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Brief Report

Children with autism spectrum disorder are more trusting than typically developing children

Li Yi [a,*], Junhao Pan [a], Yuebo Fan [b,c], Xiaobing Zou [d], Xianmai Wang [e], Kang Lee [f,g,*]

[a] Department of Psychology, Sun Yat-sen University, Guangzhou, Guangdong 510275, China
[b] Guangzhou Cana School, Guangzhou, Guangdong 510540, China
[c] Guangzhou Rehabilitation and Research Center for Children with ASD, Guangzhou, Guangdong 510540, China
[d] The Third Affiliated Hospital of Sun Yat-sen University, Guangzhou, Guangdong 510630, China
[e] Management School, Jinan University, Guangzhou, Guangdong 510632, China
[f] Dr. Eric Jackman Institute of Child Study, University of Toronto, Toronto, Ontario M5R 2X2, Canada
[g] Department of Psychology, University of California, San Diego, La Jolla, CA 92093, USA

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ABSTRACT

The current study examined whether children with autism spectrum disorder (ASD) had an indiscriminate trust bias whereby they would believe any information provided by an unfamiliar adult with whom they had no interactive history. Young school-aged children with ASD and their age- and ability-matched typically developing (TD) peers participated in a simple hide-and-seek game. In the game, an experimenter with whom the children had no previous interactive history pointed to or left a marker on a box to indicate the whereabouts of a hidden reward. Results showed that although young school-aged ASD children did not blindly trust any information provided by the unfamiliar adult, they appeared to be more trusting in the adult informant than did their age- and ability-matched TD children.

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Introduction

Young children tend to be credulous about what they are told even if the information challenges their existing knowledge or common sense (e.g., Jaswal, Carrington Croft, Setia, & Cole, 2010; Nobes

* Corresponding authors. Address: Department of Psychology, Sun Yat-sen University, 135 Xingang West Road, Guangzhou 510275, China (L. Yi), Dr. Eric Jackman Institute of Child Study, University of Toronto, 45 Walmer Road, Toronto, Ontario M5R 2X2, Canada (K. Lee).

E-mail addresses: yili5@mail.sysu.edu.cn (L. Yi), kang.lee@utoronto.ca (K. Lee).

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et al., 2003; Vosniadou & Brewer, 1992). However, because sources of information are not always reliable, it is important for children to maintain a certain amount of skepticism. Although it is controversial as to whether young typically developing (TD) children demonstrate an indiscriminate trust bias and believe whatever they are told (Clément, Koenig, & Harris, 2004; Couillard & Woodward, 1999; Jaswal et al., 2010; Koenig & Woodward, 2010; Pea, 1982), older preschoolers have been consistently found to show conscious and controlled trust to evaluate what, when, and who to trust (for a review, see Harris, 2007), referred to as "skeptical trust" or selective trust (Clément et al., 2004). To the best of our knowledge, no study has explored how children with autism spectrum disorder (ASD) trust others' testimony.

Despite this gap in the literature, research on ASD children's deceptive behaviors and their understanding of deception provides some insight into this issue. Although children with ASD can and do tell antisocial and white lies spontaneously in naturalistic settings (Li, Kelley, Evans, & Lee, 2011), they have difficulty in engaging in quintessential deception, namely, instilling false belief into the mind of the intended dupe (Baron-Cohen, 1992; Russell, Mauthner, Sharpe, & Tidswell, 1991; Sodian & Frith, 1992, 1994; Talwar et al., 2012; Yirmiya, Solomonica-Levi, & Shulman, 1996).

Considering ASD children's specific difficulty in engaging in deception and manipulating others' beliefs, it is reasonable to infer that they may also have difficulty in showing skepticism about others' testimonies. In other words, compared with TD children, they may be more likely and willing to believe what they are told. Thus, the current study aimed to examine the indiscriminate trust tendency of young school-aged ASD children compared with their age- and ability-matched TD counterparts. Specifically, we examined whether young school-aged ASD children would show more indiscriminate trust bias than their TD peers when given information by an unfamiliar adult with whom they had no previous interaction. Existing evidence shows that TD children overcome this bias by approximately 3 or 4 years of age. Alternatively, young school-aged ASD children might show skeptical trust similar to that of their TD counterparts.

We used a simple trust game adapted from paradigms of Couillard and Woodward (1999). In this game, an adult with whom children had no previous interaction would either place a marker or point to one of three boxes to inform children that a desirable item was hidden in the box. Children could trust the adult by searching for the item in the box indicated by the informant or, instead, could search in another box that was not indicated. Performing the latter response would suggest that children might not trust the information given by the adult. We chose this relatively simple task to ensure that our sample of children with ASD would understand the verbal instructions of the task because existing studies have shown this task to be appropriate for children with verbal mental age of approximately 5 years. Based on existing evidence (e.g., Clément et al., 2004), we hypothesized that the trust rates of young school-aged TD children in the current study would be higher than chance (33%) but lower than 100%. Given ASD children's difficulty with deception (e.g., Russell et al., 1991), we hypothesized that ASD children would be more likely to trust information provided by an unfamiliar adult than would their age- and ability-matched counterparts.

Method

Participants

Participants were 22 young school-aged ASD children (age range = 5 years 1 month to 8 years 9 months [5;1–8;9 years], M_{age} = 6.94 years, *SD* = 1.05, 3 female and 19 male), 27 age-matched TD children (age range = 5;1–8;7 years, M_{age} = 6.81 years, *SD* = 0.93, 3 female and 24 male), and 26 ability-matched TD children (age range = 4;1–7;10 years, M_{age} = 5.76 years, *SD* = 0.91, 3 female and 23 male).

All ASD children were previously diagnosed by experienced pediatric psychiatrists to meet the diagnostic criteria for autism according to the DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders,* fourth edition; American Psychiatric Association, 1994). However, standardized diagnostic scales such as the Autism Diagnostic Interview–Revised (ADI-R; Lord, Rutter, & Le Couteur, 1994) and the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) have not been adapted for use in China. To confirm the diagnosis of the ASD children, we used the Chinese version of the Autism Spectrum Quotient–Children's Version (AQ-Child; Auyeung, Baron-Cohen, Wheelwright, &

Table 1
Participant characteristics in each group.

		ASD	Age-matched TD	Ability-matched TD
Age	Mean (*SD*)	6.94 (1.05)	6.81 (0.93)	5.76 (0.91)
CRT	Original	20.22 (8.72)	27.37 (8.17)	20.04 (8.09)
	Standardized	87.00 (11.05)	98.27 (8.06)	95.86 (10.22)
VMA[a]		5.46 (2.13)	N/A	N/A
AQ	Mean (*SD*)	88.45 (11.49)	59.48 (13.62)	60.45 (10.96)
	Range	63–105	35–85	39–76

Note: Standard deviations are shown in parentheses.
[a] VMA was measured by the Chinese version of the PPVT-R.

Allison, 2008). The ASD children's AQ scores were significantly above the cutoff score, $t(21) = 5.09$, $p < .001$, $\eta^2 = .55$, whereas age- and ability-matched TD children's AQ scores were significantly below the cutoff score, $t(24) = -6.06$, $p < .001$, $\eta^2 = .60$, and $t(19) = -6.35$, $p < .001$, $\eta^2 = .68$, respectively. In addition, the ASD group had significantly higher scores on the AQ scale than the age-matched TD children, $t(45) = 4.83$, $p < .001$, $\eta^2 = .34$, and the ability-matched TD children, $t(40) = 8.07$, $p < .001$, $\eta^2 = .62$. There was no difference in AQ scores between the two TD groups, $t(43) = 0.26$, $p = .80$, $\eta^2 = .002$. As reported by Auyeung and colleagues (2008), the AQ cutoff score is 76 with high sensitivity and specificity (95% of ASD children, 2% of TD girls, and 7% of TD boys scored above 76).

Children's intellectual ability was measured using the Combined Raven Test (CRT, second version, CRT-C2), as listed in Table 1. There were no significant differences between ASD and age-matched TD children in age, $t(47) = 0.77$, $p = .44$, $\eta^2 = .01$, or between ASD and ability-matched TD children in ability (original CRT scores), $t(42) = 0.07$, $p = .94$, $\eta^2 = .0001$, but ASD children were older than ability-matched TD children, $t(46) = 4.53$, $p < .001$, $\eta^2 = .31$. We also measured ASD children's verbal mental age with the Chinese version of the Peabody Picture Vocabulary Test–Revised (PPVT-R). Their mean verbal mental age was 5.46 year ($SD = 2.13$).

Procedure

Children were seen individually in a quiet room. Each child completed three conditions: a point condition, a marker condition, and a control condition. There was only one trial for each condition. In the point condition, Experimenter 1 (E1) asked children to find a reward (i.e., a sticker) in three identical boxes. Before they started the search, another experimenter (E2) looked inside each of the three boxes and pointed to the box that contained the reward saying, "The reward is here" (Fig. 1A). Then children were asked to choose one of the three boxes to find the reward. They were told that if they found the reward, they could keep it. The box they touched or pointed to first was recorded as their choice. After children made a decision, to ensure that they noticed where E2 pointed, they were asked a memory control question, "Where did he [she] point to?" Then the chosen box was put aside and children were asked to wait until the end of the game (after all conditions were finished) to open all chosen boxes. Children were made to wait until the end to open all of the boxes to avoid the influence of feedback on children's behavior in the subsequent trials. The order by which E2 looked inside the three boxes (from the left to the right or from the right to the left) was randomized between trials and between participants. The marker condition was identical to the point condition except that E2, instead of pointing to the box, put a marker on the box that contained the reward without saying anything. Children were then asked to choose from the three boxes. The order of the marker and point conditions was counterbalanced between participants.

The reason why we used the point condition was that pointing, as a conventional communicative gesture, has been used in several previous studies and proven to be an effective cue well understood by TD children (Couillard & Woodward, 1999; Jaswal et al., 2010; Palmquist, Burns, & Jaswal, 2012) and ASD children (Russell et al., 1991). We included the marker condition because a marker also serves a communicative function similar to that of pointing. However, compared with pointing, a marker's referencing linkage to a referent (the baited box in the current study) is less well established,

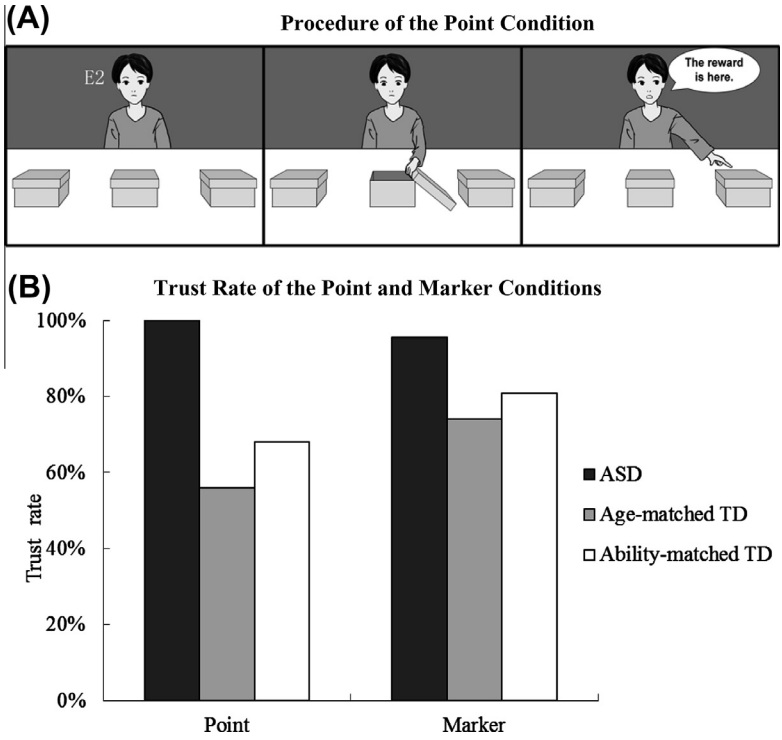

Fig. 1. Procedures of the point condition (A) and trust rates of the point and marker conditions for the ASD group ($n = 21$), age-matched TD group ($n = 27$), and ability-matched TD group ($n = 25$) (B).

automatic, and strong. Thus, children might less readily search for a reward in a box indicated by a marker than by pointing (Couillard & Woodward, 1999).

After the two experimental conditions, children also participated in the control condition. The purpose of the control condition was to ascertain whether ASD children would accept any information provided by an unfamiliar adult as true even when the information contradicted their own belief about the truth. In this condition, E2 pretended to take a phone call and left the room, during which E1 asked children to hide the reward in one of the three boxes and remember where it was hidden. E2 returned and looked inside each of the three boxes and put a marker on an empty box. Then children were asked to choose a box to find the reward. After they made a choice, E1 asked a memory control question, "Where did you hide the reward?"

Results

If children chose the box marked or pointed to by E2, the trial was coded as "trust" and scored 1. In the marker and point conditions, to choose either one of the other two boxes was coded as "mistrust" and scored 0. In the control condition, to be consistent, we coded the children's actions as "trust" (scored 1) if children chose the box marked by E2 and as "mistrust" (scored 0) if children chose the box where the reward was really hidden (no one in the control conditions chose the third box). Fig. 1B shows trust rates for different groups in each condition.

In the marker condition, 95% of ASD children, 74% of age-matched TD children, and 81% of ability-matched TD children trusted the marker, all of which were significantly higher than chance (33%), $ps < .001$ (binominal test). In the point condition, all ASD children, 56% of age-matched TD children, and 68% of ability-matched TD children trusted the experimenter's pointing, significantly higher than chance, $p < .001$, $p = .03$, and $p < .001$, respectively (binominal test).

We conducted a nonparametric repeated measures analysis of the effects of child group (ASD, age-matched TD, or ability-matched TD) and condition (marker or point) on children's trust or mistrust using the logistic regression (SAS CATMOD procedure). The child group effect was significant, $\chi^2(df = 2) = 20.28$, $p < .001$. A priori contrasts using the ASD group as the reference group showed that regardless of the marker or point conditions, ASD children were significantly more likely to trust than the age- and ability-matched TD children, $\chi^2(df = 1) = 17.93$, $p < .001$, and $\chi^2(df = 1) = 7.92$, $p = .005$, respectively. The other effects were not significant, $p > .20$.

To further test the relationship between verbal mental age and the trust rates of children with ASD, we divided ASD children into two groups: one with PPVT scores lower than the 50th percentile and the other with PPVT scores higher than the 50th percentile. We compared the trust rates between these two groups in both the marker and point conditions. Two-tailed Fisher's exact tests showed no significant difference in the trust rates between the two groups of ASD children in either condition, ps = 1.00.

In the control condition where children already knew where the reward was and were presented with a conflicting clue by E2, 76% of ASD children mistrusted the experimenter's marker, which was significantly higher than chance, $p = .049$ (binominal test). In addition, 96% of the age-matched TD group and 92% of the ability-matched TD group mistrusted the experimenter's marker, both of which were also significantly higher than the chance, $p < .001$ (binominal test). Furthermore, we compared the mistrust rate of ASD children with that of the other two groups. ASD children did not differ significantly in their mistrust rate of the experimenter compared with age-matched TD children, $p = .07$, and ability-matched TD children, $p = .20$ (Fisher's exact test). In addition, there was no significant difference between the two TD groups, $p = .61$ (Fisher's exact test).

Discussion

The current study examined whether young ASD children had an indiscriminate trust bias whereby they would believe any information provided by an unfamiliar adult with whom they had no interactive history. We compared ASD children's responses to an experimenter in a simple hide-and-seek game with those by age- or ability-matched TD children. We showed that ASD children had a significantly stronger bias in trusting an unfamiliar adult with whom they just met than both groups of TD children. When the whereabouts of the hidden reward was unknown to them, nearly all ASD children trusted the information provided by the unfamiliar adult, whereas only slightly more than half of TD children trusted the adult. However, when children knew where the reward was hidden, nearly all TD children and most ASD children mistrusted the adult. Like TD children, ASD children did not let the adult's misinformation override their own knowledge about the whereabouts of the hidden reward. These results, taken together, suggest that although young school-aged ASD children did not have an indiscriminate trust in any information provided by an unfamiliar adult, they appeared to be more trusting toward the adult informant than age- and ability-matched TD children when they themselves did not have the needed information.

To the best of our knowledge, our findings are the first to report ASD children's trusting tendency during the early ages. Much research is still needed to understand more fully the developmental pattern of trust in ASD children. For example, because we focused only on young school-aged ASD children, it is unclear whether ASD children's indiscriminate trust tendency will be as strong at 6 years of age as at younger and older ages. In addition, the current study focused only on ASD children's indiscriminate trust tendency. Future studies should also examine whether ASD children will have difficulty in demonstrating skeptical trust whereby they may selectively trust or distrust information depending on the nature of the information and the type of informant who provides the information.

Furthermore, future studies need to assess ASD children's cognitive abilities in various domains so as to elucidate underlying mechanisms that help to explain the differences between ASD and TD children. For example, our results are consistent with the findings regarding ASD children's difficulty in engaging in deliberate deception (Baron-Cohen, 1992; Russell et al., 1991; Sodian & Frith, 1992). Trust and deception may be two sides of the same coin. To deploy deception against other persons, one must understand and be able to form deceptive intentions. To decide whether to trust or mistrust another person, one must also understand that the person may have, and be capable of forming, deceptive intentions.

It is well established that deception is closely linked to theory of mind (ToM) understanding in general and false belief understanding specifically (Chandler, Fritz, & Hala, 1989; Talwar & Lee, 2008). Indeed, deception by definition involves the instilment of false beliefs into the mind of the dupe. Thus, both the deployment of deception to dupe others and the detection of others' deception to avoid being duped require the understanding and manipulation of beliefs. To deceive another individual, the deceiver must understand that his or her beliefs about the world can be different from those held by the dupe and that the deceiver can instill false beliefs into the mind of the dupe (Talwar & Lee, 2008). To trust or mistrust an interlocutor, individuals must also understand the differences between their beliefs and those of the interlocutor and that the interlocutor may have the intent to instill false beliefs in their mind.

Extensive research has shown that the understanding of deception and related ToM emerges at around 3 years of age and develops rapidly during the preschool years among TD children (Milligan, Astington, & Dack, 2007; Wellman, Cross, & Watson, 2001). In contrast, it has been repeatedly shown that ASD children are impaired in ToM understanding (e.g., Baron-Cohen, Leslie, & Frith, 1985; Fisher & Happe, 2005; Ozonoff & South, 2001; Pellicano, 2007; Peterson & Siegal, 2000; Peterson, Wellman, & Liu, 2005; Tager-Flusberg & Joseph, 2005), although this deficit may also be due to ASD children's general language impairment, not a ToM impairment specifically (e.g., Gernsbacher & Frymiare, 2005). They also have difficulty in understanding the intentional nature of deception and repeatedly fail to use appropriate deceptive strategies according to situational needs (Baron-Cohen, 1992; Russell et al., 1991; Sodian & Frith, 1992, 1994). It is perhaps the same deficit in ToM understanding and deception among ASD children that prevent them from displaying a healthy level of skepticism. Thus, to test this intriguing hypothesis, future studies must test the same ASD and TD children using both a deception paradigm and a trust paradigm. Furthermore, children's ToM understanding must be simultaneously assessed with the use of tools such as the works by Peterson and colleagues (2005) and Wellman and Liu (2004).

Another possibility is that, according to an account by Pellicano and Burr (2012), ASD children are less likely than typical children to rely on or be influenced by their prior experiences. Therefore, ASD children were less able to learn from their prior experiences that adults may lie, which accounts for their bias to trust others in this current study. Yet another alternative possibility is that ASD children obtain similar abilities as TD children to learn from their prior experiences, but their experiences have largely been of reliable adults who are eager to interact with them.

We hope that the findings from the current study and future studies, taken together, will provide a comprehensive picture of how trust develops among ASD children, how their developmental trajectory is different from or similar to that of TD children, what cognitive and social factors contribute to potentially atypical trust development in ASD children, and what treatment methods may alleviate ASD children's trust problems so as to improve the quality of their everyday social interactions with others. Although addressing all of these questions will likely take years, we believe that the current study is the first step in the right direction.

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