

THE RELATIONSHIP BETWEEN THEORY OF MIND AND RELATIONAL FRAME THEORY:
CONVERGENCE OF PERSPECTIVE-TAKING MEASURES

Annemieke L. Hendriks, Yvonne Barnes-Holmes, Ciara McEnteggart, Hubert R.A. De Mey,
Cilia L.M. Witteman, Gwenny T.L. Janssen, Jos I.M. Egger

Abstract

Objective: Perspective-taking difficulties have been demonstrated in autism and schizophrenia spectrum disorders, among other clinical presentations, and are traditionally examined from a Theory of Mind (ToM) point of view. Relational Frame Theory (RFT) offers a behavioural and contextual interpretation of perspective-taking, proposing that this ability can be studied in more detail by examining specific perspective-taking relations. To implement relational perspective-taking measures in clinical practice, it is important to gain more knowledge about how these relate to traditional measures of perspective-taking.

Method: The current study is focused on the relation between the Barnes-Holmes relational perspective-taking protocol and both the Faux-pas and the Strange Stories tests, in a sample of healthy controls and individuals with an anxiety disorder or psychotic disorder. The work expands upon earlier research in this field.

Results: Our results showed that, across the whole sample, the Barnes-Holmes protocol was positively correlated with both the Faux-pas and the Strange Stories tests. Furthermore, the Barnes-Holmes protocol was found to predict ToM performance. Correlations between the Strange Stories test and the Barnes-Holmes protocol were non-significant when we corrected for intelligence.

Conclusions: The evidence suggests that relational perspective-taking is strongly related to ToM performances. Results are compared to other RFT studies and implications for clinical practice are discussed.

Key words: perspective-taking, theory of mind, relational frame theory, schizophrenia-spectrum disorders, anxiety disorders

Declaration of interest: nothing to declare

Annemieke L. Hendriks (a,b,c), Yvonne Barnes-Holmes (d), Ciara McEnteggart (d), Hubert R.A. De Mey (b), Cilia L.M. Witteman (b), Gwenny T.L. Janssen (a,b), Jos I.M. Egger (a,b,c)

- a. Centre of Excellence for Neuropsychiatry, Vincent van Gogh Institute for Psychiatry, Venray, The Netherlands
- b. Behavioural Science Institute, Radboud University, Nijmegen, The Netherlands
- c. Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, The Netherlands
- d. Department of Experimental-Clinical and Health Psychology, Ghent University, Belgium

Corresponding author

Annemieke L. Hendriks, MSc.,
Centre of Excellence for Neuropsychiatry, Vincent van Gogh Institute for Psychiatry,
Stationsweg 46, 5803 AC Venray, The Netherlands.
Tel.: +31.478.527.339; Fax: +31.478.630.797
E-mail: ahendriks@vvgi.nl

Introduction

Over the last few decades, the study of perspective-taking has been of much interest in clinical and developmental settings. Specifically, difficulties in perspective-taking are commonly observed in individuals with autism (Baron-Cohen et al. 2000) or schizophrenia spectrum disorders (Bora et al. 2009, Sprong et al. 2007), as well as in other clinical presentations, such as schizotypy (Pickup 2006), frontotemporal dementia (Gregory et al. 2002), depression (Ladegaard et al. 2014), anxiety (Samson et al. 2012) and obsessive compulsive disorder (Sayin et al. 2010). Perspective-taking is an important feature of social cognition and interpersonal communication, and difficulties therein can result in poor social functioning. For example, problems may arise in understanding and predicting the behaviour of others, self-reflection,

empathising with others and understanding concepts such as irony, humour and deception (Barnes-Holmes et al. 2001, Heagle and Rehfeldt 2006, Howlin et al. 1999). Therefore, it is not surprising that training of perspective-taking skills, as well as other social cognitive skills, has become an important area of research in some clinical populations (e.g. Horan et al. 2008, Gevers et al. 2006).

Perspective-taking has mostly been studied using Theory of Mind (ToM); a cognitive conceptualisation of inferences about the beliefs, intentions and thoughts of others (Premack and Woodruff 1978). According to this theory, a theory of mind develops across several phases in young children, ranging from visual perspective-taking to the prediction of behaviour based on true and false beliefs (Howlin et al. 1999). It is believed that one's theory of mind is fully developed by around the age of five, although some studies suggest

that flexibility in its use continues to develop until late adolescence (Dumontheil et al. 2010).

Several tests have been developed to assess ToM skills, usually involving short stories with two or more interacting characters, in which participants are asked to apply their perspective-taking skills to infer the mental states of the characters. However, most of these tests have been designed for young children and only a few more advanced ToM tests exist for older children and adults (Baron-Cohen et al. 1999, Happé 1994). Furthermore, while ToM tests appear to provide an index of overall perspective-taking ability, they provide little insight into the possible processes involved in these abilities or how they fail to fully develop in certain individuals. Examining effective methodologies for the assessment and remediation of these skills, therefore, remains an important issue.

More recently, another approach to the study of perspective-taking has arisen through Relational Frame Theory (RFT) (Hayes et al. 2001). As a contextual and behavioural account, RFT states that perspective-taking and other forms of complex cognitive functioning can be examined by analysing the interactions between a person and his/her social environment. From this point of view, young children learn to take perspective by responding to questions about one's own perspective and the perspective of others, for example "What did you do yesterday?" or "What would you do if you were me?" In order to answer these questions, one must change from an "I-HERE-NOW" to an "I-THERE-THEN" or "YOU-THERE-THEN" perspective. Thus, perspective-taking requires that people understand and respond to interpersonal (I-YOU), spatial (HERE-THERE) and temporal (NOW-THEN) relations. Through repeated exposure to these relations, specific "relational frames" emerge, enabling people to generalise these relations to novel situations. In RFT terms, this generic ability (there are other types of relational frame) is referred to as "derived relational responding".

In order to examine the ability and flexibility to use these perspective-taking relations, a protocol was developed by Barnes-Holmes (Barnes-Holmes, 2001), that assesses relational perspective-taking at three levels of complexity. A "simple" trial in the Barnes-Holmes protocol simply requires participants to respond to an I-YOU, HERE-THERE or NOW-THEN relation, for example, "I have a green brick and you have a red brick. Which brick do I have?" In a "reversed" trial, participants are asked to change their perspective to answer the question. For example, in the trial "Yesterday I was watching television, today I am reading. If now was then and then was now, what would I be doing now?" one has to change perspective from "I-HERE-NOW" to "I-THERE-THEN" and the correct answer would be "watching television." At the most complex level of the Barnes-Holmes protocol, two relations are reversed simultaneously: "I'm sitting on the black chair and you are sitting on the blue chair. If I was you and you were me, and if here was there and there was here, where would I be?" Here, one has to change perspective from an "I-HERE-NOW" to a "YOU-THERE-THEN" perspective. As a result of the double reversal, "I" ends up back in the black chair.

An important advantage of assessing perspective-taking from an RFT point of view is the precision with which perspective-taking difficulties can be examined in individuals or specific populations. That is, with the Barnes-Holmes protocol one can determine an individual's level of accuracy (and even speed) on the perspective-taking relations, as well as the

level of complexity in using these relations. In other words, while ToM tasks provide an assessment of how perspective-taking is applied in social scenarios (by asking participants to infer the thoughts, feelings and actions of fictional characters), an assessment of relational perspective-taking represents the basic skills that comprise perspective-taking. RFT could, therefore, play an important role in the study of perspective-taking, especially in populations with potential difficulties in this regard. To implement such measures in clinical practice, however, it's important to clarify the relationship between these basic (RFT) and applied (ToM) perspective-taking skills.

Evidence from several RFT studies suggest that relational perspective-taking and ToM indeed are related concepts. For example, in one of the first studies using the Barnes-Holmes protocol, the results showed a developmental acquisition of relational perspective-taking from early childhood to adulthood, similar to what has been found in ToM research (McHugh et al. 2004). Specifically, performance on the protocol improved as a function of age, with complexity in responding still increasing in adolescence and adulthood. Also, pronounced deficits were found in similar samples compared to ToM research, for example, in individuals with autism (Rehfeldt et al., 2007), schizophrenia (Villatte et al. 2010), social anhedonia (Villatte et al. 2008) and social anxiety (Janssen et al. 2014). Specifically, problems were observed on the more complex perspective-taking relations (reversed and double-reversed trial types).

Although these results indicate that RFT may indeed offer a behavioural interpretation of ToM (McHugh et al. 2004), studies examining the direct relationship between RFT methods and ToM measures are scarce. Villatte and colleagues examined correlations between the Barnes-Holmes protocol and the Hinting task (Corcoran et al. 1995) in samples of schizophrenia (Villatte et al. 2010) and social anhedonia (Villatte et al. 2008). They found that reversed and double-reversed trials of the Barnes-Holmes protocol were correlated with the Hinting task. Furthermore, results of regression analyses indicated that these complex trial types could also predict ToM performance. Extending this type of research to other samples and ToM tests, and to other aspects of the Barnes-Holmes protocol, helps to shed more light on the relationship between RFT and ToM measures of perspective-taking.

Therefore, in the current study, we focused on the relationship between the Barnes-Holmes protocol and two different ToM tests: the Faux-pas test (Baron-Cohen et al. 1999) and the Strange Stories test (Happé 1994). These tests were developed to assess advanced ToM skills in older children and adults. Furthermore, we included a sample of participants varying in psychopathology, including healthy controls, individuals with an anxiety disorder and individuals with a psychotic disorder. We calculated correlations between the Barnes-Holmes protocol and both ToM tests in the overall sample, and examined the predictive value of the Barnes-Holmes protocol. Within our analyses, we focused both on relational complexity and the different perspective-taking relations. Our hypothesis was that both ToM tests would correlate positively with the Barnes-Holmes protocol, and that performance on the relational perspective-taking measure would predict ToM performance. Since intelligence has been found to correlate with relational perspective-taking (Gore et al. 2010), a measure of intelligence was also incorporated in the current study.

Methods

Participants

Included in this study were 27 patients diagnosed with an anxiety disorder (16 female, 11 male; mean age 42 years, standard deviation 11.8 years), eight patients diagnosed with a psychotic disorder (two female, six male; mean age 35 years, standard deviation 8.1 years) and 23 healthy controls with no reported history of psychiatric illness (12 female, 11 male; mean age 27 years, standard deviation 13.6). Patients were diagnosed according to the DSM-IV by their primary psychologist or psychiatrist and were recruited at the specialized mental health outpatient and inpatient facilities in Venray, The Netherlands, and in Kleve, Germany. The group of healthy controls was recruited from personal networks of hospital staff and students. The total group consisted of 58 participants, 28 male and 30 female.

The study was approved by the Vincent van Gogh Institutional review board (#JT/ec/U1300094) and conducted in accordance with the Declaration of Helsinki. All participants were informed about the study and provided written informed consent. After participation, all individuals were offered a debriefing, in which they were informed of their performance on the tests.

Measures

Theory of Mind (ToM) skills were measured using the Faux-pas test (Baron-Cohen et al. 1999) and the Strange Stories test (Happé 1994). In both tests we used a selection of stories based on the study by Spek and colleagues (Spek et al. 2010). The Barnes-Holmes protocol was used to assess relational perspective-taking (Barnes-Holmes 2001). An estimate of intelligence was obtained by administration of the Wechsler Adult Intelligence Scales (WAIS-III) (Wechsler 1997) for participants whose first language was German and the WAIS-IV (Wechsler 2008) or the Dutch Adult Reading Test (DART) (Schmand et al. 1991) for participants whose first language was Dutch. The order of test administration was randomised to avoid order effects.

The stories contained within the Strange Stories test and the Faux-pas test were read aloud by an experimenter, and participants also received a written version. The Strange Stories test consists of eight stories, each followed by two or three questions. The test assesses a participant's understanding of others' mental states in situations involving misunderstanding, persuasion, sarcasm, white lies or double-bluff. The Faux-pas test consists of nine stories, five contain a *faux-pas* situation and four not. A *faux-pas* situation occurs when a character says something awkward or unintentionally unfriendly to another character. Participants are asked whether a *faux-pas* occurs in the story and are questioned about the underlying motive (Spek et al. 2010). For both the Strange Stories and the Faux-pas tests, the percentage of correct answers was calculated for each participant.

The Barnes-Holmes protocol was presented on a Windows XP laptop with Java. It consists of 62 trials, and each trial consists of two questions (I and YOU). A trial contains one or two relations (I-YOU, HERE-THERE, NOW-THEN) and is presented at one of the three levels of complexity (simple, reversed, double-reversed). This results in eight trial-types (two simple I-YOU, two simple HERE-THERE, four simple NOW-THEN, eight reversed I-YOU, 12

reversed HERE-THERE, 16 reversed NOW-THEN, six double-reversed I-YOU / HERE-THERE, and 12 double-reversed HERE-THERE/NOW-THEN). The order in which the trials were presented was fixed, such that the complexity gradually increased from simple to double-reversed trials. At the start of the protocol an instruction was presented on screen, after which participants could start the task by pressing ENTER. Participants were presented with the trial and the first question appeared after pressing SPACE BAR. After answering the first question, the second question of the trial appeared automatically. Each question could be answered by pressing either the left or the right SHIFT-button (corresponding to the answers on the left and right side of the screen, respectively). The next trial appeared automatically after answering both questions. On half of the trials, the locations of both answers switched in the second question, to avoid response bias (i.e. automatically choosing the right button for the second question after choosing the left button for the first question). For similar reasons, the "I" question is presented first in half of the trials, and the "YOU" question is presented first in the other half of the trials. Trials were divided into five blocks with an increasing number of trials in each block, offering participants several possibilities for a short break. Accuracy scores were obtained for each trial and were used to calculate average scores for the different trial-types. To calculate the average scores of the different relations (I-YOU, HERE-THERE and NOW-THEN), only simple and reversed trials were used, because double-reversed trials cannot be parsed out according to one relation (see also Villatte et al. 2010).

The WAIS-III consists of 14 subtests (11 core subtests) and yields a score for full scale intelligence, verbal intelligence and performance intelligence, as well as index scores of verbal comprehension, perceptual organisation, working memory and processing speed. The WAIS-IV consists of 15 subtests (10 core subtests), which can be used to obtain scores of full scale intelligence, as well as index scores for verbal comprehension, perceptual reasoning, working memory and processing speed. In this study, we only administered the core subtests, and full scale intelligence was used as a measure of intelligence. For practical reasons, administration of the WAIS-IV was feasible for only $n=21$ Dutch participants; the time investment for this test was too great to fit the schedule of the treatment received by the other participants at the time. Alternatively, for those participants ($n=32$), an estimate of intelligence was obtained using the DART. The DART consists of 50 words with irregular pronunciation and was developed as a measure of comorbid intelligence in brain damaged patients (Schmand et al. 1991). All words were read aloud by participants and the total score of correctly pronounced words is used to obtain an intelligence score.

Statistical analyses

Data from all participants combined were used in correlational analyses between the Barnes-Holmes protocol and the Faux-pas and Strange Stories tests. Correlations between the relational perspective-taking protocol and both ToM tests were examined for both relational complexity (simple, reversed and double-reversed trials) and relation (I-YOU, HERE-THERE and NOW-THEN trials). Partial correlations with intelligence were also calculated. To examine whether relational perspective-taking predicted

ToM performance, linear regression analyses were carried out. Again, correlations assessed the potential relationship between both ToM tests and relational complexity (simple, reversed and double-reversed trials) and relation (I-YOU, HERE-THERE and NOW-THEN trials) of the Barnes-Holmes protocol. Results of these analyses are presented separately for the Faux-pas test and the Strange Stories test. Bonferroni corrections were used to reduce chances of a type I error.

Results

Faux-pas test

Correlational analyses revealed a significant correlation between the Faux-pas test and reversed trials of the Barnes-Holmes protocol ($r[58] = .359, p = .006$). Furthermore, significant correlations were found between the Faux-pas test and I-YOU trials ($r[58] = .416, p = .001$) and NOW-THEN trials ($r[58] = .302, p = .021$) of the Barnes-Holmes protocol. When we controlled for intelligence, the correlations with reversed trials ($r[58] = .323, p = .014$) and I-YOU trials ($r[58] = .391, p = .003$) remained significant. All results remained significant after Bonferroni corrections.

Results of the regression analysis on relational complexity indicated that performance on the Barnes-Holmes protocol significantly predicted performance on the Faux-pas test ($F[3, 54] = 4.318, p = .008, R^2 = .193$). Specifically, significant results in this analysis were found for reversed trials of the Barnes-Holmes protocol ($t[55] = 3.045, p = .004$). When intelligence was added to the model, results remained significant ($F[4, 53] = 3.699, p = .010, R^2 = .218$), again with reversed trials as the only significant predictor of performance on the Faux-pas test ($t[54] = 2.752, p = .008$). However, adding intelligence to the model did not significantly improve the predictive value of the model. A regression analysis with the relations (I-YOU, HERE-THERE, NOW-THEN) as independent variables, and performance on the Faux-pas test as a dependent variable, yielded a significant effect ($F[3, 54] = 4.629, p = .006, R^2 = .205$) with a significant regression coefficient for I-YOU trials

($t[55] = 2.491, p = .016$). Results remained significant when intelligence was added to the analysis ($F[4, 53] = 4.164, p = .005, R^2 = .239$), with I-YOU trials as the only predictor of performance on the Faux-pas test ($t[54] = 2.371, p = .021$). Again, adding intelligence to the model did not significantly improve the predictive value of the model. Results of both regression analyses remained significant after Bonferroni corrections.

Strange Stories test

Results of correlational analyses showed significant correlations between the Strange Stories test and reversed trials of the Barnes-Holmes protocol ($r[58] = .283, p = .031$). The correlation with NOW-THEN trials was also significant ($r[58] = .325, p = .013$), while the correlation with I-YOU trials showed a trend only ($r[58] = .256, p = .053$). Only the correlation with NOW-THEN trials remained significant after Bonferroni corrections, and when intelligence was controlled for, none of the correlations reached significance.

The regression analysis with relational complexity showed that performance on the Strange Stories was significantly predicted by performance on the Barnes-Holmes protocol ($F[3, 54] = 3.405, p = .024, R^2 = .159$). When these results were examined in more detail, results showed that only reversed trials were a significant predictor of performance on the Strange Stories test ($t[55] = 2.464, p = .017$). When intelligence was added as variable, the model remained significant ($F[4, 53] = 6.796, p = .000, R^2 = .339$). Furthermore, including intelligence significantly improved the predictive value of the model ($p = .000$). When these results were examined more closely, only overall intelligence yielded a significant regression coefficient ($t[54] = 3.798, p = .000$), while the effect of reversed trials only showed a trend ($t[54] = 1.960, p = .055$). Results of the regression analysis regarding the relations, with performance on the Strange Stories test as a dependent variable and the relations (I-YOU, HERE-THERE, NOW-THEN) as independent variables, showed that the model approached significance ($F[3, 54] = 2.693, p = .055, R^2 = .130$). The model did reach significance

Table 1. Mean accuracy in percentages for the perspective-taking measures in each subgroup of participants

	Anxiety disorder	Psychotic disorder	Healthy control
Faux-pas test	81.9	75.0	95.7
Strange Stories test	84.3	77.6	97.2
Barnes-Holmes protocol Simple trials	86.6	84.4	88.0
Barnes-Holmes protocol Reversed trials	58.7	51.0	72.9
Barnes-Holmes protocol Double-reversed trials	35.2	38.2	44.2
Barnes-Holmes protocol I-YOU trials	72.2	63.8	78.7
Barnes-Holmes protocol HERE-THERE trials	43.7	50.0	57.2
Barnes-Holmes protocol NOW-THEN trials	74.6	58.8	87.4

with intelligence added ($F[4, 53] = 6.137, p = .000, R^2 = .317$), with only intelligence as a significant regression coefficient ($t[54] = 3.802, p = .000$).

Discussion

As a traditional approach to the study of perspective-taking, Theory of Mind (ToM) has described the development of these skills in young children and provided a large body of evidence for perspective-taking difficulties in numerous clinical samples. Measures based on Relational Frame Theory (RFT), however, provide more insight in the processes that are putatively involved in the development of perspective-taking and where these do not follow a typical trajectory. That is, by examining specific functional-analytic interactions between an individual and his/her environment, RFT can determine precisely one's ability and level of complexity in perspective-taking. In the current study we examined the relationship between the two approaches to the study of perspective-taking, expanding on earlier research in this field. To this end, we examined the relationships among the Faux-pas test, the Strange Stories test and the Barnes-Holmes relational perspective-taking protocol in a sample of healthy controls and individuals with an anxiety disorder or a psychotic disorder.

Overall, our results indicated that the ToM tests were positively correlated with the Barnes-Holmes protocol. We found that the Faux-pas test was significantly correlated with reversed trials of the Barnes-Holmes protocol, as well as with both interpersonal (I-YOU) and temporal (NOW-THEN) relations. Separate regression analyses also revealed that these trial-types predicted performances on the Faux-pas test. It is noteworthy that most of these effects remained significant after controlling for intelligence. Although the effects were weaker, similar patterns were observed with the Strange Stories test. That is, significant correlations were found with reversed trials and temporal (NOW-THEN) trials of the Barnes-Holmes protocol, while the correlation with interpersonal (I-YOU) relations approached significance. However, all correlations of the Barnes-Holmes protocol with the Strange Stories test were non-significant after controlling for intelligence. Results of the regression analysis for relational complexity showed that reversed trials were the only significant predictors for performance on the Strange Stories test. The model for the relations approached significance. In both regression analyses, results improved when intelligence was added to the model.

In summary, the current results showed strong effects, especially on the reversed relational perspective-taking trials, suggesting that these were most closely related to applications of perspective-taking as assessed on the ToM tests. These findings match those reported by Villatte and colleagues (2008, 2010) with a sample presenting as high or low in social anhedonia and in a sample of healthy controls (Villatte et al. 2008), for whom both reversed and double-reversed trials were significantly correlated with performance on a ToM test (the Hinting task). However, no significant correlations were recorded in a group of patients with a diagnosis of schizophrenia (Villatte et al. 2010). Taken together, this evidence suggests that complex perspective-taking, such as accommodating the perspective of another from one's own perspective, is strongly related to ToM performances, while simple perspective-taking is not. Indeed, these results are consistent with RFT's interpretation of ToM. Specifically, simple trials of

the Barnes-Holmes protocol do not require a reversal in perspective, while ToM tests require taking the perspective of another. As a result, one would not expect simple trial types of the Barnes-Holmes protocol to correlate with ToM performances, but one would expect this type of overlap with the more complex reversed relations. Furthermore, RFT states that when basic relational repertoires are acquired, these should generalise to a range of other content areas. The current data regarding the correlations with the reversals and ToM performances support this view.

Researchers in RFT have strongly emphasized the fact that the interpersonal (I-YOU) relations are strong pre-cursors to more complex perspective-taking, such as that involved in the reversals. It has also been highlighted that individuals must continue to respond on the basis of I-YOU, even while responding to *HERE-THERE* and *NOW-THEN*. In simple terms, one's ability to respond spatially and temporally is always anchored from one's own perspective (i.e. *I-HERE-NOW*). The results of the current study support this, by showing sound correlations between the I-YOU relations and ToM performances.

From a ToM point of view, impairments in perspective-taking are generally considered to exist independently of intellectual abilities (Brüne and Brüne-Cohrs 2006). However, the current finding that intelligence appeared to influence the relationship between the Barnes-Holmes protocol and the Strange Stories test suggests otherwise. Indeed, our findings replicate those reported by Gore and colleagues (2010), who also found that intelligence was related to performances on the Barnes-Holmes protocol. This relationship is also consistent with RFT in general, which proposes that greater intelligence constitutes more complex and more flexible repertoires of derived relational responding. For RFT, therefore, one would expect a greater influence of intelligence in more complex and/or more flexible relational performances. Evidence to support this view has been reported by O'Hara and colleagues, who found relationships between complex relational tasks and the Verbal Comprehension and Perceptual Reasoning indices of the WAIS-III (O'Hara et al. 2005, O'Hara et al. 2008). Furthermore, intelligence was correlated with relational flexibility in a study by O'Toole and Barnes-Holmes (2009), in which they examined the relationship between an Implicit Relational Assessment Procedure (IRAP) and the K-BIT.

Although the current study found evidence that relational perspective-taking correlated with ToM performances, the evidence from earlier studies is somewhat more mixed. For example, after controlling for intelligence, we found no significant correlations between the Barnes-Holmes protocol and the Strange Stories test in the current study, while we found strong correlations with the Faux-pas test. To some extent, this matches the findings of Villatte and colleagues (2008, 2010) who found different correlations with ToM tests when subgroups were analysed separately. Of course, such inconsistencies may well be explained by the small sample sizes involved in these types of analyses (especially when relatively modest samples are subdivided). The same limitation may apply presently, and it is acknowledged that we employed participants who differed in their first spoken language (German or Dutch).

The results of this study have potentially important implications for the application of the Barnes-Holmes protocol in clinical practice. Overall, the results indicated that relational perspective-taking and ToM

are related, and that the Barnes-Holmes protocol is predictive of ToM performance. Therefore, consistent with RFT, basic perspective-taking skills can be seen as a prerequisite for applied perspective-taking. Training relational perspective-taking could, therefore, be beneficial in strengthening social cognitive skills in people experiencing difficulties in this area. In fact, several RFT studies have been successful in training perspective-taking skills in typically-developing children and some found that these skills generalised to other situations (Heagle and Rehfeldt 2006; Weil et al. 2011). Studies in clinical samples, however, remain limited and some have reported mixed results regarding generalisation (Jackson et al. 2014, O'Neill and Weil 2014, Lovett and Rehfeldt 2014). However, what these studies, and ours, consistently show is the more complex perspective-taking relations, the reversals, appear to be pivotal to perspective-taking deficits and how they can be remediated. These studies have also highlighted the centrality of the I-YOU relations, which the current data also suggests. This knowledge could be used to specialise assessment and training of those relations that are most relevant to the application of perspective-taking skills, for individuals with difficulties in this area.

References

- Barnes-Holmes D, Hayes SC, Dymond S (2001). Self and Self-Directed Rules. In Hayes SC, Barnes-Holmes D, Roche B. (eds) *Relational Frame Theory: A Post-Skinnerian Account of Human Language and Cognition*. Kluwer Academic/Plenum Publishers.
- Barnes-Holmes Y (2001). *Analysing Relational Frames: Studying Language and Cognition in Young Children*. National University of Ireland Maynooth.
- Baron-Cohen S, Tager-Flusberg H, Cohen DJ (eds) (2000). *Understanding Other Minds: Perspectives from Developmental Cognitive Neuroscience* 2nd ed. Oxford University Press, Oxford, England.
- Baron-Cohen S, O'Riordan M, Stone V, Jones R, Plaisted K (1999). Recognition of Faux Pas by Normally Developing Children and Children with Asperger Syndrome or High-Functioning Autism. *Journal of Autism and Developmental Disorders* 29, 5, 407-418.
- Bora E, Yucel M, Pantelis C (2009). Theory of Mind Impairment in Schizophrenia: Meta-Analysis. *Schizophrenia Research* 109, 1-3, 1-9.
- Brüne M (2003). Theory of Mind and the Role of IQ in Chronic Disorganized Schizophrenia. *Schizophrenia Research* 60, 1, 57-64.
- Brüne M, Brüne-Cohrs U (2006). Theory of Mind--Evolution, Ontogeny, Brain Mechanisms and Psychopathology. *Neuroscience and Biobehavioral Reviews* 30, 4, 437-455.
- Dumontheil I, Apperly IA, Blakemore S (2010). Online Usage of Theory of Mind Continues to Develop in Late Adolescence. *Developmental Science* 13, 2, 331-338.
- Gevers C, Clifford P, Mager M, Boer F (2006). Brief Report: A Theory-of-Mind-Based Social-Cognition Training Program for School-Aged Children with Pervasive Developmental Disorders: An Open Study of Its Effectiveness. *Journal of Autism and Developmental Disorders* 36, 4, 567-571.
- Gore N, Barnes-Holmes Y, Murphy G (2010). The Relationship between Intellectual Functioning and Relational Perspective-Taking. *International Journal of Psychology and Psychological Therapy* 10, 1, 1-17.
- Gregory C, Lough S, Stone V, Erzinclioglu S, Martin L, Baron-Cohen S, Hodges J (2002). Theory of Mind in Patients with Frontal Variant Frontotemporal Dementia and Alzheimer's Disease: Theoretical and Practical Implications. *Brain* 125, 752-64.
- Happé FGE (1994). An Advanced Test of Theory of Mind: Understanding of Story Characters' Thoughts and Feelings by Able Autistic, Mentally Handicapped, and Normal Children and Adults. *Journal of Autism and Developmental Disorders* 24, 2, 129-154.
- Hayes SC, Barnes-Holmes D, Roche B (2001). Relational Frame Theory: A Précis. In Hayes SC, Barnes-Holmes D, Roche B (eds) *Relational Frame Theory: A Post-Skinnerian Account of Human Language and Cognition*. Kluwer Academic/Plenum Publishers.
- Heagle AI, Rehfeldt RA (2006). Teaching Perspective-Taking Skills to Typically Developing Children through Derived Relational Responding. *Journal of Early and Intensive Behavior Intervention* 3, 1, 1-34.
- Horan WP, Kern RS, Green MF, Penn DL (2008). Social Cognition Training for Individuals with Schizophrenia: Emerging Evidence. *American Journal of Psychiatric Rehabilitation* 11, 3, 37-41.
- Howlin P, Baron-Cohen S, Hadwin J (1999). *Teaching Children with Autism to Mind-Read: A Practical Guide*. Wiley, Chichester, England.
- Jackson ML, Mendoza DR, Adams AN (2014). Teaching a Deictic Relational Repertoire to Children with Autism. *The Psychological Record* 64, 4, 791-802.
- Janssen G, De Mey H, Hendriks A, Koppers A, Kaarsemaker M, Witteman C, Egger J (2014). Assessing Deictic Relational Responding in Individuals with Social Anxiety Disorder: Evidence of Perspective-Taking Difficulties. *The Psychological Record* 64, 1, 21-29.
- Ladegaard N, Larsen EJ, Videbech P, Lysaker PH (2014). Higher-Order Social Cognition in First-Episode Major Depression. *Psychiatry Research* 216, 1, 37-43.
- Lovett S, Rehfeldt RA (2014). An Evaluation of Multiple Exemplar Instruction to Teach Perspective-Taking Skills to Adolescents with Asperger Syndrome. *Behavioral Development Bulletin* 19, 2, 22-36.
- McHugh L, Barnes-Holmes Y, Barnes-Holmes D (2004). Perspective-Taking as Relational Responding: A Developmental Profile. *The Psychological Record* 54, 115-144.
- O'Hara D, Pelaez M, Barnes-Holmes D (2005). Derived Relational Responding and Performance on Verbal Subtests of the WAIS-III. *The Psychological Record* 55, 1, 155-175.
- O'Hara D, Pelaez M, Barnes-Holmes D, Rae G, Robinson K, Chaudhary T (2008). Temporal Relations and Intelligence: Correlating Relational Performance with Performance on the WAIS-III. *The Psychological Record* 58, 4, 569-584.
- O'Neill J, Weil TM (2014). Training Deictic Relational Responding in People Diagnosed with Schizophrenia. *The Psychological Record* 64, 2, 301-310.
- O'Toole C, Barnes-Holmes D (2009). Three Chronometric Indices of Relational Responding as Predictors of Performance on a Brief Intelligence Test: The Importance of Relational Flexibility. *The Psychological Record* 59, 1, 119-132.
- Pickup, Graham J. 2006. Theory of Mind and Its Relation to Schizotypy. *Cognitive Neuropsychiatry* 11, 2, 177-192.
- Premack D, Woodruff G (1978). Does the Chimpanzee Have a Theory of Mind? *Behavioral and Brain Sciences* 1, 4, 515-526.
- Rehfeldt RA, Dillen JE, Ziomek MM, Kowalchuk RK (2007). Assessing Relational Learning Deficits in Perspective-Taking in Children with High-Functioning Autism Spectrum Disorder. *Psychological Record* 57, 1, 23-47.
- Samson AC, Lackner HK, Weiss EM, Papousek I (2012). Perception of Other People's Mental States Affects Humor in Social Anxiety. *Journal of Behavior Therapy and Experimental Psychiatry* 43, 1, 625-631.
- Sayin A, Oral N, Utku C, Baysak E, Candansayar S (2010).

- Theory of Mind in Obsessive-Compulsive Disorder: Comparison with Healthy Controls. *European Psychiatry: The Journal of the Association of European Psychiatrists* 25, 2, 116-122.
- Schmand B, Bakker D, Saan R, Louman J (1991). The Dutch Reading Test for Adults: A Measure of Premorbid Intelligence Level. *Tijdschrift Voor Gerontologie En Geriatrie* 22, 1, 15-19.
- Spek AA, Scholte EM, Van Berckelaer-Onnes IA (2010). Theory of Mind in Adults with HFA and Asperger Syndrome. *Journal of Autism and Developmental Disorders* 40, 3, 280-289.
- Sprong M, Schothorst P, Vos E, Hox J, Van Engeland H (2007). Theory of Mind in Schizophrenia: Meta-Analysis. *The British Journal of Psychiatry: The Journal of Mental Science* 191, 1, 5-13.
- Villatte M, Monestès JL, McHugh L, Freixa i Baqué E (2010). Assessing Perspective Taking in Schizophrenia Using Relational Frame Theory. *The Psychological Record* 60, 3, 413-436.
- Villatte M, Monestès J, McHugh L, Freixa i Baqué E, Loas G (2008). Assessing Deictic Relational Responding in Social Anhedonia: A Functional Approach to the Development of Theory of Mind Impairments. *International Journal of Behavioral Consultation & Therapy* 4, 4, 360-373.
- Wechsler D (1997). *WAIS-III Administration and Scoring Manual*. The Psychological Corporation, San Antonio, TX.
- Wechsler D (2008). *Wechsler Adult Intelligence Scale - Fourth Edition (WAIS-IV)*. NCS Pearson, San Antonio.
- Weil TM, Hayes SC, Capurro P (2011). Establishing a Deictic Relational Repertoire in Young Children. *The Psychological Record* 61, 3, 371-390.