Social attribution in children with high functioning autism and Asperger syndrome: An exploratory study in the Chinese setting

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ABSTRACT

The present study aimed to examine social attribution in children with high-functioning autism (HFA) and Asperger's syndrome (AS). A sample of 20 boys (9 with HFA and 11 with AS) and 20 age-matched controls were recruited for this study. All participated in two tasks measuring social attribution ability, the conventional Social Attribution Task (SAT) and a modified version with animals rather than shapes (mSAT). They also completed a battery of neuropsychological tests. Compared to typically developing controls, children with autism spectrum disorders were impaired on some measures in both SATs. However, group differences in 'theory-of-mind' indices were only significant in the mSAT, with the ASD group performing more poorly than controls. In addition, the scores in person index of both versions of the SAT correlated with executive function in children with HFA/AS. The current study found the mSAT paradigm was especially sensitive to ToM difficulties in young Chinese children with HFA/AS. Social attribution in children with HFA/AS, unlike neurotypical children, was related to executive function ability, suggesting these psychological domains are not distinct in children with autism spectrum disorders.

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1. Introduction

Autistic spectrum disorder (ASD) is a developmental disability characterized by impairments in communication and social interaction, and these social impairments are evident regardless of age or intelligence. One influential psychological account of ASD is the theory of mind (ToM) hypothesis, which proposes that the social and communicative abnormalities of ASD are the result of a specific inability to intuitively understand mental states, such as the beliefs, intentions and desires of others (Hill & Frith, 2003; Leslie, 1987). Individuals with ASD are said to have a deficit in ToM or mentalizing, sometimes referred to as 'mindblindness' (Baron-Cohen, 1995).

The tasks traditionally used to measure ToM ability are false belief tasks (FBTs), including first-order FBT and second-order FBT. Individuals with classical autism may have difficulty in passing a first-order FBT, which requires the participants to infer a story character's belief about a situation (Baron-Cohen, Leslie, & Frith, 1985; Perner, Frith, Leslie, & Leekam, 1989). Even more challenging are second-order FBTs, which require reasoning about what a third person understands about another person's thoughts (Baron-Cohen, 1989). However, subsequent studies have shown that a majority of intellectually able children, adolescents, and adults with high functioning autism (HFA) or Asperger's syndrome (AS) can pass false-belief

attribution tasks (Bowler, 1992; Dahlgren & Trillingsgaard, 1996; Tager-Flusberg & Sullivan, 1994), which were designed for use with children aged 4–6 years (Klin, 2000). Therefore, more advanced tests of ToM have been developed, such as the Eyes Test, in which participants try to infer mental states from photographs of the upper face/eyes (Baron-Cohen, Wheelright, Hill, Raste, & Plumb, 2001; Baron-Cohen, Wheelright, Spong, Scahill, & Lawson, 2001); reading the mind in the voice (Golan, Baron-Cohen, Hill, & Rutherford, 2007; Rutherford, Baron-Cohen, & Wheelwright, 2002); and the strange stories test of advanced ToM (Happé, 1994; Jolliffe & Baron-Cohen, 1999; Kaland, Callesen, Møller-Nielsen, Mortensen, & Smith, 2008; Kaland et al., 2002). In general, intellectually able individuals with ASD still demonstrated significantly more difficulties in mentalizing than matched controls in these advanced ToM tasks, which document ToM ability in a continuous way, unlike false belief tasks which are scored as "all or nothing" (i.e., pass/not pass).

Although advanced tasks are arguably more valid measures of ToM ability than false-belief tasks, they still have limitations in terms of their ecological validity (Beaumont & Sofronoff, 2008). In an attempt to develop measures that more closely approximate to real-life mentalizing demands, some researchers use excerpts of films (Dziobek et al., 2006; Golan, Baron-Cohen, Hill, & Golan, 2006; Heavey, Phillips, Baron-Cohen, & Rutter, 2000), television commercials (Beaumont & Newcombe, 2006), cartoons displaying a variety of child, adolescent and adult themes as materials. Again, these studies agreed that individuals with ASD struggled to infer the mental states of characters in the context of the social interaction contained in the scenes.

However, the above tasks all measure the ToM ability by explicit mentalizing demands, such as social problem-solving (Klin, 2000; Peterson & Bowler, 2000). This is not the case in more natural social situations. Thus a question remains whether individuals with ASD who pass false-belief tasks can spontaneously impute mental states. Based on early work by Heider and Simmel (1944), Klin (2000) developed the Social Attribution Task (SAT), to test spontaneous attribution of social meaning to ambiguous visual stimuli. In Heider and Simmel's (1944) famous study, a silent animation of two triangles and a circle moving within and around a rectangle was viewed by participants. The stimuli were not people or people-like, nor were they defined explicitly. The authors found that college students generally described the on-scene events as having human intent. Klin (2000) further developed the SAT paradigm, establishing a standard procedure and coding system. After viewing the video twice, participants were asked "what happened there". Compared to healthy controls, adolescents and adults with HFA or AS provided significantly shorter narratives, and did less well in a series of SAT 'indices' because they tended to describe the content of the animation in geometric terms and explain the activity in 'physical' terms. Moreover, they used ToM terms infrequently, while controls sought immediate social meaning effortlessly. In their most recent study, Klin and Jones (2006) used the SAT and a novel control animation task, the Physical Attribution Task (PAT), to show that difficulty observed in the ASD group was specific to the SAT and not evident in the PAT. These findings were taken to support the hypothesis that individuals with ASD tend not to spontaneously seek social meaning in the environment.

Taken together, these findings suggested that the SAT and similar paradigms are useful and sensitive tools to measure the ability to seek social meaning, and decode stimuli in terms of complex mental states such as beliefs, desires and intentions. However, the participants in Klin's study (2000) were adolescents and adults, and it was not clear whether this paradigm was appropriate for younger children. The stimuli in the conventional SAT are abiotic geometric figures which maybe difficult for typically developing children, and particularly those with an ASD, to describe in animate terms, let along attribute complex mental states. Consistent with this, we found that a modified version of the SAT (mSAT) which contained animals instead of shapes, was 'easier' for young children, and children under 9 years performed at baseline on the conventional SAT (Hu, Chan, & McAlonan, 2010). The mSAT incorporated more content-rich social scenarios and had impressive test-retest reliabilities (r ranging from .84 to .90), inter-rater reliabilities (r ranging from .62 to .94) and concurrent validity with the SAT in older age groups (on all the indices of the rating). Importantly, in these typical developing children, there was no significant relationship between social attribution ability (both versions) and executive function after controlling for age and verbal IQ.

Executive function (EF) is an umbrella term for abilities such as planning, working memory, impulse control, inhibition and shifting set, as well as initiation and monitoring of actions. Studies have found significant correlations between ToM and aspects of EF in ASD (Joseph & Tager-Flusberg, 2004; Pellicano, 2007; Zelazo, Jacques, Burack, & Frye, 2002), although these may be mediated by language (Joseph & Tager-Flusberg, 2004). Thus, EF has been suggested to be a prerequisite for ToM (Russell, 1997). Consistent with this, EF relies upon the prefrontal lobe (Hill, 2004; Hill & Frith, 2003), the medial prefrontal cortex is activated during mentalizing (Brunet, Sarfate, Hardy-Bayle, & Decety, 2000; Castelli, Frith, Happé, & Frith, 2002; Fletcher et al., 1995; Gallagher et al., 2000; Vogeley et al., 2001), and during the SAT (Schultz et al., 2003), and ASD groups have abnormalities in the frontal lobe (Chugani et al., 1997; McAlonan et al., 2002, 2005; MaLonan et al., 2008; Ohnishi et al., 2000; Salmond, Haan, Friston, Gadian, & Vargha-Khadem, 2003; Zilbovicius, Garreau, Samson, & Remy, 1995). That said, the correlation between ToM and EF in ASD could potentially reflect task difficulty, rather any direct causal relationship. Therefore, in order to explore the association between EF and ToM in children with ASD, we elected to use the SAT and mSAT as these are independent of EF in neurotypical children (Hu et al., 2010). We predicted that EF ability would correlate with social attribution ability in the autism group.

However, because neither version of the SAT has been previously used in such a young age group with autism, we first planned to explore correlations between conventional FBTs and the SATs and predicted positive correlations across these ToM paradigms. We also hypothesized that children with ASD would be impaired in both versions of the SAT compared to normal controls.