



Determining differences in social cognition between high-functioning autistic disorder and other pervasive developmental disorders using new advanced “mind-reading” tasks

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ABSTRACT

Deficits in understanding the mental state of others (“mind-reading”) have been well documented in individuals with pervasive developmental disorders (PDD). However, it is unclear whether this deficit in social cognition differs between the subgroups of PDD defined by the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. In this study, PDD was divided into high-functioning autistic disorder (HFA) ($n = 17$) and other PDD ($n = 11$) consisting of Asperger’s disorder ($n = 8$) and PDD-NOS ($n = 3$), and differences in mind-reading ability was examined between the two clinical groups and controls ($n = 50$) using a new advanced naturalistic task consisting of short scenes from a TV drama showing communication in social situations. The task was divided into visual and auditory tasks to investigate which modality was more valuable for individuals with PDD to understand the mental state of others. The results suggest that social cognition differs significantly between individuals with HFA and those with other PDD, with no difference being found between those with other PDD and controls. Neither the auditory or visual modality was found to be dominant in subjects with PDD in the mind-reading task. Taken together, complex mind-reading tasks appear to be effective for distinguishing individuals with HFA from those with other PDD.

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1. Introduction

The term “theory of mind (ToM)”, which describe the ability to attribute mental states to oneself or another person, was introduced in psychology by Premack and Woodruff (1978). Since Baron-Cohen, Leslie, and Frith (1985) first reported “deficit of ToM” in which the autistic condition is seen as a failure to attribute mental states to others, much work has been conducted on ToM in pervasive developmental disorders (PDD). The ability to understand the mental state of others, which underlies fundamental social skills, is also referred to as “mind-reading” (Baron-Cohen et al., 1985). The basic ToM test,

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usually consisting of the first and the second-order false belief tasks, is not sufficiently complex to detect deficits in adults with high-functioning PDD (HFPDD) (Bowler, 1992; Happé, 1994; Ozonoff, Pennington, & Rogers, 1991). Thus, an advanced ToM test, the Strange Situation Test, was devised by Happé (1994) in which participants are asked to provide an explanation for non-literal statements (e.g. irony or lie) made by story characters. Happé's study demonstrated that participants with PDD who passed the first and second-order false belief tasks did show specific deficits in ToM on this more complex test.

Many advanced ToM studies were subsequently conducted with adults with HFPDD in order to investigate subtle deficits of "mind-reading" ability. The Eyes Test was created for adults with HFPDD as a mind-reading task that uses information from the visual modality alone (Baron-Cohen, Wheelwright, & Jolliffe, 1997; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). In the task, participants are shown photographs in which only the areas of the eyes are cut out from a person's face, and they are asked to identify the person's mental state. Researchers have revealed that individuals with PDD provide less correct justifications of mental state than controls, indicating that the Eyes Test is highly accurate in measuring mind-reading ability. However, in the real world, in order to integrate all of the information which people express, we look not only at the eyes of others, but also at their facial expressions, body language, posture and so forth. Moreover, we do not look at a static face and body in the real world, but at a moving face and body. Thus, a task that presents dynamic information in both the visual and auditory modality, such as video, was deemed to be more realistic and was expected to measure the ability to understand others' mental states in daily life. Accordingly, Heavey, Phillips, Baron-Cohen, and Rutter (2000) developed the "Awkward Moments Test" which uses scenes taken from TV programs and commercials and Roeyers, Buysee, Ponnet, and Pichal (2001) devised the "Empathic Accuracy Task" which uses recordings of real communicative interactions. In their studies, participants viewed moving images (video) and tried to determine the mental states of the characters. Participants with PDD provided less correct justifications of mental state than typically developing subjects.

More recently, a question has been raised about which of the auditory and visual modality is more valuable for adults with PDD to understand the mental state of others. A task that extends the abovementioned advanced tasks into the auditory modality was created by Rutherford, Baron-Cohen, and Wheelwright (2002), and a study employing this task with adults with Asperger's disorder (AS) and high-functioning autistic disorder (HFA) revealed that both groups had difficulty extracting mental state information from vocalizations (Golan, Baron-Cohen, Hill, & Rutherford, 2007). In addition, use of the Cambridge "Mind-Reading" (CAM) Face-Voice Battery in adults with AS to test their cognition of 20 complex emotions and mental states from faces or voices (Golan, Baron-Cohen, & Hill, 2006) showed that although the participants showed deficits in social cognition when relying on either facial or vocal information alone, they could understand others' mental state better from the voices than from the faces. Given this finding among individuals with AS, one of the objectives of the present study is to identify which modality—visual (facial expression, gesture and posture) or auditory (pitch, intonation and tone of speech)—is more valuable for adults with PDD to understand the complex emotions of others.

Most recent studies using the advanced mind-reading tasks with moving stimuli have treated adults with PDD as one group. Some earlier studies, however, investigated the difference in mind-reading ability between the subgroups of PDD, especially between HFA and AS, but still today it is unclear whether in fact the two disorders differ in degree of impairment of mind-reading ability (Dahleger & Trillingsgaard, 1996; Ozonoff, Rogers, & Pennington, 1991; Ozonoff, South, & Miller, 2000; Zaitai, Durkin, & Pratt, 2003). A recent study that compared the subgroups of HFA and AS with typically developing adults was conducted by Spek, Scholte, and Van Berckelaer-Onnes (2010), who used the Eyes Test (Baron-Cohen et al., 1997), the Faux Pas Recognition Test (Stone, Baron-Cohen, & Knight, 1998) and the Strange Stories Test (Happé, 1994). The findings suggested that there was no significant difference in mind reading ability between individuals with HFA and AS on any of the tasks. However, since Spek et al. did not employ the CAM or moving images in their mind-reading task, it remains to be determined whether mind-reading ability differs on a more complex, moving mind-reading task between the PDD subgroups.

Thus, the second objective of the present study was to clarify whether any differences exist in mind-reading ability between HFA, a typical PDD, and other PDD consisting of AS and pervasive developmental disorder not otherwise specified (PDD-NOS). We hypothesized that individuals with HFA would show greater deficits in mind-reading ability than those with other PDD.

2. Methods

2.1. Participants

The clinical group comprised 28 male adolescents and adults with PDD (mean age 24.5 years, SD = 7.7 years, range = 16–45 years). Participants were recruited from a private child psychiatric clinic specializing in PDD or a research volunteer pool of the PDD research group at the National Institute of Mental Health. All participants were diagnosed by experienced child psychiatrists. The diagnostic process was conducted by a team of one child psychiatrist and one or two clinical psychologists. The psychiatrist interviewed the parents about their child's developmental history and daily behaviors. In parallel, in another room, the clinical psychologist observed the social behavior and communication of each participant during the IQ test and in conversation which included questions about daily life, their community and interpersonal relationships. Based on the data obtained, the participants were diagnosed according to the established criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) (APA, 2000): 17 were diagnosed with HFA (showing qualitative impairment in social interaction, qualitative impairment in communication, and restricted repetitive and stereotyped patterns of behavior, interests, and activities), and 11 were diagnosed with other PDD, which combined 8 participants with

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