Running head: MIND READING IN HIGH-FUNCTIONING AUTISM

How impaired is mind reading in high-functioning adolescents and adults with autism?

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Abstract

Difficulties in understanding the mental states of others are considered to be a core cognitive feature of autism spectrum disorders (ASD). Traditional false-belief tasks were not suitable to measure mind reading in adolescents and adults with ASD and were replaced by so-called more ‘advanced’ tasks. A first series of tasks included the presentation of static stimuli in the visual or auditory modality. More recently, more dynamic, naturalistic tasks were developed. The most ecologically valid task to measure mind-reading is probably the empathic accuracy paradigm. Research with advanced mind-reading tests has demonstrated that high-functioning adults with ASD should not be underestimated since they may have good and in some case very good mind-reading skills. Impairments are most obvious when an unstructured, dynamic and naturalistic task is being used.

Keywords: autism, theory of mind, empathic accuracy, mind reading

How impaired is mind reading in high-functioning adolescents and adults with autism?

One of the most striking characteristics of people with autism is their strange way of making contact with other people (Kanner, 1943). The social and communicative abnormalities that are characteristic of the disorder according to the DSM-IV-TR criteria (APA, 2000) have often been linked to an impaired theory of mind (ToM) (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997). ToM can be described as the ability to attribute mental states, such as intentions, beliefs and desires, to oneself and to others (Baron-Cohen, Leslie, & Frith, 1985). Difficulties in understanding the mental states of others are considered to be a core cognitive feature of autism spectrum disorders (ASD) (Baron-Cohen, 2001a). In its narrow use, the term theory of mind refers only to the ability to impute cognitive or volitional states to others (Premack & Woodruff, 1978). In its broader use however, the term also refers to mind reading, that covers more direct on-line processing of mental state information including both verbal and nonverbal cues, thoughts and feelings.

Mind-reading deficits in autism spectrum conditions appear to occur early in lifetime, with joint attention deficits as one of the precursors, and seem to be universal (Baron-Cohen, 2001b). Frith, Happé, and Siddons (1994) found that a subgroup of children with autism who passed standard theory-of-mind tasks gave evidence of mentalizing in their everyday day life behaviour, as measured with the Vineland Scales of Adaptive Behaviour (Sparrow, Balla, & Cichetti, 1984). It should be noted, however, that children with autism who pass ToM-tasks were rated by their teachers to be even worse than younger typically developing ToM-failers in applying mind reading in everyday

social interaction and conversation (Peterson, Garnett, Kelly, & Attwood, 2009).

Baron-Cohen (2001a & b) suggested that developmentally appropriate tests are needed in order to reveal the manifestations of the ToM abnormalities in people with autism. In this paper we will describe the evolution of the instruments used to measure ToM abilities adequately in individuals with ASD. This methodological evolution started with the use of false-belief tasks in children with autism. As a second step these simple tasks were adapted with the 'advanced' mind-reading tasks as the result. Today, a more naturalistic design for measuring empathic abilities can be found in the empathic accuracy task that has been used primarily in adults with ASD.

False belief tasks

During the first years of research within the ToM domain, a lot of studies focused on the perspective taking abilities of children with autism, who obviously experience difficulties in their ToM competence (Baron-Cohen, 1995; Baron-Cohen et al., 1985; Leekam & Perner, 1991). In these studies, researchers mainly used standard laboratory first-order false-belief tasks, which only involve inferring one person's mental state (Baron-Cohen et al., 1985). These tasks require understanding that different people can think differently about the same situation and may therefore hold a false belief (Baron-Cohen, 2001b). The most popular task is the so-called changed-location false-belief task in which an object is relocated by one character during the absence of another character who knows the original location. While typically developing 4-year-old children are able to pass these tests, the proportion of children with autism found to fail these tasks varies from 40% to 85% (Happé, 1995). Many young children with autism, even in the absence of intellectual disability, apparently do not understand that another's mental

representation of the situation is different from their own until their teens or even later (Baron-Cohen, 1995; Happé, 1995; Leekam & Perner, 1991; Leslie & Thaiss, 1992). Moreover, with the exception of somewhat older, high-functioning children (e.g., Bauminger & Kasari, 1999; Dahlgren & Trillingsgaard, 1996), they all fail second-order tests that involve the subject's reasoning about what one person thinks about another person's thoughts (Baron-Cohen, 1995). Second-order false belief tests involve considering embedded mental states, e.g., what John thinks that Mary thinks (Baron-Cohen, 2001b).

Nevertheless, some individuals with high-functioning autism or Asperger Syndrome even pass the second-order false-belief tasks in their teens or early adulthood (Bowler, 1992; Happé, 1994; Ozonoff, Rogers, & Pennington, 1991). Given the fact that typically developing children pass these tests around the age of 6 or 7, there is however no reason to conclude that social-cognitive understanding of adolescents or adults with ASD is intact. But the observation has given rise to a few more challenging so-called 'advanced' ToM tasks, which make it possible to cope with possible ceiling effects in the simple ToM tasks (Happé, 1994).

Advanced Tasks

One of the first advanced ToM measures was the "Strange Stories Task" developed by Happé (1994). This task requires subjects to make inferences about the mental states of story characters. It includes concepts such as white lie and double bluff. Since these kinds of tasks appear to be highly correlated with verbal IQ (Kaland et al., 2002), their usefulness as a tool for the assessment of social cognition is probably rather limited.

Another influential task that has been proffered as an advanced theory-of-mind test is the "Reading the Mind in the Eyes" Test (Eyes Test), used in high-functioning adults with autism or AS (Baron-Cohen, Jolliffe, et al., 1997). It involves inferring other people's mental states from a photograph of their eye region. The original adult Eyes Test was revised in 2001 (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) and in the same year an adaptation of the test was used in a study with children with AS (Baron-Cohen, Wheelwright, Spong, Scahill, & Lawson, 2001). Research in adults with ASD, using the Eyes Test, yielded mixed results. In some studies, adults with ASD showed deficits on this task (Baron-Cohen, Jolliffe et al., 1997; Baron-Cohen, Wheelwright, & Jolliffe, 1997; Baron-Cohen, Wheelwright, Hill et al., 2001), while in other studies, where other facial pictures were used, adults with ASD performed as well as controls on the Eyes Test (Ponnet, Roeyers, Buysse, De Clercq, & Van der Heyden, 2004; Roeyers, Buysse, Ponnet, & Pichal, 2001). Two studies with children with ASD (10- to 14-year olds in Back, Ropar, & Mitchell, 2007; 8- to 14-year olds in Baron-Cohen, Wheelwright, Spong, et al., 2001) showed impairment on the Eyes Task in the group of children with ASD. However, in a sample with slightly older children (11- to 15- year olds), Back et al. (2007) found no evidence for inferiority in interpreting mental states from the eyes in children with ASD.

It can however be questioned whether the Eyes task measures the ability to recognize mental states of others and to what extent the test relates to everyday social interaction (see Johnston, Miles, & McKinlay, 2009). The limitations that have been identified suggest that the test is not so advanced as originally thought and that it lacks ecological validity (Ponnet et al., 2004). The same is true for 'single-modality' tests that

require inferring people's emotions from their voice tone (Rutherford, Baron-Cohen, & Wheelwright, 2002) or providing mental-state explanations for the movement of geometric shapes such as triangles in animated cartoons (e.g., Castelli, Frith, Happé, & Frith, 2002).

Using dynamic facial stimuli may give a more accurate measure of mind-reading competence as it simulates the demands of daily social experience (Back et al., 2007; Klin, Jones, Schultz, Volkmar, & Cohen, 2002). In studies with typically developing persons, better performance on emotion recognition tasks was found when dynamic faces were used, in comparison with static faces (Harwood, Hall, & Shinkfield, 1999; Wehrle, Kaiser, Schmidt, & Scherer, 2000). Similar findings were obtained with individuals with ASD (Back et al., 2007). This 'dynamic advantage' has been attributed to additional information, typically for dynamic interactions, such as temporal cues (Back et al., 2007).

Making use of film fragments in mind-reading tasks is a first step to meet the shortcomings of the static or unimodal ToM tasks. Instruments such as the Awkward Moments Test (Heavey, Phillips, Baron-Cohen, & Rutter, 2000), the Reading the Mind in Films Task (Golan, Baron-Cohen, Hill, & Golan, 2006), the Movie for the Assessment of Social Cognition (MASC; Dziobek et al., 2006) and the Animated Theory of Mind Inventory for Children (ATOMIC; Beaumont & Sofronoff, 2008) use film scenes in a multimodal, dynamic task to assess recognition of a wide variety of complex emotions and mental states. On these tasks, both adults and children with ASD appear to exhibit difficulties in social cognition (Heavey et al., 2000; Dziobek et al., 2006; Golan et al., 2006, 2008). It should be noted that gains that were made with respect to increased approximation of everyday mind reading, resulted in a decreased pureness of the tests

since movies also inevitably involve executive functions and central coherence (Baron-Cohen, Jolliffe, et al., 1997). Moreover, unlike in real-life situations, subjects are permitted to use as much time as they need to make inferences of other persons' thoughts and feelings. In addition, like in the Eyes task, these mind-reading measures show acted emotions and mental states and no 'real' interactions and as such they do not acknowledge the difference between genuine and posed expressions of mental states. In addition, the correct answers are generated by non-impaired judges by means of consensus. The impact of the test designers with their social norms and conventions may be substantial and is certainly a potential bias (Johnston et al., 2009).

Empathic accuracy task

A more ecologically valid and naturalistic way of measuring mind-reading ability was found in the social psychological research literature on social cognition. It is provided by the empathic accuracy design of Ickes and colleagues (Ickes, 1993; Ickes, Stinson, Bissonnette, & Garcia, 1990). Good evidence for both the reliability and the validity of this method has been provided (Marangoni, Garcia, Ickes, & Teng, 1995). Empathic accuracy is the degree to which an individual is successful in the "everyday mind reading" he does whenever he attempts to infer another person's thoughts and feelings (Ickes, 1997).

In the standard stimulus paradigm, individual participants each view the same standard set of videotaped interactions and try to infer the thoughts and feelings of the same set of target persons (Marangoni et al., 1995). Roeyers et al. (2001) used this paradigm with adults with ASD. They made two videotapes with in each two volunteer

opposite-sex young adults participating in a genuine initial conversation between strangers. The interactions were covertly videotaped and after the session, each of the four young adults was instructed to make a complete log of all the unexpressed thoughts and feelings that he or she had during the interaction session. This resulted in two stimulus tapes and a whole range of thought/feeling entries for both tapes.

A group of young adults with ASD and an individually matched control group viewed both tapes. An experimenter interrupted the stimulus tapes at each of the points at which the targets had previously reported having had a thought or feeling. The participants' task was to record their own inferences about the nature of the specific thought or feeling being reported by the target at that point. Empathic accuracy scores were computed by comparing each participant's inference with the corresponding thought/feeling entry obtained from the targets on the basis of the logic and procedures developed by Ickes and his colleagues (Ickes, 2003). Subjects with ASD performed significantly worse than the control group on one of the two tapes.

Although it was not the intention to manipulate the videotapes, the conversation in the first videotape, where there was no difference in empathic accuracy between groups, was structured around one topic (a board game) and appeared to be more concrete and predictable than that in the second one. The findings were replicated in a second study using the same stimulus tapes with adults with Asperger syndrome (Ponnet et al., 2004). Again differences between the target and the control group were only found for the second, less structured, tape. IQ was measured in this study, but empathic accuracy of the clinical group was not related to intelligence.

In a next study, two new stimulus tapes were produced with ‘getting acquainted’

conversations between two strangers. However, this time, the structure of both videotapes was manipulated in such a way that one tape was more structured than the other one. While in the first tape the naturally occurring initial conversation between two strangers was recorded, the participants in the second videotape were told that it was required that they got to know each other personally before starting the experiment in which they thought they would be involved. In order to become acquainted with each other in a decent and less stressful manner, the experimenter proposed to leave the room for a short period. Before leaving, he gave the targets an eight-point list with questions they surely had to know from each other. It was found that structure of the situation clearly matters for the mind-reading abilities of subjects with ASD (Ponnet, Buysse, Roeyers, & De Clercq, 2008). The empathic accuracy scores of young adults with ASD and typically developing controls were only significantly different when subjects had to infer the thoughts and feelings of other persons in the less structured and more chaotic conversation in the first tape. There was no association between performance and IQ in the participants with ASD.

The abovementioned studies suggest that the standard stimulus empathic accuracy paradigm is a promising and valuable method to study the mind-reading abilities of adults with ASD (see also Beaumont & Sofronoff, 2008). However, this design is still different from everyday mind reading since participants serve only as perceivers and not as targets and they infer thoughts and feelings of people with whom they do not interact. This is not the case when an alternative empathic accuracy design is used: the dyadic interaction design. In this paradigm, each participant is an active and interacting member of a dyad instead of being a passive observer. Ponnet, Buysse, Roeyers, and De Corte (2005)

developed a study in which high-functioning adults with ASD, with above average intellectual abilities were videotaped with a concealed camera during an initial conversation with a typically developing stranger. Afterwards, they had to infer the unexpressed thoughts and feelings of the other person in the dyad. The participants with ASD did not differ from the typically developing participants in the ability to infer the thoughts and feelings of their interaction partner. Further analyses revealed that this was not due to the fact that the participants with ASD had unusual or strange thoughts and feelings that were difficult to infer by their typically developing interaction partner. The finding that adults with ASD performed so well in this study is probably due to the fact that they were able, to some extent, to structure the conversation they were involved in. The level of performance was not related to the IQ of the participants.

Although the dyadic interaction design is probably the most ecologically valid method that has been used up till now to measure mind-reading skills in ASD, it still differs from any real life social situation in several ways. Most importantly, the participants had to infer the thoughts or feelings of their interaction partner while they were viewing the videotape of their own conversation for a second time and they were allowed to use as much time as needed. The demands of daily life do not permit us to review our interactions and expect us to make quick and immediate inferences about the thoughts and feelings of our interaction partners.

Empathic accuracy in adolescents with ASD

While a lot of attention has been paid to school-aged children and, more recently, to adults, adolescents with ASD have been largely neglected in the mind-reading literature. This is also the case for their non-impaired peers. From a developmental point

of view however, information on mind-reading skills in youngsters is of great interest. Gleason and colleagues extended the standard stimulus paradigm of empathic accuracy by studying typically developing adolescents (Gleason, Jensen-Campbell, & Ickes, 2009). Their results revealed that teenagers who obtained higher empathic accuracy scores were more likely to have better quality friendships, and experienced lower levels of relational victimization. Additionally, adolescents who were at highest risk for internalizing and social problems had low scores on the empathic accuracy task, and on peer dimensions such as number of friends and friendship quality. It was suggested that empathic accuracy in childhood relationships might be a buffering mechanism that protects children against the development of impaired peer relationships and adjustment problems (Gleason et al., 2009).

Demurie, De Corel, and Roeyers (submitted), recently used the standard stimulus paradigm with adolescents with ASD between 11 and 17 years of age. They were compared with age-mates with ADHD and with a group of typically developing adolescents. The standard stimulus tape in this study consisted of ten short fragments with interactions between five dyads of adolescents who were initially strangers to each other. Adolescents with ASD clearly experienced difficulties in inferring the thoughts and feelings of others. They performed significantly worse than typically developing adolescents. The difference with the group with ADHD was, however, not significant. Interestingly, the empathic accuracy of the adolescents in the ASD group was positively correlated with age, but not with IQ.

Discussion and Conclusions

Apparently the majority of young children with ASD fail traditional mind-reading tasks. High-functioning adults with ASD, on the contrary, show only difficulties when more advanced or naturalistic tasks are being used. Their mind-reading impairments appear to be more subtle than those of young children. Whether this means that mind-reading abilities improve spontaneously or through teaching and training when individuals with ASD grow older, is still unclear. Research in adolescents is scarce, but the available evidence usually reveals more pronounced difficulties than in adults. Together with the findings that empathic abilities are correlated with age in children and in adolescents with ASD (Begeer, Koot, Rieffe, Meerum Terwogt, & Stegge, 2008; Demurie et al., submitted), this may indicate an improvement of mind-reading skills with growing age. More studies with adolescents and especially longitudinal studies from adolescence or earlier to adulthood are needed to shed more light on this issue. The fact that a complex paradigm as the empathic accuracy design was successfully used with adolescents with ASD, is promising for future research.

Although clear or somewhat subtle differences with typically developing persons were detected in studies with adolescents and adults with ASD, we should well be aware that these are all differences on a group level. In all the samples where the standard stimulus paradigm has been used, there were individuals with ASD who performed as well as their typically developing peers. Apart from age in the study with adolescents, however, we were not yet able to detect a characteristic that clearly distinguishes the empathic persons with ASD from those with poorer mind-reading skills. Detailed analyses in the Ponnet et al. (2008) study revealed that young adults with ASD use to a large extent the same strategies as typically developing persons to infer other people's

thoughts and feelings. This brings us to the unresolved issue as to whether the development of ToM in children with ASD is delayed, deviant or both (Serra, Loth, Van Geert, Hurkens, & Minderaa, 2002). In any case, some older individuals with ASD seem to have very similar mind-reading skills compared to typically developing adolescents and adults. This suggests that at least for a subgroup of high-functioning individuals with ASD, ToM-development is rather delayed than deviant.

Different studies with adults with ASD have shown the importance of structure to the performance on a mind-reading task. It is well known that people with ASD prefer structured situations and activities with clear rules and that their symptoms are less obvious in a highly structured context (e.g., Howlin, 1997; Mesibov, 1992). Apparently it is also much easier for them to infer thoughts and feelings of people who are engaged in a structured, quite predictable conversation, than of those involved in an unstructured, more chaotic interaction. It can be considered that all participants are familiar with the script of the structured interactions in the different empathic accuracy studies (i.e., an initial conversation of the getting acquainted type). This familiarity might be derived from experience or by having learned the script previously. Therefore, particular cues in the situation may lead to the retrieval of information from memory about similar situations to that of the target person, as well as social scripts or other socially relevant knowledge (see Karniol, 1995). Very little is known about the capabilities of subjects with ASD of using scripts, although script-fading procedures are increasingly being employed in interventions with children (e.g., Brown, Krantz, McClannahan, & Poulson, 2008). While a small study of Trillingsgaard (1999) suggested that children with autism have significantly fewer well-organized scripts for familiar social routines (such as celebrate a

birthday or make a cake) than control children, the results of a study of Volden and Johnston (1999) suggested that the basic scriptal knowledge of children with autism appears to be intact. The question remains whether these results can be generalised to adults with ASD and to what extent scriptal knowledge of adults is related to their mind-reading performance.

The so-called advanced mind-reading tests have demonstrated that high-functioning adults with ASD should not be underestimated since they may have good and in some cases very good mind-reading skills. This does not imply however, that they show appropriate social behaviour. Good mind-reading skills are often necessary but never sufficient for successful social functioning in everyday life (Astington, 2003).

Mind-reading impairments are most obvious when an unstructured, dynamic and naturalistic task is being used which circumvents the use of non-social heuristic strategies (Frith et al., 1994). The empathic accuracy tasks that have been described can be further developed to get a better insight into the nature and development of mind reading in individuals with ASD. They have the advantage of working with genuine mental states and allow to take into account and to manipulate contextual factors (Johnston et al., 2009). More recent work with typically developing adults suggests that empathic accuracy may depend more on the characteristics of the targets, than on those of the perceivers (e.g., Zaki, Bolger, & Ochsner, 2008). Our findings that the performance of adults with ASD is largely associated with the degree of structure of the conversation, rather than with IQ, may suggest that also in high-functioning ASD the focus should be more on dispositions of targets than on the identification of dispositions of accurate perceivers, although the role of scriptal knowledge should certainly be taken into account.

The recent findings in typically developing adults that auditory, and especially verbal information is more critical to empathic accuracy than visual information and that target expressivity predicts empathic accuracy (Zaki et al., 2009) is in line with this view and offers testable hypotheses for future research with individuals with ASD. Examining whether more structured conversations provide clearer verbal cues to internal states and therefore allow perceivers with ASD to improve their empathic accuracy (see Zaki et al., 2009) is most probably the next step to take.

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