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Empirical Failures of the Claim That Autistic People Lack a Theory of Mind

Morton Ann Gernsbacher,
University of Wisconsin—Madison

Melanie Yergeau
University of Michigan

Abstract

The claim that autistic people lack a theory of mind—that they fail to understand that other people have a mind or that they themselves have a mind—pervades psychology. This article (a) reviews empirical evidence that fails to support the claim that autistic people are uniquely impaired, much less that all autistic people are universally impaired, on theory-of-mind tasks; (b) highlights original findings that have failed to replicate; (c) documents multiple instances in which the various theory-of-mind tasks fail to relate to each other and fail to account for autistic traits, social interaction, and empathy; (c) summarizes a large body of data, collected by researchers working outside the theory-of-mind rubric, that fails to support assertions made by researchers working inside the theory-of-mind rubric; and (d) concludes that the claim that autistic people lack a theory of mind is empirically questionable and societally harmful.

SCIENTIFIC ABSTRACT

The assertion that autistic people lack a theory of mind—that they fail to understand that other people have a mind or that they themselves have a mind—pervades psychology. In this article, we critically examine the empirical basis of this assertion. We review empirical evidence that fails to support the claim that autistic people are uniquely impaired, much less that all autistic people are universally impaired, on theory-of-mind tasks. We highlight seminal theory-of-mind findings that have failed to replicate. We document multiple instances in which the various theory-of-mind tasks fail to converge and fail to predict autistic traits, social interaction, and empathy. We summarize a

Correspondence concerning this article should be addressed to Morton Ann Gernsbacher, Department of Psychology, University of Wisconsin—Madison, 1202 West Johnson Street, Madison, WI 53706. magernsb@wisc.edu.
Morton Ann Gernsbacher, Department of Psychology, University of Wisconsin—Madison; Melanie Yergeau, Department of English Language and Literature, University of Michigan.

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The authors have made available for use by others the data that underlie the analyses presented in this article (see Gernsbacher, 2018a), thus allowing replication and potential extensions of this work by qualified researchers. Next users are obligated to involve the data originators in their publication plans, if the originators so desire.

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The experiment materials are available at https://doi.org/10.17605/OSF.IO/3R2QY

large body of data, collected by researchers working outside the theory-of-mind rubric, that fails to support assertions made by researchers working inside the theory-of-mind rubric. We conclude that the claim that autistic people lack a theory of mind is empirically questionable and societally harmful.

Keywords

autism; theory of mind; convergent validity; predictive validity; reproducibility

> Most of us have a theory of mind in that we can guess what others are thinking and how that might differ from what we are thinking. Those with autism can be thought of as mindblind in that they cannot imagine what others might be thinking, or even that others are thinking. … To them, it would be like looking at the headlights of a car to determine why the car just did what it did, or what information it is trying to convey to us.
>
> —The Encyclopedia of Neuropsychological Disorders
>
> (Soper & Murray, 2012, p. 125)

The assertion that autistic[1] people lack a theory of mind—that they fail to understand that other people have a mind or that they themselves have a mind—pervades psychology. The assertion is taught across a wide range of psychology textbooks (Coon, Mitterer, & Martini, 2018; Kellogg, 2007; Kirk, Gallagher, Coleman, & Anastasiow, 2008; Mash & Wolfe, 2015; Myers, 2009, 2012; Sigelman & Rider, 2017). The assertion is argued by psychologists in state and federal court cases (Carter v. Superintendent, 2011; New Jersey v. Burr, 2007; United States v. Geanakos, 2017). The assertion is promoted by thousands of psychology articles; in fact, the vast majority—over 75%—of the top 500 articles indexed by Google Scholar (for “theory of mind” and “autism”) simply assert that autistic people lack a theory of mind rather than provide original data to buttress the claim (Gernsbacher, 2018a).[2] Clearly, the assertion that autistic people lack a theory of mind has become one of psychology’s sacred topics, a critical evaluation of which the current special issue solicited.

In this article, we review empirical evidence that fails to support the claim that autistic people are uniquely impaired, much less that all autistic people are universally impaired, on theory-of-mind tasks. We highlight seminal theory-of-mind findings that have failed to replicate. We document multiple instances in which various theory-of-mind tasks fail to converge and fail to predict autistic traits, social interaction, and empathy. We summarize a large body of data, collected by researchers working outside the theory-of-mind rubric, that fail to support assertions made by researchers working inside the theory-of-mind rubric. We conclude that the claim that autistic people lack a theory of mind is empirically questionable and societally harmful.

[1]We use identity-first language (e.g., autistic people, nonautistic people) rather than person-first language (e.g., people with autism, people without autism) because identity-first language is preferred by autistic people (Kenny et al., 2016), is recommended by APA (Dunn & Andrews, 2015), and is less likely to contribute to stigma (Gernsbacher, 2017).

[2]All materials and data supporting the conclusions drawn in this article are available in Gernsbacher (2018a), which is a technical report available on the Open Science Framework.

Failures of Specificity

For nearly two decades, Simon Baron-Cohen and his colleagues claimed that poor performance on theory-of-mind tasks uniquely characterized autistic people (see Table 1).The initial claim was staked on autistic children's performance on a theory-of-mind task called False Belief. In a False Belief task, a child might be introduced to two puppets, one named Sally and the other Anne. The child watches as the Sally puppet places a possession, such as a marble, inside a basket. Then, the Sally puppet is taken away, and the Anne puppet moves the marble from its previous location to another location, such as inside a box. When the Sally puppet is represented, the child is asked orally, "Where will Sally look for her marble?" If the child answers with the location where the marble actually is, rather than the location where the first puppet placed the marble, the child is considered to have failed the False Belief task and to lack a theory of mind.

Other tasks have been used to assess theory of mind; some of the more popular ones appear in Table 2. But it was autistic children's performance on False Belief tasks that propelled Baron-Cohen and his colleagues' claim that autistic people uniquely lack a theory of mind.

However, autistic children are not unique in failing False Belief tasks; so too do children with specific language impaiiment (Loukusa, Mäkinen, Kuusikko-Gauffin, Ebeling, & Moilanen, 2014; Norbury, 2005); Down syndrome (Zelazo, Burack, Benedetto, & Frye, 1996); Williams syndrome (van Herwegen, Dimitriou, & Rundblad, 2013); Prader Willi syndrome (Lo, Siemensma, Collin, & Hokken-Koelega, 2013); cerebral palsy (Caillies, Hody, & Calmus, 2012; Dahlgren, Dahlgren Sandberg, & Hjelmquist, 2003); Fragile X (Cornish et al., 2005); epilepsy (Raud, Kaldoja, & Kolk, 2015); and neurofibromatosis type I (Payne, Porter, Pride, & North, 2016), as well as children exposed prenatally to maternal smoking (Reidy, Ross, & Hunter, 2013) and drinking (Rasmussen, Wyper, & Talwar, 2009). Indeed, the more atypical the child, the more likely they are to fail false belief tasks.

Even typically developing children with fewer rather than more siblings (Jenkins & Astington, 1996; Peterson, 2000), with lower rather than higher socioeconomic status (Hughes & Ensor, 2005), or with fewer rather than more adult relatives living nearby (Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, & Berridge, 1996) are more likely to fail False Belief tasks, as are children who are blind (Brambring & Asbrock, 2010; Green, Pring, & Swettenham, 2004; Minter, Hobson, & Bishop, 1998; Peterson, Peterson, & Webb, 2000) or deaf/hard of hearing (Figueras-Costa & Harris, 2001; Jackson, 2001; Lundy, 2002; Meristo et al., 2007; Moeller & Schick, 2006; Peterson & Siegal, 1995; Russell et al., 1998).

More recently, Baron-Cohen has acknowledged that a lack of theory of mind "may not be specific" to autistic people (Baron-Cohen, 2009, p. 70; 2010, p. 169). For nearly 30 years, other researchers have also tried to correct this inaccurate claim (Eisenmajer & Prior, 1991; Frye, Zelazo, & Burack, 1998; Prior, Dahlstrom, & Squires, 1990; Tager-Flusberg, 2001, 2007; Yirmiya & Shulman, 1996; Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998; Zelazo, Jacques, Burack, & Frye, 2002). But the erroneous claim that only autistic people, "together with robots and chimpanzees" lack a theory of mind (Pinker, 2002, p. 62; see also Mitchell, 1997) and are therefore "biologically set apart from the rest of humanity in lacking the basic

machinery" (Baron-Cohen, 2009, p. 73) echoes throughout psychological literature, practice, and instruction (cf. Gernsbacher, 2007; Yergeau, 2013; Yergeau & Huebner, 2017).

Failures of Universality

A lack of a theory of mind is often assumed to be not only a unique characteristic of autistic people, but also a universal characteristic of all autistic people. Repeatedly, Baron-Cohen has claimed that "mindblindness … is universal in applying to all individuals on the autistic spectrum" (Baron-Cohen, 2008a, p. 61; Baron-Cohen, 2008b, p. 113; Baron-Cohen, 2009, p. 70; Baron-Cohen, 2010, p. 169; Baron-Cohen, 2011a, p. 40; Baron-Cohen, 2011b, p. 629; see also Table 3). This assumed universality has been widely promoted across psychology, as the opening quote of our article illustrates. However, as other authors note, many autistic children and adults pass theory-of-mind tasks; therefore, these other authors rightly argue that "mindblindness" cannot be a universal characteristic of autism (e.g., Bailey, Phillips, & Rutter, 1996; Bauminger & Kasari, 1999; Beversdorf et al., 1998; Boucher, 2012; Buitelaar, van der Wees, Swaab-Barneveld, & van der Gaag, 1999b; Charman, 2000; Ozonoff, Rogers, & Pennington, 1991).

Why do some autistic participants pass theory-of-mind tasks while others do not? Numerous researchers have aptly noted that theory-of-mind tasks rely heavily on spoken language (see Gernsbacher & Frymiare, 2005, and Gernsbacher & Pripas-Kapit, 2012, for reviews). For example, nearly half the variance in participants' performance on False Belief tasks can be predicted by their spoken language comprehension (Capage & Watson, 2001); nearly three fourths can be predicted by their facility with vocabulary (Steele, Joseph, & Tager-Flusberg, 2003) and appreciation of grammar (Peterson, Wellman, & Slaughter, 2012). In longitudinal studies, vocabulary predicts False Belief performance more powerfully than age (Steele et al., 2003); in studies comparing autistic to nonautistic participants, vocabulary predicts False Belief performance more powerfully than whether the participants are autistic (Loukusa et al., 2014; Norbury, 2005; see also Milligan, Astington, & Dack's, 2007, meta-analysis with over 100 studies of typically developing children; Yirmiya, Erel, Shaked, and Solomonica-Levi [1998], meta-analysis with 40 studies of autistic children; and Gernsbacher, 2018a, for studies published after these meta-analyses).

Other theory-of-mind tasks also draw heavily on spoken language. Happé's (1994a) Strange Stories task (see Table 2) requires comprehending complex stories and answering complex questions, which is why complex language comprehension can be the task's "only" predictor (Shaked, Gamliel, & Yirmiya, 2006, p. 183), and vocabulary can account for more than three fourths of the variance (de Lima Velloso, Duarte, & Schwartzman, 2013; see also Abell & Hare, 2005; Botting & Conti-Ramsden, 2008; Dyck, Ferguson, & Shochet, 2001; Frölander et al., 2014; Kaland et al., 2005; Loth, Gómez, & Happé, 2008; Scheeren, de Rosnay, Koot, & Begeer, 2013; Solomon, Goodlin-Jones, & Anders, 2004).

Even performance on Baron-Cohen, Wheelwright, Hill, Raste, and Plumb's (2001) Reading-the-Mind-in-the-Eyes task "involves sophisticated vocabulary" (Muller et al., 2010, p. 1095), which is why the best predictor of Reading-the-Mind-in-the-Eyes can be Speaking-Aloud-Hard-to-Pronounce-Words (Lawrence, Shaw, Baker, Baron-Cohen, & David, 2004) and why

vocabulary and grammar can account for nearly half the variance (Bennett et al., 2013; see also Botting & Conti-Ramsden, 2008; Castelli et al., 2011; Dorris, Espie, Knott, & Salt, 2004; Olderbak et al., 2015; Pino et al., 2017; Peterson & Miller, 2012).

Because theory-of-mind tasks rely heavily on "fairly complex language" (San José Cáceres, Keren, Booth, & Happé, 2014, p. 608) and because autism, by diagnostic definition, involves communication impairment (Gernsbacher, Morson, & Grace, 2016), it is unsurprising that autistic participants with communication impairment perform less well than nonautistic participants without communication impairment. And because autistic people vary in their communication impairment (Gernsbacher, Geye, & Ellis Weismer, 2005), it is unsurprising that autistic people vary in their theory-of-mind task performance.

The heavy reliance of theory-of-mind tasks on language has led theory-of-mind proponents to claim that autistic people who pass theory-of-mind tasks must be using their linguistic abilities to "hack out" the answers (Happé, 1995, p. 853; Tager-Flusberg, 2001, p. 185). This claim might seem superficially sound, but it is hard to reconcile with the fact that autistic people, on average, have communication impairments. How and why would autistic people preferentially use language to "hack out" the answers while nonautistic people, without communication impairments, do not? A related claim made by those who assume that all autistic people must lack a theory of mind, is that autistic people who pass theory-of-mind tasks must use some unknown "logic" or post hoc "strategy" (Baron-Cohen, 2006, p. 868; Frith, Happé, & Siddons, 1994, p. 110; Happé, 1994a, p. 130, 1994b, p. 220). But such post hoc claims seem to fail their own test of logic.[3]

Failures of Replication

Reproducibility is the cornerstone of science, as psychology's current focus on replication illustrates (Gernsbacher, 2018b, 2018c, 2018d; Spellman, 2015; Tackett et al., 2017). However, when tests of reproducibility are applied to claims about autism and theory of mind, the seminal findings frequently fail.

For example, cognizant of the heavy reliance on language by most theory-of-mind tasks, Baron-Cohen, Leslie, and Frith (1986) designed a nonverbal task. Children were given a scrambled set of four pictures and told to arrange the pictures in a coherent order. One set of pictures displayed a boy standing at the top of a hill with a basketball-sized rock next to his foot; another picture displayed the boy with his foot close to the rock, as though ready to kick it; another picture displayed the rock halfway down the hill; and another picture displayed the rock at the bottom of the hill. Baron-Cohen et al. (1986) deemed this type of picture sequence "mechanical," and autistic children were almost perfect in sequencing such pictures. Oddly, typically developing children performed below 50% correct on these "mechanical" pictures—which most likely was unexpected because Baron-Cohen et al. (1986, p. 116) deemed these "mechanical" pictures "the simplest."

[3]For example, some researchers claim that autistic children "fail the false belief task because they lack the capacity to acquire a theory of mind," whereas nonautistic children "fail the false belief task because of general task demands, because they don't have a grasp of false belief, or both. But they surely have a 'theory of mind'" (Bloom & German, 2000, p. B29).

Another set of pictures displayed a boy sitting on the ground holding an ice cream cone to his mouth with a girl standing nearby; in another picture, the ice-cream-holding boy is looking at the girl who, in this picture, is also sitting on the ground; in another, the girl is reaching for the boy's ice cream cone while he stretches his arm as far as possible away from the girl's reach; in the final picture, the girl holds the ice cream cone to her mouth, while the boy rubs his eyes. Autistic and typically developing children were equally adept at arranging this type of picture sequence, which Baron-Cohen et al. (1986, p. 115) deemed "behavioral" and, quite curiously, not an assay of the characters' intentions or requiring an understanding of "mental states."

An example of the last type of picture sequence displayed a girl holding a teddy bear in her arms, while a flower extends from the ground beside her; in another picture, the girl is turned completely to one side and is holding the flower's stem, while the teddy bear is on the ground behind her; in another, the girl is holding the flower to her nose, while a boy, standing behind the girl, reaches for the teddy bear on the ground; in the final picture, the girl is turned around, there's no boy or teddy bear, and the girl's mouth is wide open. Baron-Cohen et al. (1986, p. 116, 224) deemed this picture sequence "intentional," and the typically developing children, who performed so shockingly poorly on the "simplest" mechanical pictures performed nearly perfectly on these pictures, whereas the autistic children performed poorly. Baron-Cohen et al. (1986, p. 113) used these data to claim that "a specific cognitive deficit … prevents the development of a 'theory of mind' in the autistic child."

Four research teams, of whom we are aware, have published attempts to directly replicate these results—and none could do so. Using the same stimuli, procedures, and analyses, no other research team has replicated the finding that autistic participants perform significantly worse than typically developing participants on the "intentional" picture sequences ("there were no group differences on the intentional subtest of the picture sequencing measure," Ozonoff, Pennington, & Rogers, 1991, p. 1093; "contrary to … previous findings (Baron-Cohen et al., 1985, 1986), [the intentional condition of the Picture Sequence Task] … failed to reveal significant differences," Oswald & Ollendick, 1989, p. 122; "no two groups were significantly different [on the Intentional picture sequence]," Buitelaar, van der Wees, Swaab-Barneveld, & van der Gaag, 1999a, p. 46; "The [autistic] participants were close to ceiling … on the intentional Picture Sequencing items," Brent, Rios, Happé, & Charman, 2004, p. 286).

Not only does Baron-Cohen et al.'s (1986) seminal theory-of-mind study fail to replicate, but its initially reported effect size, $d = -1.714$, looms unusually large (Ioannidis, 2008). In contrast, its replications' pooled effect size is normatively tiny, $d = -0.039$ (Gernsbacher, 2018a), with a confidence interval (CI) that easily overlaps zero (i.e., 99.9% CI [−0.690, 0.611], giving us 99.9% confidence that the true effect includes zero). We are also unaware of any published studies that have replicated Baron-Cohen et al.'s (1986, pp. 116, 224) report that typically developing participants are dramatically worse on the "simplest" mechanical picture sequences than on the "fairly difficult" intentional picture sequences (cf. Rhys-Jones & Ellis, 2000; Savina & Beninger, 2007).

Similarly, Baron-Cohen, Leslie, and Frith (1985)'s seminal study reporting that autistic participants are prone to fail first-order False Belief tasks (see Table 2) is also prone to fail replication (e.g., "No statistically significant difference between groups were found in the test of first-order theory of mind … These findings suggest that the theory of mind model has its limitations in explaining autism," Dahlgren & Trillingsgaard, 1996, pp. 761, 759; "the children with autism did not underperform on this task," Russell & Hill, 2001, p. 236; "Contrary to … previous findings (Baron-Cohen et al., 1985) … [the replication] failed to reveal significant differences," Oswald & Ollendick, 1989, p. 122; "these were not statistically significant differences," Fitzpatrick, Diorio, Richardson, & Schmidt, 2013, p. 7; "no differences emerged," Yirmiya & Shulman, 1996, p. 2045; "[the replication's] findings … are not consistent with … previous reports," Yirmiya, Solomonica-Levi, Shulman, & Pilowsky, 1996, p. 1011; see also Moran et al., 2011).

Likewise, Baron-Cohen's (1989b) report that autistic participants are prone to fail second-order False Belief tasks (see Table 2) is also prone to fail replication (e.g., "No group differences were found in performance on the control or test questions," Tager-Flusberg & Sullivan, 1994, p. 577; "was no difference between normal and autistic children's performance," Leekam & Prior, 1994, p. 907; "no significant association between group membership and proportion of items passed," Bowler, 1992, p. 885; "our findings are inconsistent with early studies of False Belief abilities in autism," Bauminger & Kasari, 1999, p. 85; "The present findings contradict the claims of proponents of … the theory of mind … hypothesis of autism," Buitelaar et al., 1999a, p. 53).

Furthermore, Happé's (1994a) report that autistic participants who pass first- or second-order False Belief tasks nonetheless fail an "advanced test of theory of mind" (Strange Stories) has also failed at replication (e.g., "counter to our expectations, no group differences were found on any of the stories," Scheeren et al., 2013, p. 632; "no group differences in … the Strange Stories," Senju, Southgate, White, & Frith, 2009, p. 884; "In line with prior findings by Senju et al. (2009), no performance differences … were observed in the [Strange Stories task]," Schuwerk, Vuori, & Sodian, 2015, p. 466; see also Gillott, Furniss, & Walter, 2004; Murray et al., 2017; Ponnet, Roeyers, Buysse, De Clercq, & Van Der Heyden, 2004; Roeyers, Buysse, Ponnet, & Pichal, 2001; Schneider, Slaughter, Bayliss, & Dux, 2013; Spek, Scholte, & van Berckelaer-Onnes, 2010; White, Hill, Happé, & Frith, 2009; Wilson et al., 2014). In fact, the pooled effect size of over a dozen systematically reviewed direct replications (Gernsbacher, 2018a) not only overlaps zero ($d = -0.229$, 99.9% CI [−0.479, 0.021]), but also fails to overlap the pooled effect size of the seminal studies ($d = -1.696$, 99.9% CI [−0.932, −2.460]).

Perhaps the failure of these seminal studies to replicate derives from their small sample sizes. Samples two to three times larger are needed to reliably test the somewhat obvious hypothesis that people who like spicy food are more likely to report liking Indian food or that people who like eggs are more likely to report eating egg salad (Simmons, Nelson, & Simonsohn, 2013). Even reliably testing the hypothesis that men weigh more than women requires samples more than thrice the size of those collected in many of Baron-Cohen's seminal theory-of-mind studies (e.g., autistic participants $N = 10$, Baron-Cohen, 1989b; $N = 15$, Baron-Cohen, 1992; Baron-Cohen et al., 2001; $N = 16$, Baron-Cohen, Jolliffe,

Mortimore, & Robertson, 1997; Baron-Cohen, Wheelwright, & Jolliffe, 1997; $N = 17$, Baron-Cohen, 1991c; $N = 20$, Baron-Cohen et al., 1985, 1995; $N = 21$, Baron-Cohen et al., 1986).

Despite these seminal studies' precariously small sample sizes and their lack of replication, their grander claims continue to rebound through textbooks and scholarly literature, within and outside of psychology, and they ricochet through public vernacular. The robustness of these claims, if not the robustness of their supporting evidence, could well have deterred other researchers from publishing conflicting results (Franco, Malhotra, & Simonovits, 2014).

Failures of Convergent Validity

Several tasks have been proposed to assess theory of mind, as Table 2 illustrates. However, in more recent studies, many with quite large samples of autistic and nonautistic participants, these tasks fail to converge. These repeated failures of convergence seriously question the tasks' validity.

For example, performance on Happé's (1994a) Strange Stories task fails to correlate significantly with performance on Baron-Cohen et al.'s (2001) Reading-the-Mind-in-the-Eyes task ($N = 123$ nonautistic adults, Ahmed & Miller, 2011; $N = 100$ autistic children, Lukito et al., 2017; $N = 90$ autistic adolescents, Hollocks et al., 2014; $N = 89$ autistic and 89 nonautistic adults, Wilson et al., 2014; $N = 61$ autistic and 32 nonautistic adults, Spek et al., 2010; $N = 60$ nonautistic adolescents and 60 nonautistic adults, Vetter, Leipold, Kliegel, Phillips, & Altgassen, 2013; $N = 53$ nonautistic adults, Chen et al., 2017; $N = 50$ nonautistic adults, Scherzer, Leveillé, Achim, Boisseau, & Stip, 2012; see also Adler, Nadler, Eviatar, & Shamay-Tsoory, 2010; Brent et al., 2004; Dziobek et al., 2006; Farrant et al., 2005; Kaland, Callesen, Møller-Nielsen, Mortensen, & Smith, 2008; Kristen, Rossmann, & Sodian, 2014; Roeyers et al., 2001).[4] In fact, the average correlation between performance on the Strange Stories task and the Reading-the-Mind-in-the-Eyes task, weighted across 27 systematically reviewed samples (Gernsbacher, 2018a), is only 0.089, with a CI that overlaps zero (i.e., 99.9% CI [−.001, .178]).[5]

Similarly, the Strange Stories task fails to correlate significantly with the Animated Triangles task ($N = 100$ autistic children, Lukito et al., 2017; $N = 90$ autistic adolescents, Hollocks et al., 2014; $N = 89$ autistic and 89 nonautistic adults, Wilson et al., 2014; $N = 80$ nonautistic adults, Brewer, Young, & Barnett, 2017; see also Clemmensen et al., 2016). The

[4]Only sample sizes greater than 50 will be specified here; all other sample sizes are specified in Gernsbacher (2018a).

[5]Baron-Cohen et al. (1997) agreed that the correlation between the Strange Stories task and the Reading-the-Mind-in-the-Eyes task "warrants direct testing" and promised that their article would provide that test ("to validate the Eyes Task as a theory of mind task, subjects in the two clinical groups were also tested on Happé's [1994a] Strange Stories. In the case of the subjects with autism and Asperger Syndrome, this was part of a separate study [Jolliffe, 1997]"; pp. 815–816). Unfortunately, for neither the autistic nor the non-autistic participants is the correlation between Reading-the-Mind-in-the-Eyes and Strange Stories reported, in either Baron-Cohen et al.'s (1997) original article or Jolliffe's (1997) "separate study."

Similarly, Baron-Cohen and colleagues (Vellante et al., 2013) claimed that "studies have found the [Reading-the-Mind-in-the-]Eyes test to be highly correlated with the Strange Stories test (Baron-Cohen, Wheelwright, Hill, et al., 2001)" (p. 329). Unfortunately, the article cited by Baron-Cohen and colleagues to support this claim (viz., Baron-Cohen et al., 2001) does not include the Strange Stories task (and Jolliffe & Baron-Cohen's, 1999, article, which does include the Strange Stories task, does not include the Reading-the-Mind-in-the-Eyes task).

Strange Stories task also fails to correlate significantly with the Faux Pas task (N = 123 nonautistic adults, Ahmed & Miller, 2011; N = 61 autistic and 32 nonautistic participants, Spek et al., 2010), particularly when language comprehension is controlled.

Reading-the-Mind-in-the-Eyes fails to correlate significantly with (a) the Faux Pas task (N = 123 nonautistic adults, Ahmed & Miller, 2011; N = 80 nonautistic adults, Li et al., 2013; N = 70 nonautistic adults, Duval, Piolino, Bejanin, Eustache, & Desgranges, 2011; N = 61 autistic and 32 nonautistic adults, Spek et al., 2010; N = 53 nonautistic adults, Chen et al., 2017; N = 50 nonautistic adults, Scherzer et al., 2012), (b) the Animated Triangles task (N = 70 nonautistic adults, Duval et al., 2011; White, Coniston, Rogers, & Frith, 2011), (c) False Belief task (N = 100 autistic participants, Lukito et al., 2017; N = 90 autistic adolescents, Hollocks et al., 2014; see also Ozonoff et al., 1991), and (d) with other theory-of-mind tasks (e.g., the Hinting task, N = 134 nonautistic adults, Gooding & Pflum, 2011; N = 73 nonautistic adults, Bora et al., 2005; N = 50 nonautistic adults, Scherzer et al., 2012).

Even False Belief tasks can fail to correlate significantly with each other (e.g., Charman & Campbell, 1997; Duval et al., 2011; Hughes, 1998). The lack of convergent validity among theory-of-mind tasks undermines the core construct validity of theory of mind.

Failures of Predictive Validity

If theory-of-mind tasks assay “the basic machinery for social engagement” (Baron-Cohen, 2009, p. 73), then performance on theory-of-mind tasks should predict socioemotional function. But numerous studies document failures of prediction. For example, performance on theory-of-mind tasks fails to significantly predict

- *autistic traits in either autistic or nonautistic participants*, as measured by clinicians’ observation, self-report, or informant-report (N = 1513 nonautistic adults, Kunihira, Senju, Dairoku, Wakabayashi, & Hasegawa, 2006; N = 638 nonautistic children, Ronald, Viding, Happé, & Plomin, 2006; N = 395 autistic adults, Lombardo et al., 2015; N = 220 nonautistic adults, Ragsdale & Foley, 2011; N = 206 nonautistic men, Voracek & Dressler, 2006; N = 194 autistic and 60 nonautistic children, Scheeren et al., 2013; N = 178 autistic men, 168 nonautistic women, and 152 nonautistic men, Baron-Cohen et al., 2015; N = 108 nonautistic adults, Melchers, Montag, Markett, & Reuter, 2015; N = 100 autistic adolescents, Lukito et al., 2017; N = 100 autistic adolescents, Jones et al., 2018; N = 89 autistic and 89 nonautistic adults, Wilson et al., 2014; N = 79 nonautistic women, Valla et al., 2010; N = 56 autistic children, Salter, Seigal, Claxton, Lawrence, & Skuse, 2008; see similar results with smaller samples in Bryant, Coffey, Povinelli, & Pruett, 2013; Burnside, Wright, & Poulin-Dubois, 2017; Clemmensen et al., 2016; Dziobek et al., 2006; Murray et al., 2017; Ozonoff & McEvoy, 1994)
- *empathy and emotional understanding* (N = 484 nonautistic adults, Olderbak et al., 2015; N = 395 autistic adults, Lombardo et al., 2015; N = 342 nonautistic adolescents, Sharp & Vanwoerden, 2014; N = 220 nonautistic adults, Ragsdale & Foley, 2011; N = 200 nonautistic adults, Vellante et al., 2013; N = 178 autistic

men, 168 nonautistic women, and 152 nonautistic men, Baron-Cohen et al., 2015; *N* = 162 nonautistic adults, Ferguson & Austin, 2010; *N* = 121 nonautistic adolescents and adults, Gökçen, Frederickson, & Petrides, 2016; *N* = 108 nonautistic adults, Melchers et al., 2015; *N* = 89 autistic and 89 nonautistic adults, Wilson et al., 2014; *N* = 58 nonautistic children, Tsang, Gillespie-Lynch, & Hutman, 2016; *N* = 53 nonautistic adults, Lawrence et al., 2004; see similar results with smaller samples in Carroll & Chiew, 2006; Campbell et al., 2011; Muller et al., 2010; Peterson, 2014)

- *everyday social skills* (*N* = 398 nonautistic children, Shahrivar, Tehrani-Doost, Khorrami Banaraki, Mohammadzadeh, & Happé, 2017; *N* = 164 and 140 nonautistic adults, Ames & Kammrath, 2004; *N* = 124 nonautistic adolescents, Botting & Conti-Ramsden, 2008; *N* = 101 nonautistic children, Lunn, Lewis, & Sherlock, 2015; *N* = 97 nonautistic children, Lew et al., 2015; *N* = 65 nonautistic children, Raud et al., 2015; *N* = 63 nonautistic adults, Stanford, Messinger, Malaspina, & Corcoran, 2011; *N* = 60 nonautistic children, Raud et al., 2015; *N* = 53 nonautistic adults, Chen et al., 2017; *N* = 50 nonautistic adults, McCleery et al., 2012; see similar results with smaller samples of autistic children and adults in Bennett et al., 2013; Fombonne, Siddons, Achard, Frith, & Happé, 1994; Frith et al., 1994[6]; Hughes, Soares-Boucaud, Hochmann, & Frith, 1997; Joseph & Tager-Flusberg, 2004; Prior et al., 1990; Shaked et al., 2006; Sparrevohn & Howie, 1995; and smaller samples of nonautistic children and adults in Carroll & Chiew, 2006; Tso, Grove, & Taylor, 2010; Watson, Nixon, Wilson, & Capage, 1999; Clegg, Hollis, Mawhood, & Rutter, 2005)
- *social attention, cooperation, anticipation, persuasion, deception, and avoidance* (*N* = 402 nonautistic adolescents, Hünefeldt, Laghi, Ortu, & Belardinelli, 2013; *N* = 77 autistic children, Angus, de Rosnay, Lunenburg, Meerum Terwogt, & Begeer, 2015; see similar results with smaller samples of autistic children in Burnside et al., 2017; Chin & Bernard-Opitz, 2000; Kristen, Vuori, & Sodian, 2015; Peterson, Slaughter, & Wellman, 2018; and smaller samples of nonautistic children in Brooks & Meltzoff, 2015; Ding, Wellman, Wang, Fu, & Lee, 2015);
- *peer relations and pro-social behavior* (*N* = 263 nonautistic children, Botting & Conti-Ramsden, 2008; *N* = 128 nonautistic children, Bosacki & Astington, 1999; *N* = 115 nonautistic children, Badenes, Clemente Estevan, & García Bacete, 2000; *N* = 115 nonautistic girls and *N* = 115 nonautistic boys, Devine & Hughes, 2013; *N* = 51 nonautistic children, Capage & Watson, 2001; see similar results with smaller samples of autistic and nonautistic children, adolescents, and adults in Begeer, Malle, Nieuwland, & Keysar, 2010; Campbell et al., 2011; Lalonde & Chandler, 1995; Travis, Sigman, & Ruskin, 2001).

Indeed, when Baron-Cohen and his colleagues applied machine learning to categorize a large sample (*N* = 395) of autistic adults into those who perform better versus worse on a

[6]Only after later including "additional items specially designed to assess understanding of other minds in everyday life" could these researchers find any significant prediction of theory of mind for everyday social skills (Happé & Frith, 1996, p. 385).

theory-of-mind task, the researchers were unable to identify any variable that patterned with theory-of-mind performance "including sex/gender, age, depression or anxiety symptoms, autistic traits, trait empathy, and autism symptom severity" (Lombardo et al., 2015, p. 2). The only characteristic that reliably patterned with theory-of-mind performance was language dexterity.

Finally, if theory-of-mind tasks truly assay the ability to infer other people's "intentions, goals and desires" (Baron-Cohen et al., 1995, p. 381), and if autistic people lack a theory of mind, then autistic people should fare poorly at inferring other people's intentions, goals, and desires. But, as Table 4 illustrates, autistic people of all ages skillfully understand other persons' intentions, goals, and desires. This large body of data, collected by researchers working outside the theory-of-mind rubric, demonstrates another failure of the claim that autistic people lack a theory of mind.

Conclusion and Recommendation

In this article, we have demonstrated how the claim that autistic people lack a theory of mind fails empirically; it fails in its specificity, universality, replicability, convergent validity, and predictive validity. Despite these numerous empirical failures, the claim pervades psychology and well beyond. It is embraced by scholars in philosophy (Barnbaum, 2008), sociology (Willey, Subramaniam, Hamilton, & Couperus, 2015), economics (Singer & Fehr, 2005), anthropology (Boyer, 2000), robotics (Scassellati, 2002), and narratology (Barnes, 2012; Goodman, 2010: Zunshine, 2008). It colors contemporary entertainment (e.g., *The Good Doctor*, Yegorova, 2017), and it headlines informational websites (Autism Society of Indiana, n.d.; Autism Society of Minnesota, 2016; Autism Speaks, 2018; Scottish Autism, n.d.; Seattle Children's Hospital, 2016). It has spawned unusual speculations, evoking metaphysical (Suddendorf & Corballis, 1997), psychoanalytic (Mayes, Cohen, & Klin, 1993), and neurochemical (Abu-Akel, 2003; Abu-Akel & Shamay-Tsoory, 2011) explanations.

The claim that autistic people lack a theory of mind is so entrenched that when existing measures fail to support the claim, researchers create new measures. For example, Baron-Cohen and his colleagues motivated the need for a new theory-of-mind task by claiming that autistic adults must "have a selective theory of mind … deficit," even though existing theory-of-mind tests "are not subtle enough to detect [that] deficit" (Rutherford, Baron-Cohen, & Wheelwright, 2002, p. 189). Rajendran and Mitchell (2007) suggest, as do we, that "the development of advanced tests [is] a post hoc response in finding data anomalous to the theory of mind hypothesis" (p. 229; i.e., data that do not support the claim that autistic people lack a theory of mind).

The development of more and more theory-of-mind tests resembles a methodological arms race. The deployment of first-order False Belief tasks escalates to second-order False Belief tasks, which escalate to the so-called advanced theory-of-mind tasks (Strange Stories, Reading-the-Mind-in-the-Eyes, and Animated Triangles) and then to the Strange Stories Film task (Murray et al., 2017), the Comic Strip task (Sivaratnam, Cornish, Gray, Howlin, & Rinehart, 2012), and the Beauty Contest task (Pantelis & Kennedy, 2017)—all in pursuit of

finding a task to support the claim that autistic people lack a theory of mind, when previous tasks fail to support the claim.

Most recently, "implicit" theory-of-mind tasks have been developed (Schneider et al., 2013; Schuwerk et al., 2015; Senju et al., 2009; but see Schuwerk, Priewasser, Sodian, & Perner, 2018, and Kulke, von Duhn, Schneider, & Rakoczy, 2018, for difficulties replicating measures of implicit theory of mind). As Rajendran and Mitchell (2007) note, researchers and their deployment of increasingly "advanced tests have turned … logic on its head." The drive to create more and more theory-of-mind tasks "seem to be premised on the assumption" that autistic people lack a theory of mind; therefore, "tests which do not reveal this must be insensitive or unsuitable" (p. 229).

There has even been a move toward asking nonautistic parents to gauge their autistic offspring's theory of mind (Hutchins, Prelock, & Bonazinga, 2012), which is problematic for at least two reasons. First, as autistic scholars have explained (e.g., Sinclair, 1993) and as empirical data demonstrate (e.g., Gernsbacher, Stevenson, & Dern, 2017), nonautistic people are often as disadvantaged when trying to understand autistic people as vice versa. Milton (2012) refers to this dilemma as the "double empathy problem" (see also Gernsbacher, 2006), which Loftis (2015, p. 10) illustrates with the following conundrum: "If autistics truly have a deficit in [theory of mind], then why is it that neurotypicals find it so difficult to intuit the intentions of autistic people"?

Second, most everyone misjudges their own theory-of-mind performance (Ames & Kammrath, 2004; Realo et al., 2003; Zaki, Bolger, & Ochsner, 2008). For example, an improbable eight out of 10 U.S. college students rate their own theory-of-mind ability as better-than-average (in contrast, a more probable half rate as more logically average their public speaking ability, social self-confidence, computer skills, physical health, emotional health, creativity, and propensity for risk taking, Higher Education Research Institute, 2017). Thus, it is unlikely that nonautistic parents can accurately assess their own, let alone their autistic offspring's, theory-of-mind abilities. As even the creators of a child's version of Reading-the-Mind-in-the-Eyes task admit, "it is unknown what the child [in the stimulus photographs] was actually feeling" because the stimulus photographs "were all derived from naturalistic settings (e.g., taken by parents) rather than being posed specifically for an experiment" (Pino et al., 2017, p. 2746).

Some researchers willingly admit that we do not know what theory of mind is (Schaafsma, Pfaff, Spunt, & Adolphs, 2015), much less how to measure it. Despite this uncertainty, other researchers claim with certainty that "autism is a clear illustration of what human life would be like if one lacked a theory of mind" (Baron-Cohen, 2000a, p. 266).

For example, philosopher David Livingstone Smith (2007, p. 172) claims that autistic people "live in a world in which nothing has a mind" and "perceive [other] people as hunks of flesh moving mindlessly through space." Developmental psychologist Alison Gopnik ventures even further, graphically describing how she envisions autistic people perceive other people:

> Around me bags of skin are draped over chairs, and stuffed into pieces of cloth, they shift and protrude in unexpected ways. … Two dark spots near the top of them

> swivel restlessly back and forth. A hole beneath the spots fills with food and from it comes a stream of noises. Imagine that the noisy skin-bags suddenly moved toward you, and their noises grew loud, and you had no idea why, no way of explaining them or predicting what they would do next. (Gopnik as quoted in Baron-Cohen, 1995, pp. 4–5; Gerrans, 2002, pp. 312–313; and Smith, 2007, p. 172)

Along with the stigma promulgated by such renditions, the claim that autistic people lack a theory of mind causes societal harm (Dinishak & Akhtar, 2013). Because a lack of theory of mind is believed to impair autistic people's understanding of their selves, in addition to their understanding of others, the claim disputes autistic people's autonomy, devalues their self-determination, and discredits their credibility (Yergeau, 2018). Consequently, numerous autistic authors have decried the claim, reporting that it "perpetuates stereotypes and oversimplifications [with] the potential for tremendous harm" (Cohen-Rottenberg, 2011); that it has already "harmed … countless autistic individuals" (VisualVox, 2017); and that "its continued perpetuation will continue to be damaging to autistic people" (Nicholson, 2013). We, therefore, call for considerably greater caution before endorsing the claim that autistic people lack a theory of mind.

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Table 1

Researchers' Claims That Lack of Theory of Mind Is Specific to Autism

Citation	Quotation
Baron-Cohen (1988, p. 393)	"autistic children of normal intelligence failed to demonstrate that they could distinguish their own belief from someone else's (Baron-Cohen, Leslie, & Frith, 1985, 1986). This is seen as **an autism-specific deficit**."
Baron-Cohen (1989a, p. 188)	"What they seem to have **specific difficulty** with is understanding and predicting behavior in situations in which covert mental state attributions are required (Baron-Cohen, 1989a, 1989b, in press; Baron-Cohen et al., 1985, 1986; Leslie & Frith, 1988)"
Baron-Cohen (1989b, p. 294)	"The search for why a theory of mind fails to develop or is severely delayed in autism remains a key question for future research, and raises the clinical issue of whether any intervention could reduce **this specific delay**."
Baron-Cohen (1989c, p. 200)	"the theory of mind hypothesis never set out to explain repetitive behaviours or phenomena other than the **autism-specific**, communicative and imaginative impairments"
Baron-Cohen (1990, pp. 81, 84)	"There is indeed an **autism-specific** cognitive deficit in this domain"; "The data from the control groups further reveals that such a deficit must be **autism-specific**, rather than the result of general developmental delay"
Baron-Cohen (1991a, p. 249)	"The general assumption in the specific developmental delay theory is that autistic children's physical-causal knowledge is mental age appropriate and the only delayed aspect of their development that is **specific to autism** is in their theory of mind."
Baron-Cohen (1991b, pp. 35, 47)	"the theory of mind deficit appears to be **highly specific**"; "they seem to have a **specific inability** to understand the 'representational mind'"
Baron-Cohen (1991c, p. 312)	"the present results are therefore consistent with the hypothesis that the deficit in the development of a theory of mind in autism is **highly specific**"
Baron-Cohen (2000b, p. 15)	"children [with other developmental disabilities] may also have equivalent difficulty on 'control' tasks such as the False Photograph Task … whilst children with autism may show a **specific deficit** only on the theory of mind task"
Baron-Cohen (2001, p. 179)	"children [with other developmental disabilities] may also have equivalent difficulty on 'control' tasks such as the False Photograph Task … while children with autism may show a **specific deficit** only on the theory of mind task"
Baron-Cohen and Swettenham (1997, p. 883)	"We can therefore interpret these results in terms of there being **a specific developmental delay** in theory of mind at a number of different points."
Baron-Cohen, Campbell, Karmiloff-Smith, Grant, and Walker (1995, p. 392)	"Results from both conditions thus provided converging evidence for an **autism specific deficit** in inferring when a person is thinking"
Baron-Cohen et al. (1985, pp. 37, 44)	"Thus the dysfunction we have postulated and demonstrated is … **specific to autism**"; "We conclude that the failure shown by the autistic children in our experiment constitutes a **specific deficit**"
Baron-Cohen, Leslie, and Frith (1986, p. 121)	"These results confirm and extend the findings of Baron-Cohen et al. (1985) that autistic children show a **specific deficit** in employing a 'theory of mind'"
Baron-Cohen, Ring, Moriarty, Schmitz, Costa, and Ell (1994, p. 642)	"This deficit is further evidence for an **autism-specific** impairment in the child's concept of mind"
Frith and Happé (1994, p. 126)	"At present, all the evidence suggests that we should retain the idea of a modular and **specific mentalizing deficit** in our causal explanation of the triad of impairments in autism."
Leslie and Thaiss (1992, p. 226)	"We argue that children are equipped with a domain-specific processing mechanism ("ToMM") which allows the child to attend to mental states, which … is **specifically impaired in autism**."

Note. ToMM = theory of mind mechanism.

Table 2

Examples of Popular Theory-of-Mind Tasks

Type of task	Example
False Belief task (first-order)	Participant is shown a container with which they'd be familiar, for example, a closed bag of M&M candies. Participant is asked to predict what's inside. The bag is opened, and the participant is shown that their belief about the contents was false: The bag doesn't contain M&M candies; instead, it contains erasers. Participant is asked "What did you think would be inside the bag before I opened it?" If participant answers with the name of the bag's actual content (e.g., erasers) rather than the name of the bag's expected content (e.g., candy), the participant fails the false belief task.
False Belief task (second-order)	Similar to a first-order False Belief task (as illustrated above), except that the participant is asked, "What do you think another person would think would be inside the box before I opened it?"
Strange Stories task	Participant listens to a spoken story that contains a spoken deception (e.g., a lie, white lie, pretense, or double-bluff), a figure of speech (e.g., a metaphor or irony), a misunderstanding, persuasion, or the like. Participant is required to orally explain why the person said what they said and what they were thinking when they said it.
Faux Pas task	Participant listens to a spoken story that contains a social interaction, such as a person showing newly bought curtains to a friend, who says they don't like the curtains. Participant is required to identify whether "someone said something that they shouldn't have" and, if so, to orally explain why the person said something that they shouldn't have, what they should have said instead, and what the person and their friend must have been thinking when the person said what they said.
Animated Triangles task	Participant views a series of animations with geometric triangles. After each animation, the participant is asked to orally explain "What happened in the animation?" Unknown to the participant, their oral answers are scored according to how likely they are to interpret the animated triangles as humans interacting and the number of emotional terms they provide in their oral explanation (e.g., if they say that one triangle was bullying another triangle).
Reading-the-Mind-in-the-Eye task	Participant views only the eye region of numerous black and white photographs and for each photograph is required to select one emotional expression from a set of four emotion terms (e.g., terrified, upset, annoyed, or arrogant).

Table 3

Researchers' Claims That Lack of Theory of Mind Is Universal in Autism

Citation	Quotation
Baron-Cohen (1991b, pp. 47–48)	"the data reported here are consistent with the hypothesis that in **all cases of autism** there may be specific delay and deviance in the development of a theory of mind"
Baron-Cohen (2000b, p. 16)	"Mindreading deficits in autism spectrum conditions appear to be early occurring (from at least the end of the first year of life, if one includes joint attention deficits) and **universal** (if one tests for these either at the right point in development, or in the case of high-functioning, older subjects by using sensitive, age-appropriate tests)."
Baron-Cohen (2001a, pp. 169, 180)	"theory of mind difficulties seem to be **universal** among such individuals"
	"Mindreading deficits in autism-spectrum conditions appear to be early occurring (from at least the end of the first year of life, if one includes joint attention[4] deficits) and **universal** (if one tests for these either at the right point in development or, in the case of high-functioning, older subjects, by using sensitive, age appropriate tests)."
Baron-Cohen (2001b, pp. 3, 14)	"theory of mind difficulties seem to be **universal** among such individuals" "Mindreading deficits in autism spectrum conditions appear to be early occurring (from at least the end of the first year of life, if one includes joint attention1 deficits) and **universal** (if one tests for these either at the right point in development, or in the case of high-functioning, older subjects by using sensitive, age-appropriate tests).
Baron-Cohen (2008a, p. 61)	"A strength of the mindblindness theory is that it can make sense of the social and communication difficulties in autism and Asperger syndrome, and that it is **universal in applying to all individuals on the autistic spectrum."**
Baron-Cohen (2008b, p. 113)	"A strength of the mindblindness theory is that it can make sense of the social and communication difficulties in autism and Asperger's syndrome, and that it is **universal in applying to all individuals on the autistic spectrum."**
Baron-Cohen (2009, p. 70)	"degrees of mind-blindness are **universal in applying to all individuals on the autistic spectrum**, in that when age and mental-age-appropriate tests are used, deficits are found across the life span and independent of IQ"
Baron-Cohen (2010, p. 169)	"A strength of the mindblindness theory is that it can make sense of the social and communication difficulties in ASC [autism spectrum conditions], and that it is **universal in applying to all individuals on the autistic spectrum."**
Baron-Cohen (2011a, p. 40)	"Two strengths of the mindblindness theory are that it can make sense of the social and communication difficulties in autism and Asperger's syndrome and that it is **universal in applying to all individuals on the autistic spectrum."**
Baron-Cohen (2011b, p. 629)	"Two strengths of the mindblindness theory are that it can make sense of the social and communication difficulties in autism and Asperger syndrome and that it is **universal in applying to all individuals on the autistic spectrum."**
Baron-Cohen, Bolton, Wheelwright, Scahill, Short, Mead, and Smith (1998, p. 297)	"This impaired folk psychology appears to be **universal in autism,** even amongst adults with autism who have otherwise normal intelligence, though subtle tests of mind-reading are needed to reveal this … For this reason, autism has been characterized as involving degrees of 'mindblindness'"
Becchio, Pierno, Mari, Lusher, and Castiello (2007, p. 2408)	"Autism has been **universally** and characteristically described as a dysfunction in 'cognitive empathy', i.e. the ability to represent the thoughts, desires and beliefs of others"
Happé (2001, p. 989)	"To date, a delay in theory of mind development appears to be **a universal feature of autism."**

Table 4

Studies Demonstrating That Autistic People of All Ages Skillfully Understand Other Persons' Intentions, Goals, and Desires

Study	Measure	Empirical finding
Aldridge, Stone, Sweeney, and Bower (2000)	Nonverbal behavior	Young, preverbal autistic children understand other people's intentions "significantly better than the normally developing" children (p. 294).
Colombi et al. (2009)	Nonverbal behavior	Autistic preschool-age children understand other people's intentions, a finding that "does not easily mesh with the line of reasoning" that claims autistic people have "deficits in the understanding of others' mental states" (p. 157).
Carpenter, Pennington, and Rogers (2001)	Nonverbal behavior	Autistic pre-school-age children are not deficient "on any measure involving the understanding of others' intentions" (p. 589).
Liebal, Colombi, Rogers, Warneken, and Tomasello (2008)	Nonverbal behavior	Autistic pre-school-age children "not only can understand another person's goal," but they are motivated to "help [that person] with that goal" (p. 229).
Falck-Ytter (2010)	Eye-tracking	Autistic pre-school-age children accurately "predict other people's action goals" in ways that are "strikingly similar" to nonautistic preschoolers (p. 376).
Berger and Ingersoll (2014)	Nonverbal behavior	Autistic pre-school-age children "are able to use social-communicative cues [experimenter's facial expressions] to understand intention" (p. 3204).
Fitzpatrick et al. (2013)	Nonverbal behavior	Autistic pre-school and early grade-school-age children "have the ability to understand intentions" and are "equivalent to typically developing children" on "social coordination tests" (pp. 1, 3, 9).
Kerr and Durkin (2004)	Spoken free response (drawings)	Autistic pre-school-age children understand "that (i) thought bubbles represent thought, (ii) thought bubbles can be used to infer an unknown reality, (iii) thoughts can be different, and (iv) thoughts can be false" (p. 646).
Li et al. (2019)	Eye-tracking and pupillometry	Autistic pre-school- and grade-school-age children are similar to typically developing children in their "unconscious sensitivity to agents' intentions" (p. 9).
Green et al. (2017)	Multiple choice (photos)	Autistic grade-school-age children are as adept as nonautistic grade-school-age children at "identify[ing] … mutually voluntary interactions between intentional agents" (p. 406) and are characterized by a "similar … developmental trajectory" for this skill (p. 409).
Russell and Hill (2001)	Computer game, shooting game	Autistic grade-school-age children have "intact abilities in monitoring basic actions, intact abilities in reporting an intention, both for self and for another agent, and intact ability in reporting intended actions" (p. 317)
Vivanti et al. (2011)	Eye-tracking and nonverbal behavior	Autistic grade-school-age children "(a) consider situational constraints in order to understand the logic of an agent's action and (b) show typical usage of the agent's emotional expressions to infer his or her intentions" (p. 841).
McAleer, Kay, Pollick, and Rutherford (2011)	Multiple choice (videos)	Autistic adults demonstrate "no failure to recognize intent… . In no combination of variables did the autistic and nonautistic participants perform in a markedly different manner" (p. 1058).
Cole, Slocombe, and Barraclough (2018)	Multiple choice (videos)	Autistic adults do not differ from nonautistic adults in "implicit mentalizing" to make "social decisions [that] required the intentions of the actors to be inferred" (p. 3, 10).
Channon, Lagnado, Fitzpatrick, Drury, and Taylor (2011)	Multiple choice (written stories)	Autistic adults demonstrate "greater differentiation than controls between intentional and unintentional actions" and "between actions that the protagonists believed to be likely versus unlikely to lead to negative consequences" (p. 1534).
Sebanz, Knoblich, Stumpf, and Prinz (2005)	Response time	Autistic adults understand the intentions of a "co-actor … showing the same pattern of results as the matched control group" (p. 433).
Forgeot d'Arc et al. (2016)	Multiple choice (videos)	Autistic adults possess the same level of "spontaneous propensity to pursue goals that others pursue" as nonautistic adults possess (p. 1).
Hubert et al. (2007)	Spoken free response (videos)	Autistic adults perform equally "well in the description of basic actions" and "subjective states" as nonautistic adults, demonstrating that in autistic adults "intentionality is therefore well perceived" (p. 1390).

Study	Measure	Empirical finding
Ponnet, Buysse, Roeyers, and De Corte (2005)	Covertly videotaped interaction	Autistic adults do "not differ from the control adults in the ability to infer the thoughts and feelings of their interaction partner" (p. 595).