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## Explicit vs. applied theory of mind competence: A comparison of typically developing males, males with ASD, and males with ADHD



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### ABSTRACT

Using laboratory-type Theory of Mind (ToM) tasks (our measure of 'explicit' ToM competence) and a more ecologically-valid measure of ToM (our measure of 'applied' ToM competence), we found that for composite scores, typically developing (TD) males performed near ceiling levels on both indices and age-matched males with autism spectrum disorder (ASD) performed near floor levels on both indices. The scores for age-matched males with attention-deficit hyperactivity disorder (ADHD) showed a different pattern such that the ADHD group had high scores on the explicit measure and low scores on the applied measure. Subscale scores (early, basic, advanced ToM) for the two indices also revealed that (1) despite variable complexity, explicit ToM almost always distinguished the ASD group from the other two groups but never distinguished the ADHD and TD groups and (2) level of complexity was critical for distinguishing groups with regard to applied ToM. We suggest that although children with ADHD can calculate the content of traditional laboratory ToM tasks, this explicit ToM competence fails to be applied and expressed in real world demonstrations of ToM (especially when advanced ToM skills are assessed). By contrast, the ToM difficulties of children with ASD seem to be attributable to a deeper metarepresentational deficit. Our results have implications for practice and extend current models of social cognition in developmental disabilities by isolating variable aspects of competence that predict specific and testable models for future research.

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### 1. Introduction

Children with developmental disabilities evidence social and behavioral dysfunction which, left untreated, can lead to peer rejection, social isolation, and psychological maladjustment (Hoza, 2007; Hutchins & Prelock, 2013). Attention-deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD) are common and debilitating neurodevelopmental disorders with a chronic course. Although they are distinct diagnostic categories, these psychiatric disorders are frequently comorbid with a little over 28% of persons with ASD also meeting criteria for ADHD (Simonoff et al., 2008). An overlap of

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symptoms and impairments between the two disorders is also well-documented (Memari, Ziaee, Mifrazeli, & Kordi, 2012). For example, compared to their typically developing (TD) peers, children with ADHD and children with ASD demonstrate more inattention and over-activity (Dickerson, Calhoun, Mayes, & Molitoris, 2012), mood and behavior problems (Mayes & Calhoun, 2007), irritability, anger (Brereton, Tonge, & Einfled, 2006), anxiety, and depression (Matson & Cervantes, 2014; Stratis & Lecavalier, 2013), and have higher rates of executive dysfunction (Lawson, Papadakis, Higginson, Barnett, & Willis, 2014) and language delay (Miniscalco, Hagberg, Kadesjo, Westerlund, & Gillberg, 2007). Although there is agreement that children with ASD and children with ADHD have many similar comorbid problems, consensus is lacking as to whether, or to what extent, certain 'Theory of Mind' deficits typical of ASD are common in ADHD.

### 1.1. Theory of mind

Theory of Mind (ToM) has been defined as "a body of conceptual knowledge that underlies access to both one's own and others' mental states" (Sodian, Hulsken, & Thoermer, 2003, p. 778). Originally used in a narrow sense (i.e., merely to describe performance on the false belief task), ToM has come to be construed as a broad, complex, and multifaceted construct. To illustrate, ToM includes (but is not limited to) the ability to engage in joint attention and pretense, the understanding of play pragmatics, empathy, intentionality, and the capacity to distinguish appearance from reality and the mental from the physical world. It involves affect recognition, first- and second-order thinking, visual perspective-taking, and the understanding that seeing leads to knowing. One with a mature ToM also comprehends the mind as an active interpreter and can make inferences and reason about the causes and consequences of one's own and others' thoughts and feelings. Indeed, ToM has been described as a construct that "refuses to be corralled" (Astington & Baird, 2005, p. 4) and it is often used interchangeably with terms like 'social cognition', 'mind-reading', 'mentalizing', and 'perspective-taking' (Hutchins, Prelock, & Bonazinga, 2012).

#### 1.1.1. ToM and ASD

The widening scope of the term ToM is primarily attributable to the breadth and pervasiveness of the social-cognitive impairments that have been documented in ASD. Owing to nearly three decades of robust empirical findings revealing deficits in ToM in ASD (for a review see Wellman & Peterson, 2013), energy and enthusiasm for the notion of ToM as a core deficit has endured. Specific empirical evidence for this 'Theory of Mind Hypothesis' of autism (Baron-Cohen, 1995) first came from two landmark studies (Baron-Cohen, Leslie, & Frith, 1985; Wimmer & Perner, 1983) demonstrating that children with ASD had significant difficulties understanding that others could have a belief that contradicted reality (i.e., a false belief). The fact that individuals with ASD performed poorly on a variety of ToM tasks but succeeded on carefully designed control tasks suggested that ToM impairments were not the result of more general cognitive dysfunction. Although differences in the measurement of ToM are known to influence performance (e.g., van Buijssen, Hendriks, Ketelaars, & Verhoeven, 2011), research shows that persons with ASD generally underperform TD individuals on assessment of an extensive range of mental states (e.g., Sterck & Begeer, 2010).

Although it has some serious limitations (see Hutchins & Prelock, 2015), the ToM hypothesis makes intuitive sense and parsimoniously explains the social communication and social interaction deficits that are the defining features of ASD. These deficits include a limited range of communicative functions, less diverse and elaborate functional play, difficulty modulating the use of prosody and gesture to aid communication, lack of social responsiveness, and failure to establish or maintain eye contact, to name a few. Whatever specific explanation is provided for the social communication and social interaction difficulties in ASD, it seems clear to many researchers and practitioners that they are a result of some underlying cognitive process that has come to be broadly referred to as ToM.

#### 1.1.2. ToM and ADHD

Social cognition deficits are not strictly limited to people with ASD and there are a variety of circumstances and disorders that can hinder ToM development (Dyck, Ferguson, & Shochet, 2001). Some ADHD researchers have pointed to impairment in specific social cognitive domains (e.g., empathy; Demurie, De Coral, & Roeyers, 2011; emotion recognition, prosody perception; Uekermann et al., 2010) as a basis for social dysfunction in ADHD. Others, explaining social deficits more generally (i.e., not specific to ADHD), have adopted a procedural model (i.e., Crick & Dodge, 1994) postulating disruption in a series of social-information processing steps that children go through when faced with social situations (i.e., encoding of cues, interpretation of cues, clarification of goal states, accessing/generating responses, response decision, and behavioral enactment). Indeed, compared to TD children, children with (or at risk for) ADHD tend to encode social information less accurately and, in turn, have difficulty integrating social cues and formulating appropriate responses (Coy, Speltz, DeKlyen, & Jones, 2001; Milch-Reich, Campbell, Pelham, Connelly, & Geva, 1999). Still other researchers have implicated biased or distorted social attribution as a causal factor underlying the social dysfunction in ADHD. For example, Andrade et al. (2012) reported that children with ADHD not only detected fewer social cues but also attributed more negative and less positive intent to peers and generated fewer positive responses compared to TD children.

Of course, there are multiple pathways to social difficulties and research employing more traditional ToM tasks has highlighted the potential of executive dysfunction (not ToM impairment) as a root cause of the social deficits of ADHD. While three studies (Charman, Carroll, & Struge, 2001; Happé & Frith, 1996; Perner, Kain, & Barchfeld, 2002) have reported no impairment on advanced ToM tests in school-aged children with (or at risk for) ADHD, findings are mixed and at least two

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