurs in a sequential manner with earlier skills (e.g., in perspective-taking) acting as prerequisites for the development of the more complex skills (e.g., deception). In the remaining parts of the current paper, we present an alternative interpretation of these ToM skills that has emerged from the field of behavioral psychology, and in particular from the modern behavioral account of language and cognition known as RFT. In describing the RFT account of these abilities, we will also summarize evidence from numerous empirical studies that have investigated the validity of the RFT concepts in this regard, and other studies that have attempted to remediate deficits in these areas using interventions

suggested by RFT. In the final section of the paper, possible areas of overlap between the ToM and RFT approaches to perspective-taking, understanding false belief, and deception will be discussed.

RELATIONAL FRAME THEORY AND PERSPECTIVE-TAKING

The relational frames that appear to be most critical for the development of perspective-taking skills are the deictic frames that specify a relation in terms of the perspective of the speaker (these are sometimes referred to as the perspective-taking frames). Unlike other relational frames, these do not appear to have formal or nonarbitrary counterparts (e.g., ‘same as’ arbitrary relations may be based on a learning history involving formal similarity). The three deictic frames that appear to be involved in perspective-taking are the frames of I and YOU, HERE and THERE, and NOW and THEN (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2001; McHugh, Barnes-Holmes, & Barnes-Holmes, 2004). 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. Consider a similar scenario to that presented for ToM Level 2, in which two children are sitting opposite one another and observing a picture placed on the table in front of them. In this arrangement, the child on one side of the table will see the picture the right way up, whereas the child on the other side will see the picture upside down. Although both children in this example are observing the same picture, the perspective of the child on one side is different from the perspective of the child on the other side. In other words, when the child on one side speaks of seeing the picture from “here”, it is not the same place as when the child on the other side speaks of “here”.

Although many instances of perspective-taking involve the spoken words “I, “you”, “here”, “there”, “now”, and “then” (e.g., “you were there then and I am here now”), RFT argues that the perspective-taking properties may be present even when these actual words are absent. Specifically, relevant phrases often include, or substitute, words that participate in frames of coordination with particular individuals, places, and times (e.g., “It is one o’ clock and I am at home [HERE and NOW], but Molly [YOU] is still at playschool” [THERE and NOW]). These substituted words serve the same contextual functions that would otherwise be provided by the actual words (e.g., “I” and “you”) themselves. For example, “Molly” or “her” may be functionally equivalent

*Table 1. Examples of the Perspective-taking Trial-types used by McHugh, et al. (2004).*I-YOU Frame*Simple I-YOU task*

"I have a red brick and you have a green brick. Which brick do you have? Which brick do I have?"

Reversed I-YOU task

"I have a red brick and you have a green brick. If I was you and you were me. Which brick would I have? Which brick would you have?"

HERE-THERE Frame*Simple I-YOU within Simple HERE-THERE task*

"I am sitting here on the blue chair and you are sitting there on the black chair. Where are you sitting? Where am I sitting?"

Reversed I-YOU within Simple HERE-THERE task

"I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me: where would I be sitting? Where would you be sitting?"

Simple I-YOU within Reversed HERE-THERE task

"I am sitting here on the blue chair and you are sitting there on the black chair. If here was there and there was here: where would you be sitting? Where would I be sitting?"

Double Reversed I-YOU/HERE-THERE task

"I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me, and if here was there and there was here: where would I be sitting? Where would you be sitting?"

NOW-THEN Frame*Simple I within Simple NOW-THEN task*

"Yesterday I was watching television, today I am reading. What am I doing now? What was I doing then?"

Simple YOU within Simple NOW-THEN task

"Yesterday you were watching television, today you are reading. What are you doing now? What were you doing then?"

Simple I within Reversed NOW-THEN task

"Yesterday I was watching television, today I am reading. If now was then and then was now: what would I be doing then? What would I be doing now?"

Simple YOU within Reversed NOW-THEN task

"Yesterday you were watching television, today you are reading. If now was then and then was now: what would you be doing then? What would you be doing now?"

Simple I within Simple HERE-THERE within Simple NOW-THEN task

"Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. Where was I sitting then? Where am I sitting now?"

Simple YOU within Simple HERE-THERE within Simple NOW-THEN task

"Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. Where were you sitting then? Where are you sitting now?"

Simple I within Reversed HERE-THERE within Simple NOW-THEN task

"Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here: where would I be sitting then? Where would I be sitting now?"

Simple YOU within Reversed HERE-THERE within Simple NOW-THEN task

"Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here: where would you be sitting then? Where would you be sitting now?"

Simple I within Simple HERE-THERE within Reversed NOW-THEN task

"Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If now was then and then was now: where would I be sitting then? Where would I be sitting now?"

Simple YOU within Simple HERE-THERE within Reversed NOW-THEN task

"Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If now was then and then was now: where would you be sitting then? Where would you be sitting now?"

Simple I within Double HERE-THERE/NOW-THEN Reversed task

"Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here and if now was then and then was now: where would I be sitting now? Where would I be sitting then?"

Simple YOU within Double HERE-THERE/NOW-THEN Reversed task

"Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here and if now was then and then was now: where would you be sitting now? Where would you be sitting then?"

to “YOU”, and “at playschool” may be functionally equivalent to “there”. What is important, from an RFT point of view, is the generalized relational activity and not the actual words themselves.

To date, several studies have investigated the RFT approach to perspective-taking. One of the earliest studies in this area was conducted by McHugh, et al. (2004), and employed a revised version of a test protocol developed previously by Barnes-Holmes (2001). Both studies involved a protocol that was designed to target explicitly the three perspective-taking frames of I-YOU, HERE-THERE, and NOW-THEN. In addition, the McHugh, et al. protocol investigated three levels of relational complexity across the perspective-taking tasks, referred to as: simple relations, reversed relations, and double reversed relations. This latter protocol contained trial-types that involved various combinations of the perspective-taking frames and levels of relational complexity, and these are outlined in Table 1.

Consider the following perspective-taking trial-type referred to by McHugh, et al. as a ‘Simple I-YOU trial,’ described as such because the I-YOU frame is targeted explicitly and the level of relational complexity is the lowest possible (i.e., simple). During this trial, participants were presented with the following question: “If I (Experimenter) have a red brick and YOU (Participant) have a blue brick: Which brick do I have? Which brick do YOU have?” According to RFT, responding correctly to this trial (i.e., “You/Experimenter have a red brick and I/Participant have a blue brick”) requires that participants respond in accordance with the I-YOU frame, under the contextual control of the if-then frame. In other words, the if-then frame determines the functions (i.e., of the red and blue bricks) that become attached to I and YOU in that context. McHugh and colleagues referred to this task as ‘simple’ in terms of relational complexity because neither of the I/YOU relations was reversed.

The McHugh protocol included similar trials (referred to as simple HERE-THERE trials) that involved the same level of relational complexity but that targeted the HERE-THERE frame (rather than I-YOU). In a simple HERE-THERE trial, the participants were instructed, for example, as follows: “I am sitting here on the blue chair, and you are sitting there on the black chair. Where are you sitting? Where am I sitting?” Although in this trial the HERE-THERE relations are targeted explicitly, it is also evident from the example that the task contains I-YOU relations. A correct response on this trial, therefore, requires that participants respond in accordance with both I-YOU and HERE-THERE frames, under the contextual control of if-then. In the third type of simple relational task presented by McHugh, et al., NOW-THEN relations were targeted explicitly. Consider the following example: “Yesterday I was watching television, today I am reading. What was I doing then? What am I doing now?” All NOW-THEN trials differed from the other trials in that they did not involve responding to both I and YOU simultaneously (see Table 1). Consider again the current example (referred to as a Simple I within Simple NOW-THEN trial) in which the participant was asked only to determine what I (the Experimenter) am/was doing. In other words, the participant was required to take only the perspective of another and the perspective of the self was not presented. In the development of the original perspective-taking protocol, Barnes-Holmes (2001) argued that this modification was necessary because if both perspectives are

requested during a NOW-THEN trial, some of the relations to be derived become unspecified. Consider, for example, the following hypothetical trial: “Yesterday I was watching television, today you are reading”. As a result of this information, you will be able to determine the I-THEN and the YOU-NOW relations, but the I-NOW and YOU-THEN relations cannot be specified without additional information (e.g., stating that I was watching television yesterday provides no information about what you were doing at that time). In order to address this issue, the perspective-taking protocols by Barnes-Holmes and by McHugh, et al. contained trials that targeted NOW and THEN relations from the perspective of I (Simple I within Simple NOW-THEN trials), and a similar number of trials that targeted NOW-THEN relations from the perspective of you (Simple YOU within Simple NOW-THEN trials).

According to RFT, a more complex level of relational responding is required to derive deictic relations when they are reversed (i.e., these tasks require a higher level of relational complexity than deriving simple relations). The McHugh protocol contained reversals of the relations from all three perspective-taking frames (see Table 1). Consider the following reversed I-YOU trial: “If I have a red brick and you have a green brick, and if I was you and you were me: Which brick would you have? Which brick would I have?” In the language of RFT, a correct response to this trial involves a transformation of functions in accordance with a deictic relation between I and YOU (required by the statement “if I was you and you were me”). More specifically, the mutually entailed relation between I and YOU transfers “red brick” from I to YOU and “green brick” from YOU to I. The protocol also contained trials involving similar reversals of the HERE-THERE and NOW-THEN relations (see Table 1). Once again, during NOW-THEN reversed trials only one perspective was tested in order to avoid the derivation of unspecified relations.

According to McHugh, et al., the third and highest level of relational complexity involves ‘double reversed relations,’ in which two types of deictic relations are reversed simultaneously. In the development of the perspective-taking protocol, Barnes-Holmes (2001) had designed two types of double reversal tasks. During I-YOU/HERE-THERE double reversals, the relations contained within the deictic frames of I-YOU and HERE-THERE are reversed simultaneously. Consider the following trial: “I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me, and if here was there and there was here: Where would you be sitting? Where would I be sitting?” (see Table 1). In this trial, the I-YOU reversal followed by the HERE-THERE reversal involves two sets of mutually entailed relations between I and YOU and between HERE and THERE, thus reversing the initially reversed relations. In simple terms, the participant deriving these relations ends up in the seat in which s/he originally started.

HERE-THERE/NOW-THEN double reversal trials followed the same format, but were based on the simultaneous reversal of HERE-THERE and NOW-THEN relations (rather than I-YOU and HERE-THERE relations). Consider the following example: “Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here, and if now was then and then was now: Where would I be sitting now? Where would I be sitting then?” Once again, the

participant deriving these relations ends up in the chair in which s/he started, because the two sets of mutually entailed relations between HERE and THERE and between NOW and THEN reverse the initially reversed relations.

In a related study, McHugh, Barnes-Holmes, O'Hara, & Barnes-Holmes (in press) exposed thirty-two undergraduate participants (aged 18-30 years old) to the tasks described above across four experimental conditions. These conditions were employed in order to investigate different ways of presenting the trials and different numbers of exposures to the various trial-types. During Conditions 1-3, the researchers employed the full perspective-taking protocol (referred to as the "extended protocol") developed by Barnes-Holmes (2001), which contained 265 trials. Only the format in which the extended protocol was presented differentiated these three conditions. Specifically, in Condition 1, the experimenter read all tasks aloud, and a range of visual aids were used during the presentation of each trial (similar items had been employed previously by Barnes-Holmes in an attempt to reduce the memory requirements of the experimental tasks when presented to young children.) In Condition 2, the trials were presented in written form to participants, and no visual aids were employed. This comparison was designed to determine whether the visual aids facilitated the relational performances of participants in the previous condition. In Condition 3, the experimenter once again read out the tasks, but during this condition no visual aids were employed. This condition was used to determine whether any differences recorded between Conditions 1 and 2 resulted from the participants' reading of the tasks or from the visual aids. During Condition 4, the researchers presented participants with an abbreviated version of the original protocol that consisted of only 66 (rather than 265) trials. Two key features differentiated this short protocol from the original extended protocol. First, although the short protocol contained all of the same trial-types, there were fewer exposures to each. Second, in the short protocol the trials were randomly presented, whereas in the original protocol the trial-types were presented in a fixed sequence of I-YOU, HERE-THERE, and NOW-THEN relations, respectively. Both of these modifications had arisen from the fact that the extended protocol had been designed originally by Barnes-Holmes (2001) for training with young children, whereas McHugh, et al. (in press) used both protocols for test purposes only with adult participants. Thus, in order to eliminate possible fatigue and order effects that resulted from use of the extended protocol in Conditions 1-3, McHugh, et al. employed the short protocol in Condition 4. In this condition the experimenter read the instructions and no visual aids were employed.

McHugh, et al. (in press) analyzed their findings in terms of the type of protocol employed across experimental conditions (i.e., they analyzed the data from the extended protocol used in Conditions 1-3 separately from the data from the short protocol employed in Condition 4). The findings from this study first revealed no significant differences among Conditions 1-3, suggesting that neither the person reading the tasks nor the visual aids had an effect on participants' performances. Consistent significant differences, however, were recorded for both relation type and relational complexity within these conditions. With regard to relation type, participants' performed significantly better on I-YOU relations compared to HERE-THERE relations, but no significant differences were recorded among the other relations. With regard to relational complexity,

participants in Conditions 1-3 performed significantly better on simple relations compared to both reversed and double reversed relations; and on reversed relations compared to double reversed relations.

The results of Condition 4 revealed significantly better performances on I-YOU relations when compared to both HERE-THERE and NOW-THEN relations. Because the latter finding was not recorded in the former conditions, it suggests that the lack of differences observed therein might well have resulted from an order effect (i.e., the extensive exposure to HERE-THERE trials facilitated correct responding on the NOW-THEN trials). With regard to relational complexity in Condition 4, participants produced significantly better performances on simple relations when compared to both reversed and double reversed relations (but no significant difference was recorded between reversed and double reversed relations as in previous conditions). The researchers suggested that one possible reason for this latter difference across the protocols was that most of the double reversal trials in the extended protocol were presented at the end of the protocol, whereas this was not the case with the short protocol. The significant differences, therefore, in the former protocol may have resulted from fatigue effects that produced increases in the error rates on the double reversed relational performances, but not on the reversal trials presented before that point. In summary, therefore, the findings from McHugh, et al. suggested that adult participants performed differently on different types of deictic relations. Specifically, the participants performed better on I-YOU relations than on HERE-THERE or NOW-THEN relations. These participants also performed differently on the different levels of relational complexity, and produced better performances on simple relations than on reversed or double reversed relations. Overall, these significant differences in performances for relation type and relational complexity suggested that even in adult populations, perspective-taking appears to consist of functionally distinct relational components.

In the subsequent study by the same authors (McHugh, et al., 2004), the shortened perspective-taking protocol was used in an attempt to conduct a developmental profile of relational perspective-taking skills in individuals from different age groups. The same 66-trial protocol used in the previous study (Condition 4) was presented twice to forty participants from five age bands spanning from early childhood to adulthood. These age bands were as follows: 3-5 years (early childhood); 6-8 years (middle childhood); 9-11 years (late childhood); 12-14 years (adolescence); and 18-30 years (adulthood). During this study, all experimental trials were read aloud by the experimenter and no visual aids were employed.

These researchers analyzed their data from this study in terms of age, relation type, and relational complexity. The mean percentage of errors of participants in each of the five age groups on the three levels of relational complexity is presented in Figure 1. The figure indicates a clear developmental trend in the abilities of participants from the different age groups to perform the perspective-taking tasks using the relational protocol. In other words, accuracy on the perspective-taking tasks increased as a function of age. Specifically, the youngest children (aged 3-5 years) produced significantly higher levels of errors overall than all of the older participants (ranging from 6-30 years), and the middle and late childhood groups produced significantly higher levels of errors than

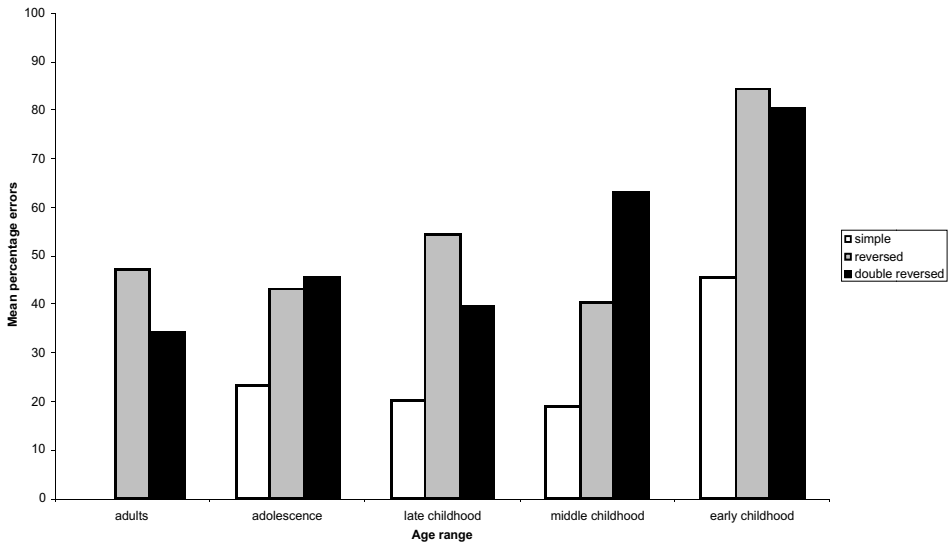


Figure 1. Mean percentage of errors recorded for the five age groups of participants in the perspective-taking protocol employed by McHugh, et al. (2004).

both the adolescents and adults.

With regard to relation type, the findings from this study revealed significant differences between NOW-THEN and HERE-THERE simple relations; between HERE-THERE and I-YOU reversed relations, and between NOW-THEN and I-YOU reversed relations. Similar to the results of the previous study, these data indicated that responding in accordance with the NOW-THEN frame produced the greatest difficulty for the participants. With regard to relational complexity, the data from the latter study showed significant differences between simple and reversed trials for all three relation types (i.e., significantly stronger performances were recorded on I-YOU simple relations than on I-YOU reversed trials; on HERE-THERE simple than reversed relations; and on NOW-THEN simple than reversed relations). This pattern of significant differences indicates that levels of accuracy appeared to decrease as a function of relational complexity. Broadly speaking, participants in the four oldest age groups produced their lowest levels of errors on I-YOU relations and their highest levels of errors on NOW-THEN relations. Furthermore, participants performed better on simple relations overall than on reversed relations. As well as being consistent with the findings from the previous study involving the same protocol, the authors also noted the consistency of these data with the mainstream cognitive literature, which has reported that performances on simple ToM tasks generally develop across the ages of four and five years old, and are usually well established by age six (Taylor, 1988).

In two related studies, McHugh, et al. (2004) investigated whether the low rates of accuracy recorded with the youngest group of children was simply a function of the length of the statements contained within some of the tasks (Study 2), and whether the

low rates of errors recorded with the adult participants was possibly a function of experimenter cueing (Study 3). In Study 2, the researchers controlled for statement length by the inclusion of reversed and double reversed foil trials presented to new participants from the two youngest age groups in Study 1 (no foils of simple relations were included). These trials contained statements of the same number of words as the original trials but did not involve complex relational responding. An example of a foil reversal trial is as follows: "I am sitting here on the blue chair and you are sitting there on the black chair. If here was there and there was here: Where would I be sitting? Where would you be sitting?" This foil trial differed from the original HERE-THERE reversals because no transformation of functions between mutually entailed relations is required (i.e., the participant and experimenter remain in the same positions in which they began).

When compared to Study 1, participants from both age groups in Study 2 produced significantly lower levels of errors on both the reversed and double reversed relations (including foils). This finding lent firm support to the conclusion that the performances of the youngest children in Study 1 were due, at least in part, to the requirement that a deictic relation be derived in order to produce the correct response to reversed and double reversed trials.

In Study 3, the researchers attempted to control for possible experimenter cueing with the use of an automated version of the protocol presented to another group of adult participants. Across the two studies, no significant differences were recorded between the performances of the adult participants exposed to table-top and automated procedures. This finding indicated that it was unlikely that participants exposed to the table-top procedure in Study 1 were influenced by experimenter cueing.

In summary, therefore, the findings from these studies indicated that the relational repertoires required for perspective-taking appear to follow a distinct developmental trend that is generally consistent with trends observed for ToM perspective-taking skills, and that these relational repertoires may be comprised of functional relational components. The findings from these studies overall point to the possible utility of describing and investigating perspective-taking using concepts generated by RFT. One of the most significant outcomes of this work has been the development of a precise and reliable protocol for studying perspective-taking that can be administered to individuals from a range of age bands. However, in all of the studies described thus far, the perspective-taking protocol has only been used as a test procedure. In other words, it is yet to be evaluated as a possible tool for remediating perspective-taking deficits, such as those characteristically observed in autistic populations. If it could be demonstrated that the existing protocol may facilitate the establishment of these relational skills *ab initio*, then the utility of the RFT approach to perspective-taking would be greatly enhanced.

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, 2003a). In the first study by Barnes-Holmes, two children were exposed to the extended perspective-taking protocol with corrective feedback presented after each trial. In order to complete all levels of the protocol, one seven-year-old female required

explicit training on the 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. These data are also consistent with the ToM literature, and suggest that these perspective-taking abilities are rarely present in children under four years of age and that even in older children, the relational repertoires may not be fully established or flexible.

In the most recent perspective-taking study by McHugh, et al. (2003a), the shortened version of the protocol was used to assess and establish relational perspective-taking in a four-year old male. Although the findings from this study indicated that on initial assessment the child displayed a repertoire of simple I-YOU and simple HERE-THERE relations, no relational skills with regard to NOW-THEN appeared to be present. Explicit training on reversed and double reversed I-YOU and HERE-THERE relations was provided and the child proceeded through this training with relative ease. Much greater difficulty, however, was encountered during attempts to establish NOW-THEN responding, even with simple tasks. Extensive training on all levels of NOW-THEN responding was necessary in order for this child to complete the perspective-taking protocol.

Thus far, several studies have investigated the development and establishment of perspective-taking skills using concepts and methodologies generated by RFT. This work has identified specific relational components that constitute perspective-taking as a set of overarching relational skills, and has suggested ways in which these components overlap and influence one other. Furthermore, the results of the work conducted to date have suggested significant overlap between this approach to perspective-taking and ToM. As well as the development of a reliable protocol for assessing perspective-taking, even in young children, several studies have highlighted the possible use of the protocol as an effective tool for facilitating or establishing the perspective-taking skills if they are found to be deficient or absent.

As a result of the work on perspective-taking, McHugh, Barnes-Holmes, & Barnes-Holmes (2003b) began to investigate the relational skills that might be involved in understanding false belief as a more complex form of perspective-taking. In pursuit of this aim, the researchers attempted to develop a similar protocol that might target explicitly the relational frames involved in false belief, and which might also be used eventually to remediate deficits in this regard. It is to this issue that we now turn.

RELATIONAL FRAME THEORY AND FALSE BELIEF

Because the RFT research on perspective-taking appeared to be consistent with the ToM Levels 1-3 of understanding informational states in the self and others, it seemed feasible that the RFT analysis could be extended to an understanding of true and false belief at Levels 4 and 5 of ToM. Furthermore, perhaps the existing protocol for assessing perspective-taking could be modified to investigate true and false belief.

In an attempt to investigate the understanding of true and false belief, McHugh,

Table 2. Examples of the Six Trial-types in the False Belief Protocol Employed by McHugh et al. (2003b)

HERE Trial-type

*"If you put the pencil in the sweet box and I am here.
What would I think is in the sweet box?
What would you think is in the sweet box?"*

NOT HERE Trial-type

*"If you put the pencil in the sweet box and I am not here.
What would you think is in the sweet box?
What would I think is in the sweet box?"*

THERE Trial-type

*"If you put the pencil in the sweet box and I was there.
What would I think is in the sweet box?
What would you think is in the sweet box?"*

NOT THERE Trial-type

*"If I put the pencil in the sweet box and you were not there.
What would you think is in the sweet box?
What would I think is in the sweet box?"*

BEFORE NOW Trial-type

*"You open the sweet box and there is a pencil inside now.
Now what do you think is in the sweet box?
Before now what do you think is in the sweet box?"*

AFTER NOW Trial-type

*"I open the sweet box and there is a pencil inside now.
Now what do I think is in the sweet box?
After now what do I think is in the sweet box?"*

et al. (2003b) developed a short protocol of relational tasks modeled on their perspective-taking task. This task emphasized the deictic relational frames and drew on the ToM procedure known as the *Deceptive Container Task*. The new protocol consisted of six trial-types that differed from each other in terms of the relational frame or frames being targeted. The six trial-types were referred to by McHugh, et al. as: HERE trials, THERE trials, NOT HERE trials, NOT THERE trials, BEFORE NOW trials, and AFTER NOW trials. Examples of these trial-types are presented in Table 2.

In this protocol, three trial-types were employed to assess responding to true belief (consistent with ToM Level 4): these were HERE trials, THERE trials, and AFTER NOW trials. In the first two trial-types, responding in accordance with the frame of HERE-THERE was targeted explicitly, whereas the third trial-type targeted NOW-THEN responding. Consider the following THERE trial: "If you put the pencils in the sweet box and I am there: what would I think is in the sweet box? What would

you think is in the sweet box?" This trial-type emphasizes the THERE aspect of responding on the basis of the HERE-THERE frame (because the action in question has been conducted in a location specified as THERE). The protocol also contained HERE trials that were identical to THERE trials, except that the perspective of HERE was emphasized (e.g., "If you put the pencils in the sweet box and I was here: what would I think is in the sweet box? What would you think is in the sweet box?"). The third trial-type designed to assess responding on the basis of true belief was referred to as an AFTER NOW trial. Consider the following example: "You open the sweet box and there are pencils inside now. Now, what do you think is in the sweet box? After now, what would you think is in the sweet box?" This task assessed true belief because the correct response required participants to indicate that they can act on the basis of what they have seen as true. These three trial-types were incorporated into the protocol in an attempt to assess responding on the basis of true belief, and as such were used to permit comparisons with false belief.

From an RFT perspective, responding in accordance with logical not may be important in understanding false belief. In line with this thinking, the three true belief trial-types described above were modified in order to permit them to function as false belief trials, and were referred to as NOT HERE, NOT THERE, and BEFORE NOW trials. The former two false belief trials were almost identical to the true belief HERE and THERE trials, respectively, except that they involved the addition of logical not. Consider a NOT HERE trial: "If I put the pencils in the sweet box and you were not here: what would I think is in the sweet box? What would you think is in the sweet box?" The correct response in this case involves indicating that I (Experimenter) will know what is inside, but you (Participant) will not know, because you were not located here where the action in question occurred. The NOT THERE trials were almost identical to the NOT HERE trials, except that once again THERE was emphasized instead of HERE. Unlike the other false belief trials, BEFORE NOW trials did not assess false belief by emphasizing logical not. Instead, false belief was implied in the temporal order of the events stated in the trial. Consider the following example: "You open the sweet box and there are pencils inside now. Now, what do you think is in the sweet box? Before now, what did you think was in the sweet box?" This task assessed false belief because the correct answer required participants to determine that BEFORE NOW they could only act on the basis of a false belief (i.e., that there were sweets in the sweet box).

The true and false belief protocol developed by McHugh, et al. contained ten exposures to each of the six trial-types by incorporating five hypothetical stimulus sets. For example, during one stimulus set a sweet box contained pencils instead of sweets, and during another set, a cookie jar contained a teddy instead of cookies. The use of multiple stimulus sets permitted adequate exposures to each trial-type that were then used to generate a developmental profile of true and false belief abilities, similar to that which was conducted with the development of perspective-taking skills. Once again, five groups of participants aged within five age bands from early childhood to adulthood were compared. The mean number of errors on the six trial-types for participants in each of the five age bands is presented in Figure 2.

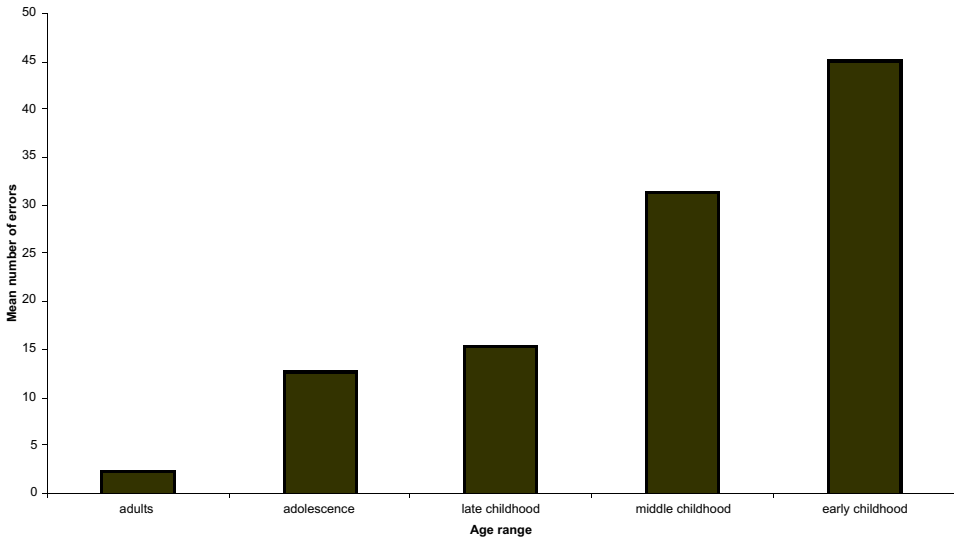


Figure 2. Mean number of errors recorded for the five age groups of participants in the true and false belief protocol employed by McHugh, et al. (2003b).

Figure 2 indicates a clear developmental trend in the abilities of participants aged from early childhood to adulthood to respond on the basis of true and false belief as assessed on the relational protocol. Participants in the youngest age group (3-5 years) produced the highest number of errors while those in the oldest age group (18-30 years) produced the lowest number of errors. Furthermore, the number of errors produced by participants between these two age groups increased as a function of age. Statistical analyses revealed significant differences in the level of errors overall among all age groups except between adolescence and late childhood. Unlike the results of the previous RFT study on perspective-taking, no significant differences were recorded among any of the six trial-types, suggesting possible functional overlap among responding to true and false belief on this relational protocol.

As a natural extension of the previous work on perspective-taking, McHugh, et al (2003b) attempted to use RFT concepts in order to account for the development of understanding true and false belief. The results from this work were remarkably similar to those obtained with perspective-taking, and showed a strong developmental trend in the emergence of these skills. Although much more work needs to be done, the results of this first investigation suggested significant functional overlap between understanding true/false belief and perspective-taking that appeared to be largely consistent with the ToM literature in this area. It was once again the utility of the relational frame approach to perspective-taking and false belief that led to a subsequent attempt to expand these ideas in an attempt to understand and investigate the development of deception, and it is to this issue that we now turn.

RELATIONAL FRAME THEORY AND DECEPTION

As an extension of the RFT research program on perspective-taking and responding to true/false belief, researchers in this area have also begun an empirical analysis of deception. In line with ToM, RFT research in this area has approached deception as a more complex type of false belief responding. Based on this reasoning, McHugh, Barnes-Holmes, & Barnes-Holmes (2003c), modified their relational true/false belief protocol to include tasks that appear to target the relational skills that may underpin deception, as traditionally defined.

In this study, forty participants aged between 3 and 30 years old were involved, and were grouped as before according to five age categories in order to generate a possible developmental profile of deception skills. The deception protocol consisted of six trial-types, referred to here as: First-order Positive trials; First-order Negative trials; Control Positive trials; Control Negative trials; Second-order Positive trials; and Second-order Negative trials, and these are presented in Table 3.

All of the trial-types in the deception protocol involved the automated presentation of scenarios that were similar to that created in the Maxi Test, as traditionally employed by ToM researchers. Specifically, all trial-types involved one picture of an object to be hidden (e.g., a teddy), and two pictures of places in which to hide the object (e.g., a

Table 3. Examples of the Six Trial-types in the Deception Protocol Employed by McHugh, et al. (2003c)

First-order Positive Tasks

"If I have a teddy and I want you to find it, where should I put the teddy?"

First-order Negative Tasks

"If you have a teddy and you don't want me to find it, where should you hide the teddy?"

Second-order Positive Tasks

"If you have a teddy and if you know that I know you're trying to hide it from me, where should you hide the teddy?"

Second-order Negative Tasks

"If I have a teddy and if I know that you don't know I'm trying to hide it from you, where should I hide the teddy?"

Control Positive Tasks

"You and I are playing a game, if you have a teddy and you want me to find it, where should you put the teddy?"

Control Negative Tasks

"You and I are playing a game, if I have a teddy and I don't want you to find it, where should I hide the teddy?"

toy box and a refrigerator). During each trial, a hypothetical situation was then created with regard to the three pictures. Consider the following First-order Positive trial, in which the pictures of a teddy, a toy box and a refrigerator were presented on the computer screen, and the participant was then instructed as follows: "If I have a teddy and I want you to find it, where should I put the teddy?" Participants were then required to drag the picture of the object, (i.e., the teddy) into one of the target locations (i.e., into either the refrigerator or the toy box). This trial-type was referred to as a First-order Positive trial because it involved the protagonist (i.e., the experimenter) positively wanting the participant to find the object, and the trial did not involve any form of deception. A correct response on this trial would involve the participant indicating that I (experimenter) should put the teddy in the toy box because this is where you (participant) will be able to find it (because one would normally look for a teddy in a toy box rather than a refrigerator). First-order Negative trials were almost identical to this, except that the scenario presented to the participant indicated that I (experimenter) do *not* wish you (participant) to find the object. A correct response on this trial-type would involve the participant indicating that I (experimenter) should hide the teddy in the location in which you (participant) are not likely to find it (e.g., I should hide a teddy in a refrigerator rather than a toy box).

The Control Positive and Control Negative trials were employed by McHugh, et al. to act as control trials for the shorter statements involved in the First-order Positive and Negative trials when compared with the Second-order Positive and Negative trials, respectively. The only difference between the first-order and control trials was that the latter involved the words "You and I are playing a game" at the beginning of the statement. Consider the following example of a Control Negative trial: "You and I are playing a game, if you have a teddy and you do not want me to find it, where should you hide the teddy?"

The remaining two trial-types in the deception protocol were referred to as Second-order Positive and Second-order Negative trials, both of which were based on the first-order trials, but which were more complex in terms of the level of relational activity required to respond to them correctly. Consider the example of a Second-order Positive trial in which the participant was instructed as follows: "If I have a teddy and if I know that you know I'm trying to hide it from you, where should I hide the teddy?" A correct response to this trial would involve the participant indicating that I (experimenter) should hide the teddy in the toy box because you (participant) will not look in the toy box (where you normally would expect to find a teddy) because you think I am trying to hide the teddy from you.

Now consider an example of a Second-order Negative trial, in which the participant may be instructed as follows: "If you have a teddy and if you know that I don't know you're trying to hide it from me, where should you hide the teddy?" A correct response to this trial would involve the participant indicating that you (participant) should hide the teddy in the refrigerator because I (experimenter) will not look there, (i.e., you would not normally expect to find a teddy in the refrigerator) because I do not know that you are trying to hide the teddy from me.

The mean number of errors on the six trial-types produced by participants from

the five age groups in the deception study is presented in Figure 3. The figure indicates a clear developmental trend in terms of the number of errors overall produced by participants across the five age groups. That is, participants in the youngest age group (3-5 years) produced the largest number of errors while participants in the oldest age group (18-30 years) produced the least number of errors. As expected, the number of errors produced by participants in the different age categories also increased as a function of age. Statistical analyses revealed significant effects for age and trial-type, and a significant interaction effect between these two variables. With regard to age, there were significant differences among all age groups except between adolescence and late childhood. Significant differences were also recorded among trial-types, with younger participants (3-5 and 6-8 year olds) performing significantly worse on the Second-order than on the First-order trials, and older participants (9-30 year olds) performing equally well across all tasks. Significant differences were also recorded between the Control trials and the Second-order trials, but not between the First-order trials and the Control trials. This finding suggests that the weaker performances on the Second-order trials probably resulted from the greater level of relational complexity than simply from the length of the statement presented during the task. In summary, the results from the RFT deception study indicated a clear developmental trend in the performances of participants aged from childhood to adulthood on the deception protocol.

In a related study currently underway by the same researchers, the deception protocol has also been used in an attempt to train these deception skills in young

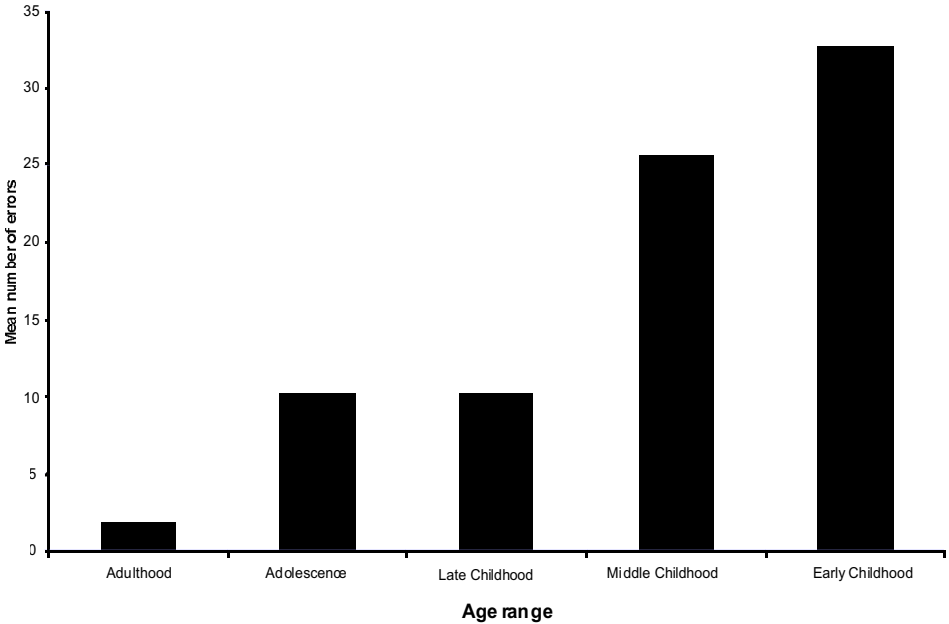


Figure 3. Mean number of errors recorded for the five age groups of participants in the deception protocol employed by McHugh, et al., (2003c).

children when the relational repertoires are found to be absent (McHugh, et al. 2003c). 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 protocol, and the child has subsequently performed 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.

SUMMARY AND CONCLUSIONS

The cognitive abilities involved in ToM, understanding false belief, and deception are considered by most mainstream cognitive and developmental psychologists to be critical for competent adult functioning. Theory of Mind researchers, in particular, have devoted considerable research attention to these areas, although there remains little clear evidence to validate the concepts and methodologies they have employed. For example, the ToM literature gives no clear distinction between false belief and deception. Furthermore, little or no empirical evidence attests to the efficacy of ToM interventions that have been used to establish perspective-taking, false belief understanding or deception, when these skills are found to be absent.

Prior to the emergence of RFT as a modern behavioral and functional account of human language and cognition, behavioral psychologists had very little to say about complex cognitive skills such as perspective-taking, false belief, and deception. However, with RFT's explicit interest in cognition as a viable subject matter, and with the inherent developmental nature of RFT as a theory of language and cognition, it has now provided behavioral researchers with a set of conceptual and methodological tools to address these issues from a behavioral perspective. The empirical work reported in the current article on perspective-taking, false belief, and deception indicates that a behavioral interpretation and investigation of these abilities is both possible and informative. Furthermore, the considerable overlap between the RFT data and the ToM findings on these topics may be an important area for future study and integration between these two disparate traditions. The evidence from the training studies also suggests that there may be considerable practical benefits to be gained from a relational frame analysis of these cognitive abilities. Although much more work needs to be done from both conceptual and applied perspectives, the evidence reported in the current paper suggests that such endeavors may well be worthwhile.

REFERENCES

- Barnes-Holmes, Y. (2001). *Analysing relational frames: Studying language and cognition in young children*. Unpublished doctoral thesis. National University of Ireland, Maynooth, Ireland.
- Barnes-Holmes, Y., Barnes-Holmes, D., & Cullinan, V. (2001). Education. In S.C. Hayes, D. Barnes-Holmes & B. Roche (Eds.), *Relational frame theory: A post-Skinnerian account of human*

language and cognition. New York: Plenum.

- Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, M.A.: Bradford Books, MIT Press.
- Baron-Cohen, S. & Hammer, J. (1997). Parents of children with Asperger Syndrome: What is the cognitive phenotype? *Journal of Cognitive Neuroscience*, 9, 548-54.
- Baron-Cohen, S., Tager-Flusberg, H., & Cohen, D. (2000). *Understanding other minds: Perspectives from developmental cognitive neuroscience* (2nd Ed.). Oxford: Oxford University Press.
- Hayes, S.C. (1984). Making sense of spirituality. *Behaviorism*, 12, 99-110.
- Hayes, S.C., Barnes-Holmes, D., & Roche, B. (2001) (Eds.), *Relational frame theory: A post-Skinnerian account of language and cognition*. New York: Plenum Press.
- Harman, G. (1978). Studying the chimpanzee's theory of mind. *Behavioral and Brain Sciences*, 1, 515-526.
- Howlin, P., Baron-Cohen, S., & Hadwin, J. (1999). *Teaching children with autism to mind-read: A practical guide*. Chichester, England: Wiley.
- McHugh, L., Barnes-Holmes, Y., & Barnes-Holmes, D. (2004). Perspective-taking as relational responding: A developmental profile. *The Psychological Record*, 54, 115-145.
- McHugh, L., Barnes-Holmes, Y., O'Hora, D., & Barnes-Holmes, D. (in press). Perspective-taking: A relational frame analysis. *Experimental Analysis of Human Behavior Bulletin*.
- McHugh, L., Barnes-Holmes, Y., & Barnes-Holmes, D. (2003a). *Training perspective-taking with a four year old child*. Paper presented at the First World Congress on ACT, RFT and the New Behavioral Psychology, Linköping, Sweden.
- McHugh, L., Barnes-Holmes, Y., & Barnes-Holmes, D. (2003b). *Knowing when a belief is just a belief*. Paper presented at the annual convention of The Association for Behavior Analysis, San Francisco, USA.
- McHugh, L., Barnes-Holmes, Y., & Barnes-Holmes, D. (2003c). *An empirical analysis of deception as derived relational responding*. Paper presented at the First World Congress on ACT, RFT and the New Behavioral Psychology, Linköping, Sweden.
- Perner, J., Leekam, S. R., & Wimmer, H. (1987). Three-year-olds' difficulty with false belief. *British Journal of Developmental Psychology*, 5, 125 – 37.
- Premack, D. (1990). Do infants have a theory of self propelled objects? *Cognition*, 36, 1-16.
- Premack, D. & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, 4, 515-526.
- Sodian, B., Taylor, C., Harris, P.L., & Perner, J. (1991). Early deception and the child's theory mind: False trails and genuine markers. *Child Development*, 62, 468 – 483.
- Wimmer, H. & Perner, J. (1983). Beliefs about beliefs: representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, 13, 103-28.
- Woodruff, G. & Premack, D. (1979) Intentional communication in the chimpanzee: The development of deception. *Cognition*, 7, 333-362.

Received March 31, 2003

Final acceptance June 10, 2004