



Published in final edited form as:

J Autism Dev Disord. 2013 September ; 43(9): 2199–2206. doi:10.1007/s10803-013-1757-3.

Brief Report: Difficulty in Understanding Social Acting (But Not False Beliefs) Mediates the Link Between Autistic Traits and Ingroup Relationships

Daniel Y.-J. Yang and

Child Study Center, Yale University, New Haven, CT, USA

Reneée Baillargeon

Department of Psychology, University of Illinois, Champaign, IL, USA

Daniel Y.-J. Yang: yung-jui.yang@yale.edu

Abstract

Why do individuals with more autistic traits experience social difficulties? Here we examined the hypothesis that these difficulties stem in part from a challenge in understanding social acting, the prosocial pretense that adults routinely produce to maintain positive relationships with their ingroup. In Study 1, we developed a self-administered test of social-acting understanding: participants read stories in which a character engaged in social acting and rated the appropriateness of the character's response. Adults who scored 26 or higher on the Autism Spectrum Quotient (AQ) questionnaire gave significantly lower ratings than comparison participants (AQ <26). Study 2 found that difficulty in understanding social acting, but not false beliefs, mediated the link between autistic traits and perceived ingroup relationships.

Keywords

Social acting; False beliefs; Social relationships; Autism; Asperger syndrome

Introduction

“Acting is a survival mechanism; it's a social unguent and it's a lubricant.... People lie, constantly, every day, by not saying something that they think, or saying something that they don't think, or showing something that they don't feel”, Marlon Brando, *The Dick Cavett Show*, June 12, 1973.

Children and adults with high-functioning autism spectrum disorder (HFASD) perform less well than neurotypical controls on a variety of false-belief tasks: for example, they are less likely to spontaneously anticipate where an agent who holds a false belief about the location of an object will search for the object (e.g., Senju et al. 2009, 2010); they are less likely to

© Springer Science+Business Media New York 2013

Correspondence to: Daniel Y.-J. Yang, yung-jui.yang@yale.edu.

Electronic supplementary material The online version of this article (doi:10.1007/s10803-013-1757-3) contains supplementary material, which is available to authorized users.

offer correct explanations for the actions of mistaken or deceitful agents (e.g., Kaland et al. 2005; White et al. 2009); and they judge more harshly the actions of mistaken agents who inadvertently cause physical or psychological harm to others (e.g., Moran et al. 2011; Zalla et al. 2009). These findings naturally give rise to the question of how this challenge in false-belief understanding may be linked to the persistent difficulties that individuals with HFASD experience in developing and maintaining positive social relationships (e.g., Baron-Cohen and Wheelwright 2003; Orsmond et al. 2004). Is it that impaired false-belief understanding signals broad “theory-of-mind” deficits that make it difficult for individuals with HFASD to correctly predict, interpret, and respond to others’ actions? Or is the link between impaired false-belief understanding and poorer social relationships less direct? Here we explored one hypothesis about such an indirect link, termed the *social-acting hypothesis* (Baillargeon et al. in press-a).

The social-acting hypothesis rests on four assumptions. First, our ability to attribute false beliefs depends on at least two cognitive systems: (a) the psychological-reasoning (or “theory-of-mind”) system, which allows us to infer and reason about others’ mental states, and (b) the decoupling system, which enables us to hold in mind two distinct representations, one corresponding to reality (as we construe it) and one corresponding to an alternative, decoupled version of reality (e.g., Baillargeon et al. in press-b; Leslie 1987, 1994; Yang and Pelphrey in press). When recruited by the psychological-reasoning system, the decoupling system allows us to represent reality-incongruent mental states such as false or pretend beliefs. For example, if Sally hides a marble in a basket, and in her absence Anne moves it to a box, our decoupling mechanism generates a separate, decoupled version of reality that incorporates Sally’s false belief but otherwise functions as expected, making it possible for us to correctly predict where Sally will search for the marble when she returns.

Second, the psychological-reasoning and decoupling systems regularly interact with other cognitive systems: for example, they interact with the language-processing system to help us represent intended as opposed to literal meanings in ironic or sarcastic remarks (e.g., Bohrn et al. 2012); and they interact with the ingroup-support system to help us represent real as opposed to simulated mental states in social acting (e.g., Baillargeon et al. in press-b). By *social acting*, we mean the prosocial pretense that adults routinely produce—in the form of white lies, equivocations, false cheer, feigned interest, tactful omissions, and the like—for the purpose of maintaining positive relationships with their social groups (e.g., friends, coworkers, relatives; henceforth ingroup). As Mr. Brando aptly observed, we do not, and should not, speak our minds at every turn: instead, we convey more or less than we believe, we exaggerate some sentiments while suppressing others, we embellish, we prevaricate, we feign interest and approval, all in an effort to “lubricate” everyday encounters with our ingroup: prevent aggressive confrontations, avoid hurt or embarrassed feelings, smooth over awkward situations, bolster feelings of trust and acceptance, and so on. Recent research suggests that even toddlers are sensitive to the ingroup-support bias that leads individuals to engage in social acting (e.g., pretend to enjoy offered food) with their ingroup (Baillargeon et al. in press-a).

Third, the decoupling system of children and adults with HFASD shows a pervasive deficiency, as evidenced by their difficulties in understanding not only false beliefs, as was

mentioned earlier, but also pretend play, irony and sarcasm, and white lies (e.g., Happé 1994; Jolliffe and Baron-Cohen 1999; Kaland et al. 2002, 2005; Li et al. 2011; MacKay and Shaw 2004; Pexman et al. 2011; White et al. 2009).

The fourth and last assumption of the social-acting hypothesis is that, although the decoupling deficiency of individuals with HFASD impedes both their false-belief and their social-acting understanding, it is primarily the latter limitation that has a detrimental effect on their everyday social interactions. False-belief attribution is not an everyday occurrence, but social acting is; neurotypical children take many years to achieve skillful, nuanced, and context-sensitive social acting (e.g., Banerjee et al. 2011; Xu et al. 2010), so it is plausible that even a subtle deficiency would have long-term severe consequences.

The present research was intended as a preliminary test of the social-acting hypothesis. In Study 1, we developed a new measure of social-acting understanding that could be self-administered in a survey format. This measure built on prior work by Happé (1994) in which young autistic adults (who all passed first-order false-belief tasks) were presented with “Strange Stories”: for example, a character might produce pretense (e.g., “This banana is a telephone!”), sarcasm (e.g., “That’s what I called politeness!”), or white lies (e.g., “It’s just what I wanted”). When asked to explain the character’s actions, participants were reliably less likely than neurotypical adults to offer correct explanations. These results were subsequently confirmed and extended in several investigations (e.g., Jolliffe and Baron-Cohen 1999; Kaland et al. 2002, 2005; White et al. 2009).

In our social-acting task, adults read short stories in which a character engaged in social acting by producing a response that was decoupled from a negative thought or feeling. After each story, participants rated the appropriateness of the character’s response. In one story, for example, Hanna, who is a newly-elected senior representative in her high school, makes a major mistake in a school assembly. She confides in her friend Irene, who privately agrees this was a bad mistake but responds, “It was your first time talking in front of the public as a class rep, don’t worry, these things happen, we all make little mistakes at first.” Participants were asked to rate the appropriateness of Irene’s response.

Participants in Study 1 were recruited through Amazon’s Mechanical Turk (MTurk), and their autistic traits were measured using the Autism Spectrum Quotient (AQ) questionnaire (Baron-Cohen et al. 2001). This questionnaire consists of 50 items and is a self-administered instrument for measuring how many autistic traits an adult of normal intelligence possesses. Autistic traits tap autism-like variation in the general population (e.g., Robinson et al. 2011; Sasson et al. in press; Von Dem Hagen et al. 2011). Woodbury-Smith et al. (2005) have shown that the threshold of 26 in the AQ questionnaire has good discriminative validity and good screening properties for identifying individuals with HFASD. We therefore divided participants in Study 1 into a high-AQ group (AQ \geq 26) and a low-AQ group (AQ < 26). We predicted that participants in the high-AQ group would be less able to appreciate the appropriateness of the decoupled responses in our social-acting task and would therefore rate these responses significantly lower than would participants in the low-AQ group.

In Study 2, we examined autistic traits, social-acting understanding, false-belief understanding, and perceived ingroup relationships. We predicted that impaired social-acting understanding would mediate the link between autistic traits and ingroup relationships, but that impaired false-belief understanding would not.

We reasoned that because our studies were intended as a preliminary test of the social-acting hypothesis, comparing the responses of high- and low-AQ individuals from the general population represented an acceptable first step. If our studies revealed significant links between autistic traits, social-acting understanding, and ingroup relationships, then future studies could focus on individuals with a clinical diagnosis of HFASD to explore these links further.

Study 1

Methods

Participants—We recruited 79 adults from the United States through MTurk, a crowdsourcing web service that can be used for experimental research (e.g., Paolacci et al. 2010) and has been found to yield data comparable to those obtained via traditional methods (e.g., Buhrmester et al. 2011; for the sample characteristics of the MTurk pool compared to the undergraduate pool, see Behrend et al. 2011). All participants gave their informed consent prior to their inclusion in the study. One participant was eliminated because his averaged rating in the social-acting stories was more than 3 standard deviations below the mean. The final sample ($n = 78$) included 46 women and 32 men, mean age = 31.91 ($SD = 7.93$).

Procedure and Measures—We developed five social-acting stories. Each described an interaction between two ingroup characters; at the end of the story, the target character held a negative thought or feeling but produced a decoupled, more positive response (see Social-Acting Stories in Online Resource). Following each story, participants rated the appropriateness of the target character's response on a scale from 1 = *very inappropriate* to 7 = *very appropriate*. The internal consistency of the stories was good, Cronbach's $\alpha = 0.74$. In addition to these stories, we included three distractor stories in which the target character had a negative thought or feeling and produced a non-decoupled, negative response (see Distractor Stories in Online Resource). Participants rated the appropriateness of the target character's response using the same scale. The order of the eight stories was randomized for each participant.

After completing the social-acting task, participants filled out the AQ questionnaire ($\alpha = 0.82$). Using the threshold of 26 (Woodbury-Smith et al. 2005), as explained earlier, we divided the sample into a high-AQ group ($AQ \geq 26$, $n = 14$, $M = 28.29$, $SD = 2.13$) and a low-AQ group ($AQ < 26$, $n = 64$, $M = 16.83$, $SD = 4.82$).

Results and Discussion

Autistic traits (as measured by AQ scores) and social-acting understanding (as measured by averaged appropriateness ratings in the five social-acting stories) were significantly negatively correlated, $r(76) = -0.25$, $p < .05$. This correlation was not significant within

either the high-AQ group alone, $r(12) = -0.33$, *ns*, or the low-AQ group alone, $r(62) = -0.10$, *ns*, suggesting that the overall correlation between autistic traits and social-acting understanding was driven primarily by the difference between the two groups. Comparison of the social-acting ratings in both groups confirmed that the high-AQ group ($M = 5.66$, $SD = 0.81$) gave reliably lower ratings than the low-AQ group ($M = 6.11$, $SD = 0.69$), $t(76) = -2.16$, $p < .05$, Cohen's $d = 0.60$.

As predicted, the high-AQ group judged the decoupled responses in the social-acting stories as less appropriate than did the low-AQ group. The results of Study 1 thus provided construct validity for our social-acting task and provided new evidence that individuals with more autistic traits have difficulty understanding social acting.

Study 2

Study 2 had three goals. The first was to determine whether social-acting understanding would mediate the link between autistic traits and perceived ingroup relationships, as predicted by the social-acting hypothesis. We used the task developed in Study 1 to assess social-acting understanding, and a new self-report measure to assess perceived ingroup relationships. The second goal was to test the suggestion, again derived from the social-acting hypothesis, that false-belief understanding would *not* serve as a mediator in the link between autistic traits and perceived ingroup relationships. We used a self-administered task developed by Young et al. (2007) to assess false-belief understanding. Finally, the third goal of Study 2 was to confirm the results of Study 1 and address a possible confound: perhaps (a) participants tended to base their ratings in the social-acting stories solely on the positivity of the responses and (b) the high-AQ group generally perceived the responses in these stories as less positive than did the low-AQ group. To evaluate this possibility, in Study 2 we added three control stories in which the target character held a positive thought or feeling and produced a non-decoupled, positive response (see Control Stories in Online Resource). Including these stories allowed us to indirectly control for the positivity of the responses in the social-acting stories.

Methods

Participants—Through MTurk, we recruited 119 adults from the United States. All participants gave their informed consent prior to their inclusion in the study. One participant was eliminated because her averaged rating in the social-acting stories was more than 3 standard deviations below the mean. The final sample ($n = 118$) included 72 women and 46 men, mean age = 33.27 ($SD = 11.90$).

Procedure and Measures—Participants first received the social-acting task, which included the five social-acting stories ($\alpha = 0.69$) and the three distractor stories from Study 1, as well as the three new control stories ($\alpha = 0.83$). Following each story, participants rated the appropriateness of the target character's response using the same scale as in Study 1. The order of the 11 stories was randomized for each participant.

After participants completed the social-acting task, we measured their perceived ingroup relationships. To start, we listed 14 types of social groups (friends, coworkers, relatives,

church friends, and so on) and asked participants to check all of the groups to which they belonged. We then asked participants to rate how well they interacted with the individuals in this broad ingroup on six items of relationship quality ($\alpha = 0.91$; see Ingroup Relationship Items in the Online Resource), using a scale from 1 = *strongly disagree* to 7 = *strongly agree*. Example items were “we get along well with each other” and “we support each other well”.

Next, we measured participants’ false-belief understanding. The self-administered test developed by Young et al. (2007) involves four types of stories depicting accidental harms, attempted harms, intentional harms, and neutral acts. For each type of story, we randomly selected three stories from the pool provided by Young et al., for a total of 12 stories. Of particular importance (since our goal was to assess false-belief understanding) were the accidental-harm stories, in which a character who acted on a false belief inadvertently caused a friend to die. At the end of each story, participants were asked to rate the moral permissibility of the character’s action, using a scale from 1 = *completely morally forbidden* to 7 = *completely morally permissible*. The rationale behind the accidental-harm stories is that the more participants are able to take into account the character’s false belief (and thus innocent intentions), the more they should judge the character’s action to be permissible. In line with this rationale, Moran et al. (2011) found that adults with HFASD rated the character’s action in the accidental-harm stories as less permissible than did neurotypical adults; the two groups did not differ in their moral judgments of the other stories. In our analyses, we accordingly focused on the accidental-harm stories ($\alpha = 0.74$) and treated the other stories as distractor items.

Finally, as in Study 1, participants completed the AQ questionnaire ($\alpha = 0.82$). Again, based on the threshold of 26 (Woodbury-Smith et al. 2005), we divided the sample into a high-AQ group (AQ \geq 26, $n = 26$, $M = 29.08$, $SD = 3.78$) and a low-AQ group (AQ < 26, $n = 92$, $M = 17.42$, $SD = 4.84$).

Results and Discussion

As shown in Table 1, autistic traits (as measured by AQ scores) and social-acting understanding (as measured by appropriateness ratings in the social-acting stories) were significantly negatively correlated, $r(116) = -0.26$, $p < .01$, confirming the results of Study 1. Ratings in the social-acting and control stories were positively correlated, $r(116) = 0.46$, $p < .001$, suggesting that the perceived positivity of the responses in these stories affected participants’ judgments. However, after including ratings in the control stories as a covariate, autistic traits still significantly predicted ratings in the social-acting stories, $\beta = -0.22$, $t(115) = -2.69$, $p < .01$, and the high-AQ group ($M = 5.63$, $SD = 0.81$) still judged the responses in the social-acting stories as less appropriate than the low-AQ group ($M = 6.06$, $SD = 0.66$), $F(1, 115) = 5.14$, $p < .05$, partial $\eta^2 = 0.04$.

Autistic traits were not correlated with ratings in the control stories, $r(116) = -0.10$, *ns*, and there was no difference in the ratings of these stories between the high-AQ group ($M = 6.62$, $SD = 0.81$) and the low-AQ group ($M = 6.79$, $SD = 0.39$), $t(116) = -1.57$, *ns*. Thus, unlike the social-acting stories, the control stories did not reveal differences between the high- and low-AQ groups.

Autistic traits were negatively correlated with false-belief understanding (as measured by permissibility ratings in the accidental-harm stories), $r(116) = -0.19, p < .05$. The high-AQ group ($M = 4.28, SD = 1.63$) rated the responses in the accidental-harm stories as less morally permissible than did the low-AQ group ($M = 5.02, SD = 1.49$), $t(116) = -2.18, p < .05$, Cohen's $d = 0.47$, replicating the results of Moran et al. (2011).

Finally, in line with previous findings (e.g., Baron-Cohen and Wheelwright 2003; Orsmond et al. 2004), autistic traits and perceived ingroup relationships were significantly negatively correlated, $r(116) = -0.22, p < .05$. The high-AQ group judged the quality of their relationships with their ingroup ($M = 5.47, SD = 0.91$) to be lower than did the low-AQ group ($M = 6.17, SD = 0.70$), $t(116) = -4.19, p < .001$, Cohen's $d = 0.86$.

Mediation Analyses—In our next analyses, we compared false-belief understanding and social-acting understanding as potential mediators in the link between autistic traits and perceived ingroup relationships.

First, we tested the mediating role of false-belief understanding by estimating the indirect effect of autistic traits (AQ) on perceived ingroup relationships (IR) through false-belief understanding (FBU). This indirect effect was non-significant, $\beta_{AQ \rightarrow FBU} (-0.19, t_{116} = -2.07, p < .05) \times \beta_{FBU \rightarrow IR} (0.04, t_{115} = 0.48, ns) = -0.01$, Sobel's $Z = -0.47, ns$, providing no support for the role of false-belief understanding as a mediator.

Next, we tested the mediating role of social-acting understanding by estimating the indirect effect of AQ on IR through social-acting understanding (SAU), while controlling for the perceived positivity of the responses in the social-acting stories (by including participants' ratings in the control stories as a covariate). To allow for controlling the covariate and testing multiple mediators in a mediation model, we used the INDIRECT macro developed by Preacher and Hayes (2008), which relies on bootstrapping and provides statistical estimates of satisfactory accuracy. The indirect effect of SAU was significant, $\beta_{AQ \rightarrow SAU} (-0.22, t_{115} = -2.69, p < .01) \times \beta_{SAU \rightarrow IR} (0.25, t_{114} = 2.56, p < .05) = -0.06$, 95 % CI = $[-0.14, -0.01]$, while the direct link between AQ and IR was no longer significant after adding social-acting understanding, $\beta_{AQ \rightarrow IR} = -0.14, t_{114} = -1.54, ns$ (see Fig. 1). Moreover, the indirect effect of SAU remained significant even after further controlling for FBU, 95 % CI = $[-0.137, -0.004]$. Finally, when we pitted SAU and FBU against each other while controlling for the ratings in the control stories, the indirect effect of SAU was significant, 95 % CI = $[-0.142, -0.008]$, whereas that of FBU was non-significant, 95 % CI = $[-0.023, 0.052]$. In sum, the findings provide support for the role of social-acting understanding, but not false-belief understanding, as a mediator in the link between autistic traits and perceived ingroup relationships.

Overall Analysis—In a final analysis pooling the data from Studies 1 and 2, autistic traits and social-acting understanding were again significantly negatively correlated, $r(194) = -0.26, p < .001$. This correlation was not significant in either the high-AQ group alone, $r = -0.08, ns$, or the low-AQ group alone, $r = -0.13, ns$, suggesting that it was driven mainly by the difference between the two groups. As predicted, the high-AQ group ($n = 40, M = 5.64$,

SD = 0.80) judged the responses in the social-acting stories as less appropriate than did the low-AQ group ($n = 156$, $M = 6.08$, $SD = 0.67$), $t(194) = -3.54$, $p < .001$, Cohen's $d = 0.59$.

General Discussion

The present studies produced two main findings. First, participants with more autistic traits performed reliably less well in a novel social-acting task that involved rating the appropriateness of decoupled, social-acting responses. Second, performance in this social-acting task, but not in a false-belief task, mediated the link between autistic traits and poorer perceived ingroup relationships. Together, these results provide preliminary support for the social-acting hypothesis, which holds that (a) the decoupling system of individuals with more autistic traits shows a pervasive deficiency, and (b) although this deficiency impedes both false-belief and social-acting understanding, it is primarily the latter limitation that affects everyday social interactions.

The present findings confirm and extend prior results that children and adults with HFASD are less likely than neurotypical controls to offer correct explanations for Strange Stories involving white lies and other deceptive actions (e.g., Happé 1994; Jolliffe and Baron-Cohen 1999; Kaland et al. 2002, 2005; White et al. 2009). Our findings are also consistent with the results of Badenes et al. (2000), which showed that peer-rejected 6-year-old boys did not differ from average and popular boys in a first-order false-belief task, but performed more poorly in a white-lie task (popular girls also performed better than their peers in a deception task, which is again consistent with the social-acting hypothesis). Finally, our findings are consistent with results from tasks assessing faux-pas understanding. In a longitudinal study, Banerjee et al. (2011) found that better faux-pas understanding at age 9 predicted higher peer acceptance at age 10, whereas poorer faux-pas understanding at age 10 predicted increased peer rejection at age 11 (in contrast, no significant cross-lagged pathways were found between scores on a second-order false-belief task and peer relations). Children and adults with HFASD have also been shown to exhibit impaired faux-pas understanding (e.g., Baron-Cohen et al. 1999; Shamay-Tsoory et al. 2002; Zalla et al. 2009). In everyday life, a faux pas often represents a failure to engage in social acting, due to a false belief about the situation: instead of producing a white lie, equivocal statement, or tactful omission (as one would if in full possession of the facts), one serves up an unvarnished, non-decoupled negative judgment. To illustrate, consider a story that is often used in faux-pas research (e.g., Baron-Cohen et al. 1999; Zalla et al. 2009): Jill moves to a new house and installs new curtains in her bedroom; her friend Lisa falsely assumes that the curtains were left by the previous owner and tells Lisa the curtains are horrible and should be replaced. Had Lisa known the curtains were installed by Jill, she would most likely have refrained from criticizing them; her false belief thus led to her failure to engage in social acting. It seems plausible that the ability to understand social-acting failures in faux-pas tasks develops hand in hand with the ability to appreciate social-acting successes in white-lie and related tasks, and that both are important in predicting positive ingroup relationships.

Future research can build on the present findings in several directions. First, it will be important to confirm these findings using individuals with a clinical diagnosis of HFASD, in tasks examining not only social-acting comprehension (as in the present research) but also

social-acting production. Parents and clinicians often report that individuals with HFASD tend to be more bluntly honest; it will be interesting to see whether greater production of overly-frank responses tends to be associated with lower appropriateness ratings in our social-acting comprehension task. Another critical research direction will be to identify the possible cause(s) of impaired social-acting understanding. According to the hypothesis outlined in the Introduction, at least three systems are involved in social-acting understanding: the psychological-reasoning, decoupling, and ingroup-support systems.¹ We have suggested that impaired social-acting understanding stems primarily from a decoupling deficiency, but it could be that limitations in all three systems, or in the connections between them, contribute to this impairment. For example, it could be that individuals with more autistic traits have a weaker sense of ingroup support and as a result are less able to understand (or are less comfortable with) the white lies and other prosocial deceptions that are part and parcel of everyday ingroup interactions. Clearly, much remains to be understood about the nature and causes of impaired social-acting understanding and about the mechanisms by which it leads to social deficits. Hopefully, the tools of neuroscience can also be brought to bear on these questions; one methodological advantage of the social-acting task developed here is that it can easily be adapted for such investigations.

In sum, the present studies found that individuals with more autistic traits were less likely to appreciate the appropriateness of everyday social acting, and that this impaired understanding mediated the link between autistic traits and poorer perceived ingroup relationships. The present results thus fit well with continuing efforts to identify specific disadvantages in everyday social understanding that are directly connected to social deficits (e.g., Hughes and Leekam 2004; Peterson et al. 2009) and, as such, can suggest new possibilities for tailored treatments.

Acknowledgments

The research reported in this manuscript was supported by a Hilibrand Autism Fellowship from the Yale Child Study Center to Daniel Yang, and by a grant from the National Institute of Child Health and Human Development to Renée Baillargeon (HD-21104).

References

- Badenes LV, Estevan RAC, Bacete FJG. Theory of mind and peer rejection at school. *Social Development*. 2000; 9:271–283.
- Baillargeon, R.; He, Z.; Setoh, P.; Scott, R.; Sloane, S.; Yang, DY-J. False-belief understanding and why it matters: The social-acting hypothesis. To appear. In: Banaji, MR.; Gelman, S., editors. *Navigating the social world: What infants, children, and other species can teach us*. New York: Oxford University Press; (in press-a)
- Baillargeon, R.; Scott, RM.; He, Z.; Sloane, S.; Setoh, P.; Jin, K.; Bian, L. Psychological and sociomoral reasoning in infancy. In: Shaver, P.; Mikulincer, M.; Borgida, E.; Bargh, J., editors. *APA handbook of personality and social psychology: Vol.1. Attitudes and social cognition*. Washington, DC: APA; (in press-b)

¹To be clear, the first two systems (the psychological-reasoning and decoupling systems) are assumed to provide the mechanism for false-belief understanding, while their interactions with the last system (the ingroup-support system) provide the mechanism for social-acting understanding.

- Banerjee R, Watling D, Caputi M. Peer relations and the understanding of faux pas: Longitudinal evidence for bidirectional associations. *Child Development*. 2011; 82(6):1887–1905. [PubMed: 22023260]
- Baron-Cohen S, O’Riordan M, Stone V, Jones R, Plaisted K. Recognition of faux pas by normally developing children and children with Asperger syndrome or high-functioning autism. *Journal of Autism and Developmental Disorders*. 1999; 29:407–418. [PubMed: 10587887]
- Baron-Cohen S, Wheelwright S. The Friendship Questionnaire: An investigation of adults with Asperger syndrome or high-functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders*. 2003; 33(5):509–517. [PubMed: 14594330]
- Baron-Cohen S, Wheelwright S, Skinner R, Martin J, Clubley E. The Autism-Spectrum Quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders*. 2001; 31(1):5–17. [PubMed: 11439754]
- Behrend TS, Sharek DJ, Meade AW, Wiebe EN. The viability of crowdsourcing for survey research. *Behavior Research Methods*. 2011; 43(3):800–813. [PubMed: 21437749]
- Bohrn IC, Altmann U, Jacobs AM. Looking at the brains behind figurative language: A quantitative meta-analysis of neuroimaging studies on metaphor, idiom, and irony processing. *Neuropsychologia*. 2012; 50:2669–2683. [PubMed: 22824234]
- Buhrmester M, Kwang T, Gosling SD. Amazon’s Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*. 2011; 6(1):3–5.
- Happé FGE. An advanced test of theory of mind: Understanding of story characters’ thoughts and feelings by able autistic, mentally handicapped, and normal children and people. *Journal of Autism and Developmental Disorders*. 1994; 24(2):129–154. [PubMed: 8040158]
- Hughes C, Leekam SR. What are the links between theory of mind and social relations? Review, reflections and new directions for studies of typical and atypical development. *Social Development*. 2004; 13:590–619.
- Jolliffe T, Baron-Cohen S. The strange stories test: A replication with high-functioning people with autism or Asperger syndrome. *Journal of Autism and Developmental Disorders*. 1999; 29(5):395–406. [PubMed: 10587886]
- Kaland N, Møller-Nielsen A, Callesen K, Mortensen EL, Gottlieb D, Smith L. A new ‘advanced’ test of theory of mind: Evidence from children and adolescents with Asperger syndrome. *Journal of Child Psychology and Psychiatry*. 2002; 43(4):517–528. [PubMed: 12030597]
- Kaland N, Møller-Nielsen A, Smith L, Mortensen EL, Callesen K, Gottlieb D. The strange stories test: A replication study of children and adolescents with Asperger syndrome. *European Child and Adolescent Psychiatry*. 2005; 14:73–82. [PubMed: 15793686]
- Leslie AM. Pretense and representation: The origin of “theory of mind”. *Psychological Review*. 1987; 94:412–426.
- Leslie AM. Pretending and believing: Issues in the theory of ToMM. *Cognition*. 1994; 50:211–238. [PubMed: 8039362]
- Li AS, Kelley EA, Evans AD, Lee K. Exploring the ability to deceive in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*. 2011; 41(2):185–195. [PubMed: 20556501]
- MacKay G, Shaw A. A comparative study of figurative language in children with autistic spectrum disorders. *Child Language Teaching and Therapy*. 2004; 20(1):13–32.
- Moran JM, Young LL, Saxe R, Lee SM, O’Young D, Mavros PL, et al. Impaired theory of mind for moral judgment in high-functioning autism. *Proceedings of the National Academy of Sciences, USA*. 2011; 108(7):2688–2692.
- Orsmond GI, Krauss MW, Seltzer MM. Peer relationships and social and recreational activities among adolescents and adults with autism. *Journal of Autism and Developmental Disorders*. 2004; 34(3): 245–256. [PubMed: 15264493]
- Paolacci G, Chandler J, Ipeirotis PG. Running experiments on Amazon Mechanical Turk. *Judgment and Decision Making*. 2010; 5(5):411–419.

- Peterson CC, Garnett M, Kelly A, Attwood T. Everyday social and conversation applications of theory-of-mind understanding by children with autism-spectrum disorders or typical development. *European Child and Adolescent Psychiatry*. 2009; 18(2):105–115. [PubMed: 18810310]
- Pexman PM, Rostad KR, McMorris CA, Climie EA, Stowkowy J, Glenwright MR. Processing of ironic language in children with high-functioning autism spectrum disorder. *Journal of Autism and Developmental Disorders*. 2011; 41(8):1097–1112. [PubMed: 21061054]
- Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*. 2008; 40:879–891. [PubMed: 18697684]
- Robinson EB, Munir K, Munafò MR, Hughes M, McCormick MC, Koenen KC. Stability of autistic traits in the general population: Further evidence for a continuum of impairment. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2011; 50(4):376–384. [PubMed: 21421177]
- Sasson NJ, Nowlin RB, Pinkham AE. Social cognition, social skill, and the broad autism phenotype. *Autism*. (in press).
- Senju A, Southgate V, Miura Y, Matsui T, Hasegawa T, Tojo Y, et al. Absence of spontaneous action anticipation by false belief attribution in children with autism spectrum disorder. *Development and Psychopathology*. 2010; 22(2):353–360. [PubMed: 20423546]
- Senju A, Southgate V, White S, Frith U. Mindblind eyes: An absence of spontaneous theory of mind in Asperger syndrome. *Science*. 2009; 325:883–885. [PubMed: 19608858]
- Shamay-Tsoory SG, Tomer R, Yaniv S, Aharon-Peretz J. Empathy deficits in Asperger syndrome: A cognitive profile. *Neurocase*. 2002; 8:245–252. [PubMed: 12119321]
- Von Dem Hagen EAH, Nummenmaa L, Yu R, Engell AD, Ewbank MP, Calder AJ. Autism spectrum traits in the typical population predict structure and function in the posterior superior temporal sulcus. *Cerebral Cortex*. 2011; 21(3):493–500. [PubMed: 20439317]
- White S, Hill E, Happé F, Frith U. Revisiting the strange stories: Revealing mentalizing impairments in autism. *Child Development*. 2009; 80(4):1097–1117. [PubMed: 19630896]
- Woodbury-Smith MR, Robinson J, Wheelwright S, Baron-Cohen S. Screening people for Asperger syndrome using the AQ: A preliminary study of its diagnostic validity in clinical practice. *Journal of Autism and Developmental Disorders*. 2005; 35(3):331–335. [PubMed: 16119474]
- Xu F, Bao X, Fu G, Talwar V, Lee K. Lying and truth-telling in children: From concept to action. *Child Development*. 2010; 81(2):581–596. [PubMed: 20438462]
- Yang, DY-J.; Pelphrey, KA. Dissociable neural systems for mindreading and their disruption in autism. To appear. In: Baron-Cohen, S.; Tager-Flusberg, H.; Lombardo, M., editors. *Understanding other minds*. 3. New York: Oxford University Press; (in press)
- Young L, Cushman F, Hauser M, Saxe R. The neural basis of the interaction between theory of mind and moral judgment. *Proceedings of the National Academy of Sciences, USA*. 2007; 104:8235–8240.
- Zalla T, Sav AM, Stopin A, Ahade S, Leboyer M. Faux pas detection and intentional action in Asperger syndrome: A replication on a French sample. *Journal of Autism and Developmental Disorders*. 2009; 39(2):373–382. [PubMed: 18726150]

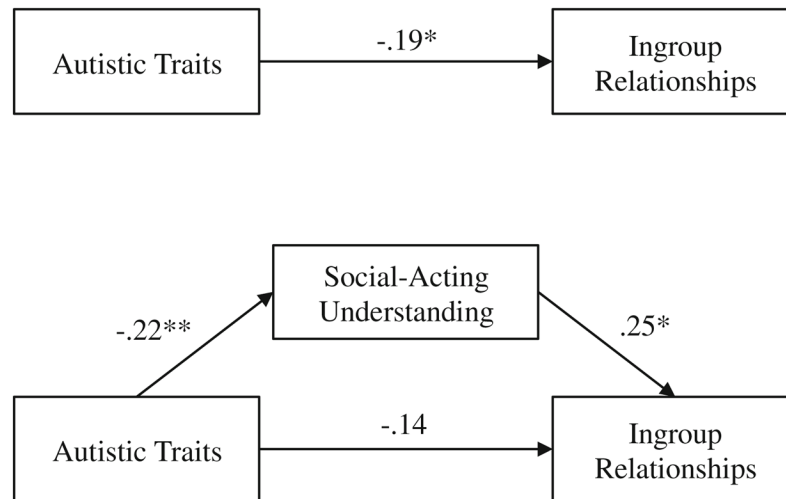


Fig. 1. Results depicting the link between autistic traits and perceived ingroup relationships (*top model*), as mediated by social-acting understanding (*bottom model*). All analyses controlled for response positivity (by including participants' ratings in the control stories as a covariate). Estimates are standardized regression coefficients. * $p < .05$, ** $p < .01$

Table 1

Correlations among major variables in Study 2

Measure	1	2	3	4	5	M	SD
1. Autistic traits	(0.82)					19.99	6.69
2. Perceived ingroup relationships	-0.22*	(0.91)				6.02	0.80
3. Social-acting understanding	-0.26**	0.36***	(0.69)			5.96	0.71
4. Control stories	-0.10	0.29**	0.46***	(0.83)		6.75	0.51
5. False-belief understanding	-0.19*	0.08	0.21*	0.19*	(0.74)	4.86	1.55

Numbers within the parentheses are alpha reliabilities

* $p < .05$,

** $p < .01$,

*** $p < .001$