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Distrust and retaliatory deception in children with Autism Spectrum Disorder

Li Yi [a,*], Yuebo Fan [b,c], Jiao Li [a], Dan Huang [b,c], Xueqin Wang [d,e], Wenle Tan [a], Xiaobing Zou [f], Kang Lee [g,**]

[a] Department of Psychology, Sun Yat-sen University, China
[b] Guangzhou Cana School, China
[c] Guangzhou Rehabilitation & Research Center for Children with ASD, China
[d] Department of Statistical Science, School of Mathematics and Computational Science, Sun Yat-sen University, China
[e] Zhongshan School of Medicine, Sun Yat-sen University, China
[f] The Third Affiliated Hospital of Sun Yat-sen University, China
[g] Dr. Eric Jackman Institute of Child Study, University of Toronto, Canada

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ABSTRACT

This study examined trust and retaliatory deception in children with Autism Spectrum Disorder (ASD). In Experiment 1, school-aged children with ASD and ability-matched typically developing (TD) children participated in a game to find a hidden prize. An adult repeatedly misinformed children about the whereabouts of the prize. Although children with ASD did not blindly trust all information provided by the informant, they were significantly more trusting of the deceptive adult than TD children. Further, children with ASD were less likely to retaliate by deceiving the adult than TD children. Experiment 2 showed that children with ASD who distrusted a deceptive adult were less flexible and therefore less able to generalize their distrust to different situations compared to TD children.

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1. Introduction

In addition to learning through direct observations, young children rely heavily on the testimonies of others to acquire knowledge. Children rely on such sources as their parents, teachers, siblings, and peers to learn new words, scientific facts, geographic information, history, moral norms, and cultural beliefs (e.g., Harris, 2007). Children under age four are willing to trust others' testimony, even those that challenge their own observations, knowledge, or common sense (Jaswal, Croft, Setia, & Cole, 2010). While it is important to trust others to acquire knowledge, children must also have a healthy dose of skepticism because information provided by others may not always be credible for a variety of reasons (e.g., Jaswal & Malone, 2007; Mills, 2013). For example, an informant may have false information or have deceptive intentions. The majority of the existing research on trust development has focused on typically developing (TD) children. Few studies have examined how children with Autism Spectrum Disorder (ASD) trust others' deceptive testimony and whether their trust tendency is similar to, or different from, that of TD children. The present study was conducted to bridge this important gap in the literature.

* Corresponding author at: Department of Psychology, Sun Yat-sen University, 135 Xingang West Road, Guangzhou 510275, China.
** Corresponding author at: Dr. Eric Jackman Institute of Child Study, University of Toronto, 45 Walmer Road, Toronto, Ontario, Canada.
Tel.: +1 416 934 4597.

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As children develop, they learn to evaluate what, when, and whom to trust, which is called selective trust (e.g., Harris, 2007). Evidence of early signs of selective trust emerges in toddlerhood (e.g., Ganea & Harris, 2012; Koenig & Echols, 2003; Koenig & Woodward, 2010; Pea, 1982). With increased age, preschoolers begin to take into account their relationship with the informant (Corriveau & Harris, 2009), the informant's past reliability (e.g., Corriveau & Harris, 2009; Koenig & Harris, 2005), the informant's confidence level (e.g., Jaswal, 2004; Jaswal & Neely, 2006), and the informant's intentions and deceptive history (e.g., Lee & Cameron, 2000; Mascaro & Sperber, 2009; Vanderbilt, Liu, & Heyman, 2011), among other factors. Selective trust is adaptive for children because with increased age, children's social milieu expands. With this expansion come individuals who may not have the best information for children, or who may not have children's best interests at heart. Being selectively trusting allows children to avoid being misled by information from such individuals, while at the same time allowing them to acquire credible information that meets their everyday and developmental needs.

Although young preschoolers could selectively evaluate different sources of information, and distrust unreliable sources, some studies have shown that young preschoolers show a trust bias toward the deceptive information provided by an adult (Clément, Koenig, & Harris, 2004; Jaswal et al., 2010). For example, Couillard and Woodward (1999) examined preschool children's understanding of deceptive pointing by asking children to find a hidden prize in one of two containers. An experimenter played the role of a "trickster" by either pointing to, or placing a marker on, an empty container. Findings indicated that 3-year-olds failed to realize that the experimenter tricked them; they ignored that their failures in the previous trials were due to the deceptive pointing and repeatedly searched for the prize in the empty container. A similar study, using verbal testimony, instead of pointing, also elicited a similar indiscriminant trust bias in 3-year-olds (Jaswal et al., 2010). This indiscriminant trust bias, according to Jaswal et al. (2010), could be adaptive because "it would allow children to sidestep the usually unnecessary, often time-consuming, and sometimes impossible task of evaluating the veracity of everything they are told" (p. 1542). However, children were less likely to be misled by a physical marker than a testimony with pointing, which suggested children's difficulty in inhibiting the deceptive pointing per se.

To date, only one study examined the trust behaviors in children with ASD (Yi et al., 2013). In this study, children were asked to indicate in which of three boxes they believed a sticker was in according to either a confederate's pointing or a physical marker without feedback. That is, children were not allowed to look inside the boxes to know if their predictions were actually correct. Results showed that in this situation, children with ASD were more likely to trust the confederate than typical children in both the pointing and the marker conditions. No study has so far examined how and whether children with ASD trust another's testimony when the person is deceptive.

Nevertheless, a series of studies on deceptive behaviors and understanding of deception in children with ASD have provided some insights into this issue. Several studies have found that children with ASD can, and do, tell antisocial and white lies spontaneously in naturalistic settings (Li, Kelly, Evans, & Lee, 2011; Talwar et al., 2012). However, many studies have shown that children with ASD have difficulty engaging in deception in the true sense of the word, that is, to instill a false belief in the mind of the intended dupe (Baron-Cohen, Tager-Flusberg, & Cohen, 1994; Russell, Mauthner, Sharpe, & Tidswell, 1991; Sodian & Frith, 1992; Talwar et al., 2012; Yirmiya, Solomonica-Levi, & Shulman, 1996). For example, Russell et al. (1991) explored the ability of children with ASD aged between 7 and 17 years to deceive by asking them, as well as TD children and children with Down Syndrome (DS), to play a "windows task." The task involved an experimenter deciding in which of two boxes to look for a chocolate. Children, who could see the location of the chocolate through the windows of the boxes, could help the experimenter by pointing to the correct box. Children were given the chocolate if the experimenter picked the wrong box, so it was in their best interest to point to the empty box. Most DS and 4-year-old TD children deceived the experimenter by pointing to the empty box, whereas most ASD and 3-year-old TD children pointed to the baited box.

Sodian and Frith (1992) examined whether the difficulty with deception in children with ASD was due to a specific deficit in their manipulation of beliefs or due to lack of inhibitory control. They used both a deception task and a sabotage task. In both tasks, children were requested to help a "nice" puppet find a sweet in one of two boxes, and to prevent a "nasty" puppet from finding the sweet. In the deception task, children had to tell the truth to the nice puppet ("the box is open") and tell a lie to the nasty puppet ("the box is locked"). In the sabotage task, children had to lock the baited box to prevent the nasty puppet from obtaining the prize, or lock the empty box so that the nice puppet could obtain the prize in the full box. Children with ASD failed at the deception task but succeeded at the sabotage task, suggesting that their failure to deceive others is due to a specific deficit in understanding and manipulating beliefs, but not to an inability to inhibit a behavioral response.

Further studies indicated that although children with ASD can use simple deceptive strategies, they might still have difficulty understanding that deception involves the manipulation of others' minds (Baron-Cohen, 1992; Yirmiya et al., 1996). Baron-Cohen (1992) investigated the deception strategies of children with ASD in a Penny Hiding Game in which children had to hide a penny in one hand or the other to prevent the guesser from knowing where it was. Children with ASD were as capable as TD and DS children in using an "object occlusion" hiding strategy (to ensure that the guesser could not see the penny), but were less able to use the "information occlusion" strategy (to prevent the guesser from getting access to information about the location of the penny). Their failure to use the information occlusion strategy implied that they have a specific difficulty engaging in deception by manipulating others' beliefs. Similarly, Yirmiya et al. (1996) asked TD children, children with intellectual disabilities (ID), and children with ASD to help a doll hide a car and then to deceive a competitor about the location of the hidden object by either laying a false trail or erasing all trails. Children with ASD performed worse than TD children, but did not differ from children with ID in their deceptive acts. However, children with ASD were less able to predict the outcome of their deceptive acts than TD and ID groups, again suggesting their inability to understand that deception involves the manipulation of others' beliefs. Recent studies by Li et al. (2011) and Talwar et al. (2012) used a temptation-resistance paradigm in which children played a guessing game with an experimenter. They were asked not to peek at a toy, but were given an opportunity to cheat when left alone in the room. When the experimenter returned, children were asked whether they peeked, and then to guess what the toy was. Both of these studies directly tested whether children with ASD would violate the experimenter's instruction by cheating and whether they would lie about it. Results showed that fewer children with ASD lied about peeking than TD children; children with ASD had more difficulty in semantic leakage control (Li et al., 2011; Talwar et al., 2012). It appears that the deficits of children with ASD in Theory of Mind (ToM) were related to the limitations observed in their ability to deceive others (Talwar et al., 2012).

Children with ASD have difficulty not only in committing acts to deceive others, but also in understanding or detecting deception by other people (see Ranick, Persicke, Tarbox, & Kornack, 2013). To detect other people's deceit, children have to be aware of others' deceptive intention, which requires knowledge about others' mental states (Lee & Cameron, 2000; Leekam & Prior, 1994). Considering the deficits of understanding others' mental states in children with ASD (see Baron-Cohen, 2001, for a review), which may underlie their poor ability to deceive, it is reasonable to infer that they may also have difficulty detecting others' deceit. Yi et al. (2013) found that children with ASD are more likely and willing to believe what they are told compared with TD children, when there was no element of deception involved.

The present study specifically examined whether children with ASD would have a similar trust bias in a deceptive situation, with three major goals. The first goal of the present research was to examine whether children with ASD would show an indiscriminant trust bias for information provided by an adult informant who had previously, and repeatedly, provided misinformation, and who had been labeled as deceptive. Considering the limited cognitive abilities of the children with ASD, we used a simple trust game modeled after the paradigms used by Couillard and Woodward (1999).

In this trust game, an adult confederate (Experimenter 2, E2) was introduced by Experimenter 1 (E1) to the child as a "tricky" person who "did not want you to win the prize." Children were shown three identical boxes and told that only one of the boxes contained a prize. Children were told that they could keep the prize if they chose the correct box; otherwise the confederate would get to keep it. The confederate looked into all boxes and pointed to the empty box, saying, "The prize is in here." Then children were asked to find the prize. If children trusted the confederate's testimony, they would choose the box indicated by the confederate and thus lose the prize; alternatively, if they showed distrust in the confederate, they would search for the prize in another box and win the prize (unbeknownst to children the two other boxes both contained prizes). This procedure was repeated for 10 trials to ascertain how children initially trusted the confederate and how quickly they learned to distrust the confederate as evidence for the confederate's trickery mounted.

The existing evidence shows that typically developing children show discriminate trust by about 3–4 years of age and will readily distrust information provided by an adult informant who has been labeled as, or shown to be, deceptive (e.g., Lee & Cameron, 2000). Thus, we hypothesized that our 4- to 6-year-old TD children should show distrust in the confederate's information from the first trial and this distrust should continue throughout the 10 trials. Given the existing evidence for the difficulty of children with ASD in understanding deception, we hypothesized that children with ASD would show greater trust in the deceptive confederate than the TD children in the initial trials.

The second goal of this research was to examine whether, after being exposed to misinformation provided by a deceptive confederate, children with ASD and TD children would, in addition to learning to distrust the confederate, also learn to retaliate by deceiving the confederate in return. We used a deceptive game that was identical to the trust game except that the roles of the confederate and the child were reversed. Children would hide the prize and be asked by the confederate where they hid the prize. Again there were 10 trials in total. Extensive evidence has shown that children above 4 years of age are highly capable of lying and performing deceptive acts (e.g., Russell et al., 1991). Thus, we hypothesized that the 5-year-old TD children would readily deceive the confederate. In contrast, based on the current literature on the difficulty of children with ASD with carrying out deception (e.g., Russell et al., 1991), we hypothesized that children with ASD would have difficulty providing misleading information to the confederate and thus would tell the truth to the confederate regarding the whereabouts of the prize, even after repeated losing the prize.

The third goal of the present research was to examine how TD and ASD groups' tendency to distrust and deceive correlated with their executive function (EF), and false belief (FB) understanding. Previous research has shown that TD children's tendency to trust and their understanding of deception is significantly related to their ToM and inhibitory control (e.g., Carlson, Moses, & Hix, 1998; Jaswal et al., 2010): in order to deceive others, children need to understand and manipulate other people's beliefs, and to suppress the actions to indicate the truth. Children with ASD have repeatedly shown impairments in both ToM (e.g., Baron-Cohen, Leslie, & Frith, 1985; see Baron-Cohen, 2001, for a review) and EF (see Hill, 2004, for a review). Thus, we expected that ASD and TD groups' performance on the trust and the deception tasks in the current research would be correlated with their performance on the FB tasks and the Dimensional Card Sorting (DCCS) task, which explore the social and cognitive factors that may influence development of distrust and deception in children with ASD and TD children.

2. Experiment 1

2.1. Method

2.1.1. Participants

Participants were 25 children with ASD (age range: 5.68–10.83 years, $M = 7.57$, $SD = 1.24$, 3 female) and 25 TD children (age range: 4.33–6.17 years, $M = 5.25$, $SD = .64$, 3 female), matched based on their ability (IQ test scores) and their verbal mental age (VMA). TD children were recruited from a preschool and a primary school in Guangzhou, China. Children with ASD were recruited from a special school for children with ASD in the same city.

All children with ASD were previously diagnosed using diagnostic criteria for autism according to the *DSM-IV-TR* (American Psychiatric Association, 2000) by two experienced pediatric clinicians. Only one child with ASD was classified as having Asperger syndrome; others were classified as having the Autistic disorder according to *DSM-IV-TR*. Standardized diagnostic scales such as the Autism Diagnostic Interview-Revised (ADI-R, Lord, Rutter, & Le Couteur, 1994) or the Autism Diagnostic Observation Schedule (ADOS, Lord et al., 2000) have not been widely used in China. Therefore, we confirmed the diagnosis of children with ASD by using the Chinese version of the Autism Spectrum Quotient: Children's Version (AQ-Child) developed by Auyeung, Baron-Cohen, Wheelwright, and Allison (2008). The AQ cut-off score is 76 with high sensitivity and specificity (95% ASD children, 2% TD girls and 7% TD boys scored above 76), as reported by Auyeung et al. (2008). Mean AQ scores of children with ASD were significantly above the cut-off score (76), $t(24) = 4.29$, $p < .001$, while TD children's mean AQ scores were significantly below the cut-off score (76), $t(20) = -7.37$, $p < .001$. Children's non-verbal IQ was measured using the Combined Raven Test (CRT, second version, CRT-C2; Gao, Qian, & Wang, 1998), administered by experimenters who had been adequately trained according to the standard protocol. No group difference in original IQ scores was found, $t(47) = .001$, $p = .999$ (see Table 1). We also measured children's VMA with the Chinese version of the Peabody Picture Vocabulary Test-Revised (PPVT-R; Sang & Miao, 1990), also administered by experimenters who had been adequately trained according to the standard protocol. No group difference of VMA was found, $t(43) = -1.35$, $p = .18$.

2.1.2. Procedure

Children were tested individually in a quiet room. All children participated in three tasks, the baseline task, the trust task, and the deception task. On a separate day, between 7 and 10 days apart, children completed the FB and the DCCS tasks.

2.1.2.1. Baseline task. The procedure is shown in Fig. 1. E1 showed the child three identical boxes, one of which they were told contained a prize. E1 opened the boxes and looked into them one by one while making sure that the child could not see inside the boxes. Then E2, always a female adult who was trained according to the study protocol beforehand, pointed to the box with the prize and said, "The prize is in here." Here both verbal testimony and pointing were used in order to convey a strong and unambiguous message. E1 then asked the child, "Where is the prize?" It was emphasized that if children chose the correct box, they could keep the prize. After children made their decision, the box was put aside and not opened. This task was repeated five times. The location of the prize and the order the boxes were opened in was randomized across trials. The baseline task measured children's initial tendency to trust what they were told by E2. No feedback was provided to children.

2.1.2.2. Trust task. E1 then introduced E2 as a "tricky" person who "did not want you to win the prize." E1 showed three identical boxes and told the child that only one of the boxes contained a prize. Children were told that they could keep the prize if they chose the correct box; otherwise E2 would keep it. E1 confirmed with the child about the rule of the game, "If you find the prize, then what will happen? If not, then what will happen?" Then E2 looked into all boxes, pointed to the empty box, and said, "The prize is in here." E1 asked the child, "Where is the prize?" Then E1 opened the box selected by the child and gave the child feedback by saying either "Here is the prize! You can have it." or "It's an empty box, so E2 wins the prize." The other two boxes remained unopened. If the child chose a box other than the empty box indicated by E2, E1 always told the children that they got a prize.

This task had 10 trials. After each trial children were provided with feedback as to whether they found the prize or not. Children were considered to have passed this game when they succeeded in finding the prize in 5 successive trials.

2.1.2.3. Deception task. Following the trust task, the roles of the child and E2 were reversed. The child was now asked to hide the prize, "This time you are going to hide the prize and E2 is going to look for it." E2 turned around so as not to see the child hiding the prize. E1 showed the child three identical boxes, and asked the child to hide the prize in one of them. After the child completed the hiding and closed the boxes, E1 asked the child where the prize was hidden and did not proceed until the

Table 1
Participant characteristics in each group.

Variable	Experiment 1			Experiment 2		
	ASD	TD	Group difference	ASD	TD	Group difference
Male (female)	22 (3)	22 (3)	–	13 (0)	18 (0)	–
Age range	5.68–10.83	4.33–6.17	–	5.58–11.83	5.08–6.67	–
Mean age	7.57 (1.24)	5.25 (.64)	$t(35.87) = 8.35$, $p < .001$	8.00 (1.83)	5.69 (.48)	$t(13.22) = 4.44$, $p = .001$
IQ (original)	18.04 (9.22)	18.04 (7.74)	$t(47) = .00$, $p = .99$	26.92 (12.47)	23.61 (6.75)	$t(17.07) = .87$, $p = .40$
IQ (standardized)	76.69 (15.19)	92.76 (13.67)	$t(38) = -3.41$, $p = 002$	84.47 (12.44)	98.15 (10.74)	$t(29) = -3.27$, $p = .003$
VMA[a]	4.73 (1.87)	5.32 (.92)	$t(43) = -1.35$, $p = .18$	6.51 (2.46)	6.14 (.65)	$t(9.91) = .47$, $p = .65$
AQ	87.36 (13.23)	58.77 (10.97)	$t(43) = 8.00$, $p < .001$	83.54 (17.40)	66.18 (9.58)	$t(17.50) = 3.24$, $p = .005$

Note. Standard deviations are shown in parentheses.
[a] VMA was measured by the Chinese version Peabody Picture Vocabulary Test-Revised (PPVT-R).

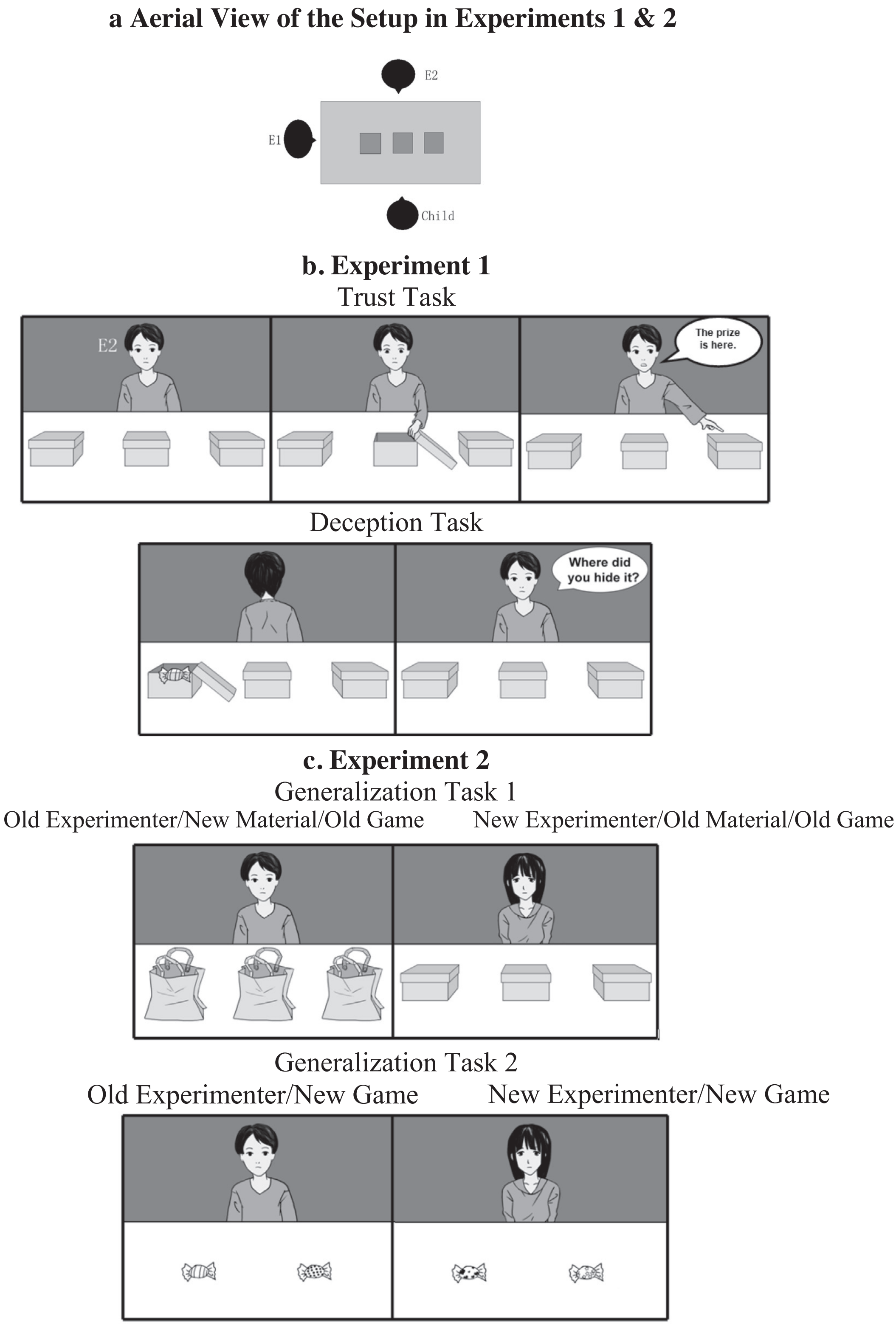

Fig. 1. Schematic drawing of (a) the experimental settings, and the procedures of (b) the trust and the deception tasks in Experiment 1 and (c) the generalization tasks 1 and 2 in Experiment 2.

child answered this question correctly. E2 turned back around and asked the child, "Where did you hide it?" Children were told that if E2 found the prize, E2 would keep it; if not, then the child would get to keep the prize. This question was repeated until the child gave an answer. This task was repeated 10 times. After each trial children were provided with feedback on whether E2 found the prize or not. If children could successfully deceive E2 and obtain the prize in 5 successive trials, they were considered to have passed the game.

In the above two tasks, two different trained adults acted as the experimenter (E1), and another two adults as confederates (E2). To control for a potential gender effect, all adults were females. All experimenters were adequately trained beforehand according to the task protocol.

2.1.2.4. False belief tasks. Traditional FB tasks, the location-change task (Wimmer & Perner, 1983) and the false-content task (Perner, Leekam, & Wimmer, 1987) were adapted for children with ASD (e.g., Baron-Cohen et al., 1985) and Chinese-speaking children (Lee, Olson, & Torrance, 1999). In the location change task, the child was shown two dolls, a toy, a box, and a drawer. E1 performed a play for the child about the two dolls, "This is Xiao-Hong, and this is Xiao-Lan. They are playing together in a room. Xiao-Hong puts her toy into the box and closes the lid. Then Xiao-Hong leaves the room for lunch. When Xiao-Hong is gone, Xiao-Lan opens the box, takes the toy out of the box, puts it into the drawer, and closes it. Later, Xiao-Hong returns and she is going to look for her toy." Children were asked: "Where will Xiao-Hong look for her toy first?"

In the false-content task, children were shown a crayon box and were asked, "What do you think is in the box?" Then the experimenter opened the box to show that there were, in fact, crayons in the box. E1 then emptied the box by taking out all the crayons, and placing candy into the crayon box. Children then were asked: "X (name of a classmate of the child) is coming here and he has never seen this box before. If I ask him what he thinks is in the box, what do you think his answer will be, crayons or candy?"

2.1.2.5. DCCS task. Children's executive functioning was measured using the DCCS task, a widely used measure of EF for children across a wide range of ages (Zelazo, 2006). We followed the standardized protocol used in Zelazo (2006). In this task, children were shown a series of bivalent test cards and two bivalent target cards. Being bivalent here means that each card has two dimensions, color and shape. Children were asked to sort the cards according to certain rules (by color or by shape). The DCCS task is comprised of the pre-switch phase, the post-switch phase and the border phase. In the pre-switch phase, children were asked to sort the test cards according to one dimension (e.g., color). In the post-switch phase, the rule switched and children were asked to sort the cards according to the other dimension (e.g., shape). These two phases consisted of six trials each. A 4-trial practice was provided before the pre-switch phase to ensure that children understood the task. Then, children went on to the border phase, in which they must associate each rule to the appearance of a border (e.g., if there is a border, then sort by color; if not, then sort by shape). The border phase had 12 trials. A total score for DCCS was calculated by summing all the correct trials in all three phases for each child.

In total, five different experimenters tested children on the false belief and executive functioning tasks. They all had extensive experiences interacting with children with ASD and had been adequately trained according to the task protocols.

2.1.3. Data analysis

In the baseline and the trust tasks, children scored 0 when they trusted E2 and chose the baited box, or scored 1 when they distrusted E2 and chose either of the other two boxes. In the deception task, children scored 0 when they told E2 the truth about the location of the prize; they scored 1 when they deceived E2 about the location of the prize by pointing to an empty box. When children did not respond, the trial was coded as missing data. Children's performance in the trust and the deception tasks was compared to chance performance using one-sample *t* tests and compared between ASD and TD groups using ANCOVAs with IQ and VMA as covariates.

Trial-by-trial analyses were also conducted for each trial of the trust and the deception tasks. First, Chi-square or Fisher's exact tests were performed to examine the group difference of the trust and deception performance for each trial. Second, survival analyses and log-rank tests were conducted to examine how learning curves of the trust and deception tasks differed between groups. Finally, the performance of the trust and deception tasks was correlated with their age, VMA, IQ, as well as FB and DCCS performance.

2.2. Results and discussion

2.2.1. Baseline and trust tasks

As listed in Table 2, results of the one-sample *t* test showed that in the baseline task, the distrust scores of ASD and TD groups were significantly below chance levels (i.e., 33%), $t(24) = -4.16$, $p < .001$, $\eta^2 = .42$, and $t(24) = -3.83$, $p = .001$, $\eta^2 = .38$, respectively. The chance level was defined as the probability of successfully finding the prize independently or based merely on random guesses. Thus the chance here was choosing one box randomly out of three boxes, which made it 33%. We further conducted an ANCOVA to examine the group difference in the performance of the baseline task, with VMA and IQ as covariates. No significant difference of distrust scores was found between ASD and TD groups, $F(1, 40) = .12$, $p = .74$, $\eta^2 = .00$. This finding suggested that ASD and TD groups showed a similar tendency to trust the confederate in the baseline task, when there was no element of deception.

Table 2
Mean and standard deviations of performance in the baseline task, the trust task, the deception task, the FB Tasks, and the DCCS task, in ASD and TD groups, and their group differences.

Experiment	Tasks		ASD			TD			Group difference covariates: VMA, IQ
			M	*SD*	*n*	*M*	*SD*	*n*	
1	Baseline		.72	1.14	25	.56	1.45	25	$F(1, 40) = .12$, $p = .74$
	Trust		4.96	2.87	24	9.12	.88	25	$F(1, 39) = 57.22$, $p < .001$
	Deception		4.17	3.68	23	9.36	.76	25	$F(1, 38) = 45.71$, $p < .001$
	FB		.60	.64	25	.92	.76	25	$F(1, 40) = 4.47$, $p = .041$
	DCCS		12.68	7.70	25	17.56	6.57	25	$F(1, 40) = 7.37$, $p = .010$
2	Generalization task 1	Old experimenter	4.31	1.55	13	4.67	.97	18	$F(1, 20) = 1.14$, $p = .30$
		New experimenter	4.54	1.20	13	4.28	1.64	18	$F(1, 20) = .14$, $p = .71$
	Generalization task 2	Old experimenter	.46	.97	13	3.67	1.53	18	$F(1, 20) = 24.62$, $p < .001$
		New experimenter	.77	1.30	13	3.06	2.04	18	$F(1, 20) = 6.21$, $p = .022$

In the trust task, the distrust score for ASD and TD groups were both significantly above chance levels (i.e., 33%), $t(23) = 2.78$, $p = .011$, $\eta^2 = .25$, and $t(24) = 32.83$, $p < .001$, $\eta^2 = .98$, respectively (Table 2). An ANCOVA with IQ and VMA as covariates found that TD children were significantly more likely than children with ASD to distrust E2 in the trust task, $F(1, 39) = 57.22$, $p < .001$, $\eta^2 = .60$. That is, in the trust task, both ASD and TD groups showed a tendency to distrust the confederate, although TD children were more likely to distrust the confederate than children with ASD. This finding was consistent with our hypothesis that children with ASD would display more trust in others than TD children.

A trial-by-trial analysis was conducted to test the group differences for each trial of the trust task (see Fig. 2a). Results showed that ASD and TD groups responded similarly in Trial 1 of the trust task, $\chi^2(1, N = 49) = .04$, $p = .84$, but from Trials 2 to 10, children with ASD were less likely than TD children to distrust E2 who repeatedly deceived them about the location of the prize, $ps < .01$(Chi-square test for Trial 1, Fisher's exact test for the rest trials, two-tailed). This finding indicates that, although ASD and TD groups displayed similar tendencies to trust E2 initially, only TD children immediately learned from the feedback and adjusted their strategies accordingly in order to win the prize.

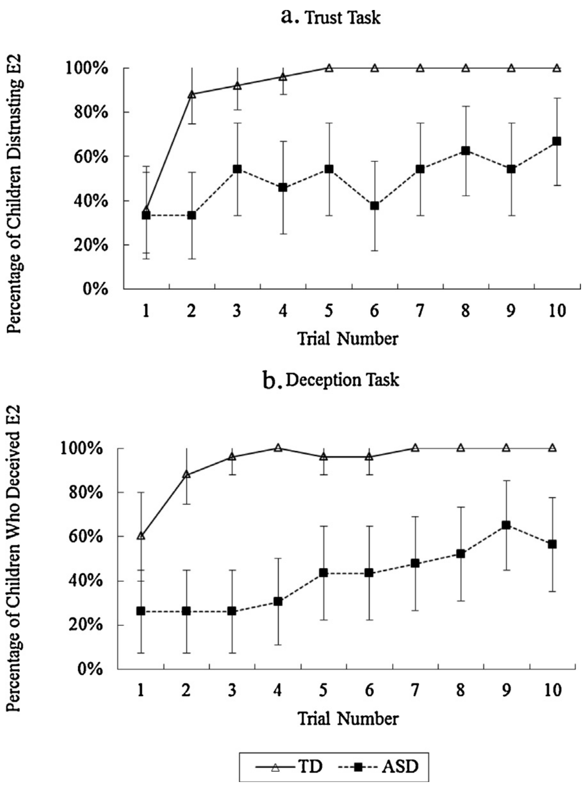

Fig. 2. Percentage of children with ASD and TD children who distrusted or deceived E2 as a function of trial numbers in the trust (a) and the deception tasks (b) in Experiment 1 (error bars represent 95% confidence intervals).

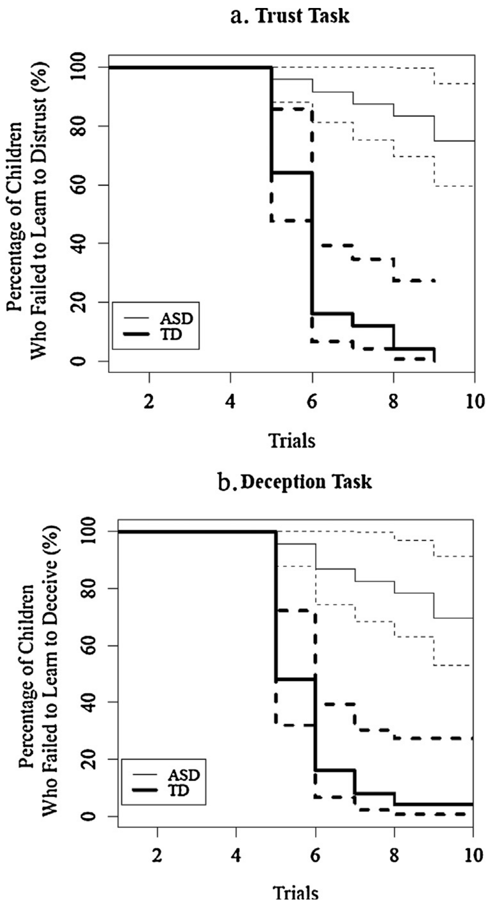

Fig. 3. Percentages of children who failed to learn to distrust or deceive over trials in the trust and deception tasks, for ASD and TD groups in Experiment 1 (dash lines represent 95% confidence intervals).

We further conducted a survival analysis to test how children's performance in the trust task changed through the 10 trials (see Fig. 3a). Curves in the graph represent the percentages of children who failed to distrust at specific time points. Dash lines represent the 95% confidence intervals. Children were considered to have successfully learned to distrust when they distrusted E2 in 5 successive trials. Results showed that in the trust task, the TD group all showed steep downward trends with 84% of them beginning to distrust before the 3rd trial. At the end of the task, all TD children successfully learned to distrust E2. However, the learning curve of the children with ASD was less steep and by the end of the task, only 25% of children in the ASD group learned to distrust the confederate. We conducted a log-rank test that showed a significant group difference of the learning time cost (defined as the learning time, or number of trials needed to pass the task), $p < .001$.

2.2.2. Deception task

A one-sample t test showed that The deception scores of children with ASD did not differ significantly from chance, $t(22) = 1.10$, $p = .29$, $\eta^2 = .05$, while TD children's deception scores were significantly above chance, $t(24) = 39.80$, $p < .001$, $\eta^2 = .99$ (see Table 2). Further, an ANCOVA showed that when IQ and VMA were statistically controlled, children with ASD were less likely than TD children to deceive E2 about the location of the prize, $F(1, 38) = 45.71$, $p < .001$, $\eta^2 = .55$. This finding indicates that TD children were more likely to deceive the experimenter than children with ASD who responded randomly, which is consistent with the results from previous research regarding difficulty engaging in deception in children with ASD (e.g., Baron-Cohen, 1992; Russell et al., 1991).

A trial-by-trial analysis was conducted to test the group differences for each trial of the deception task (see Fig. 2b). Results showed that children with ASD were less likely to deceive E2 than TD children from Trials 1 to 10, $ps < .05$ (Chi-square test for Trial 1, Fisher's exact test for the rest of the trials, two-tailed). Thus, similar to the trust task, TD children were more likely to learn to retaliate by deceiving the confederate than children with ASD.

We also conducted a survival analysis to test how children's performance in the deception task changed through the 10 trials. As shown in Fig. 3b, curves in the graph represent the percentages of children who failed to deceive at specific time points. The survival analysis (Fig. 3b) showed a similar trend as in the trust task: 84% TD children began to deceive from the first two trials, and 96% of them succeeded to deceive E2 at the end of the game. In contrast, 65% children with ASD still failed to deceive E2 at the end of the game. A log-rank test showed a significant difference of the learning time cost between the two groups in the deception tasks, $p < .001$.

2.2.3. False belief and DCCS tasks

The FB understanding of children with ASD was compared to that of the TD children. For both FB tasks, when children answered the key question correctly, they scored 1; otherwise, they scored 0. Children's scores on the location change task and the false content task were added to produce a total FB score, ranging from 0 to 2 (see Table 2). The number of correct trials in all three phases of the DCCS was summed up to calculate a total score for each child. We conducted an ANCOVA to test the group difference in the FB performance with VMA and IQ as covariates, which found that when the IQ and VMA were statistically controlled, children with ASD performed poorer in the FB tasks than TD children, $F(1, 40) = 4.47$, $p = 041$, $\eta^2 = .10$. Additionally, an ANCOVA found a significant group difference for the total DCCS scores between ASD and TD groups, $F(1, 40) = 7.37$, $p = .010$, $\eta^2 = .16$. The TD group scored significantly higher in the DCCS task than the ASD group, when the IQ and VMA were statistically controlled.

2.2.4. Correlational analyses

Pearson correlations were conducted for each group of children to examine the inter-correlations between children's learning time cost in the trust tasks and their age, EF (measured by DCCS), and FB understanding. Results (Table 3) showed a significant positive correlation between the learning time cost of the trust and the deception tasks in children with ASD, $r_p = .51$, $p = .013$. Thus, children with ASD who were faster to learn to distrust E2 after being tricked by E2 were also faster to learn to use a retaliatory deceptive strategy against E2. The VMA in children with ASD was negatively correlated with their learning time cost of both the trust and the deception tasks, $r_p = -.66$, $p = .002$, $r_p = -.73$, $p < .001$, respectively. TD children's VMA was negatively correlated with the learning time cost of the deception task, $r_p = -.49$, $p = .016$. Those children with ASD with higher VMA were faster to learn to distrust and deceive E2; whereas TD children with higher VMA were faster to learn to deceive E2. IQ of children with ASD was negatively correlated with their learning time cost of the deception task, $r_p = -.76$, $p < .001$. Those children with ASD with higher IQ were faster to learn to deceive E2. The DCCS performance of the children with ASD were negatively correlated with the learning time cost of the trust and the deception tasks, $r_p = -.53$, $p = .008$, $r_p = -.53$, $p = .010$, respectively. These children with ASD with higher DCCS performance were faster in learning to trust and deceive E2. The correlations between the FB performance and the performance in the trust and deception tasks were not significant for both groups, $ps > .05$.

We also calculated partial correlations after partialing out the effects of age and VMA. Results showed a positive correlation between the learning time cost of the trust and deception tasks for the ASD group, $r_p = .52$, $p = .034$, suggesting that even after the effects of age and VMA were controlled, children with ASD who were faster to learn to distrust E2 in the trust task were still faster to learn to deceive E2. No correlation was found for the TD group after controlling out the effects of age and VMA, $ps > .05$.

Table 3
Intercorrelations (a) and partial correlation (b) between the learning time cost in the trust and the deception tasks, and children's age, VMA, IQ, scores of the DCCS task, and false belief (FB) understanding for ASD and TD groups in experiment 1.

(a) Pearson correlations

TD\ASD	1	2	3	4	5	6	7
1. Trust	–	.51*	.17	−.66**	−.37	.18	−.53**
2. Deception	.26	–	−.19	−.73***	−.76***	.21	−.53**
3. Age	−.01	−.35	–	.40	.22	−.18	.01
4. VMA	−.27	−.49*	.52*	–	.71***	−.30	.65**
5. IQ	−.34	−.34	.24	.42*	–	−.29	.40
6. FB	−.06	.40	−.10	−.19	.03	–	−.07
7. DCCS	−.19	−.25	.44*	.34	.61**	−.17	–

(b) Partial correlations (controlling for age, VMA)

TD\ASD	1	2	3	4	5
1. Trust	–	.52*	−.15	−.11	−.01
2. Deception	.18	–	−.48	.07	−.48
3. IQ	−.26	−.16	–	−.08	.37
4. FB	−.13	.35	.17	–	.17
5. DCCS	−.17	−.05	.56**	−.10	–

Notes. Correlations for children with ASD are presented above the diagonal, and correlations for TD children are presented below the diagonal.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

3. Experiment 2

The purpose of Experiment 2 was to examine whether children with ASD and TD children who distrusted the deceptive confederate could generalize their distrust to different persons or situations. We only included children with ASD and TD children who passed a pretest task by showing distrust in E2. The pretest followed the same procedure as the trust task in Experiment 1 (the baseline phase or the deception task was not included). We explored whether these children with ASD and TD children would trust a new experimenter (E3) who used the same objects as E2 for the hide-and-seek game (the Generalization Task 1a: old objects with new experimenter), or E2 (the same experimenter) with new objects for the game (the Generalization Task 1b: new objects with old experimenter). We also introduced a new trust task (the Generalization Task 2: new game with new or old experimenter) to explore whether children would trust the old and the new experimenters in a totally different situation. In the Generalization Task 2, children had to choose one of two candies; the experimenter (old or new, depending on the condition) told them that one candy tasted good and the other one tasted bad.

We hypothesized that, in the Generalization Task 1, both groups of children would still distrust the new experimenter with the old materials and the old experimenter with new materials. However, TD children, but not children with ASD, would generalize their distrust to the totally new game (the Generalization Task 2). We hypothesized that, since children with ASD are known to show less cognitive flexibility (see Hill, 2004, for a review), they would be less likely to generalize their distrust to a new situation or person.

3.1. Method

3.1.1. Participants

Thirteen children with ASD (age range: 5.58–11.83 years, $M = 8.00$, $SD = 1.76$, all male) and eighteen ability-matched TD children (age range: 5.08–6.67 years, $M = 5.69$, $SD = .48$, all male) passed the pretest and participated in Experiment 2. A total of 57 children with ASD were tested in Experiment 2, but 44 of them failed the pretest. Thus, only 13 eventually passed the pretest (to distrust E2 in at least 5 successive trials) and preceded to the generalization tasks. There were 13 out of 18 TD children and 9 out of 13 children with ASD in Experiment 2 who also participated previously in Experiment 1, which was conducted about one month before Experiment 2. All children with ASD had been previously diagnosed by clinicians according to the diagnostic criteria for ASD according to the *DSM-IV-TR* (American Psychiatric Association, 2000), and confirmed by AQ (see Table 1). All children with ASD were classified as having the Autistic disorder according to *DSM-IV-TR*. No group difference in original IQ scores of CRT was found, $t(17.07) = .87$, $p = .40$. The mean VMA of the ASD group ($M = 6.51$, $SD = 2.46$) did not significantly differ from that of the TD group ($M = 6.14$, $SD = .65$), $t(9.91) = .47$, $p = .65$.

3.1.2. Procedure

Children were tested individually in a quiet room. Each child participated in three tasks: the pretest, Generalization Task 1, and Generalization Task 2. There were two conditions for each generalization task: the old experimenter condition and the new experimenter condition. The pretest was always performed first, and then the four conditions were conducted in a randomized order. Only those children who passed the pretest (to distrust E2 in at least 5 successive trials) could proceed to the generalization tasks. The whole procedure was videotaped and children's choices were manually recorded.

3.1.2.1. Pretest. The procedure for the pretest was exactly the same as the trust task in Experiment 1. Only those children who distrusted E2 (i.e., who chose winning boxes) for five successive trials were considered to have passed the pretest and could proceed to the subsequent tasks.

3.1.2.2. Generalization Task 1. Each child completed both the new and the old experimenter conditions for this task. For the new experimenter condition, the same procedure was used as in the pretest, except a new experimenter, E3, who had not been labeled as deceptive, replaced E2. The experimenters were described as someone who could provide information about the whereabouts of the prize. The person was labeled neither as "tricky" nor as "nice". For the old experimenter condition, the same procedure was used as in the pretest, except paper bags replaced the boxes, and the type of prize was changed (i.e., from candy to stickers). Both conditions were repeated five times, and no feedback was provided. Thus, children would be given the prizes after the whole experiment was over.

3.1.2.3. Generalization Task 2. We used a candy-tasting game consisting of both the old and the new experimenter conditions. Each condition consisted of five trials. In the first trial, children were introduced to two types of candy that they had never seen or eaten before. The two types of candy were in comparable, yet distinct, wrapping and E1 confirmed with the children that they had never eaten either type of candy before. E1 told the children that the two types of candy tasted different. Then, children were asked to pick one of the two types of candy. Before they made the decision, children were told that E2 (old experimenter condition) or E3 (new experimenter condition) "had eaten these candies before" and would help them. E2 or E3 was seated across from the child with one type of candy in each hand. E2 or E3 told the child "I have tasted these candies before. This one tastes good," (put one candy down on the table) "and this one tastes bad." (put the other candy down). The type of candy that was considered "good" was randomized across conditions. Then E1 asked the child, "You can only pick one candy. Which one would you like to choose?" Each trial used a new pair of candies. Both conditions were

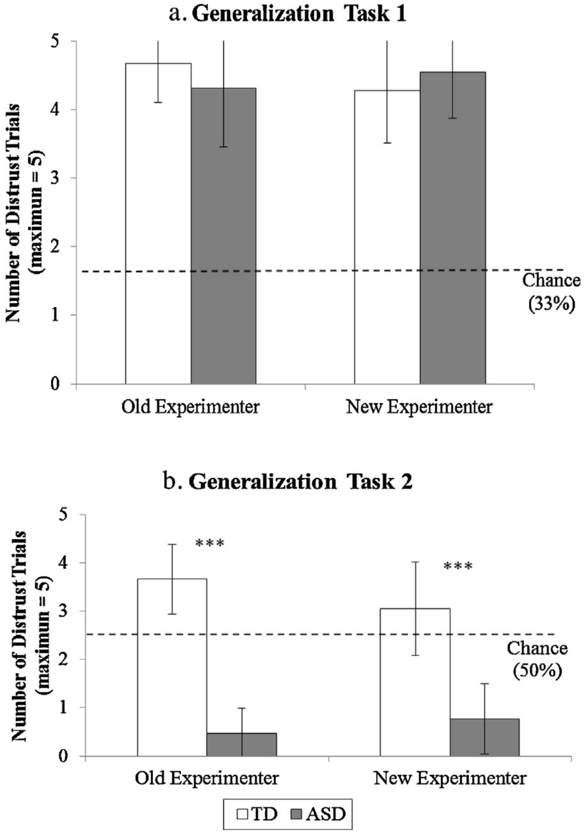

Fig. 4. Total numbers of distrust trials in the Old and New Experimenter Conditions in the Generalization Task 1 and 2 for ASD and TD groups in Experiment 2 (error bars represent 95% confidence intervals). ***$p < .001$.

repeated 5 times without any feedback. Children were given the candies after the entire experiment was completed. In all conditions, children scored 0 when they trusted E2 or E3 (i.e., to choose the baited box or candy), and 1 when they distrusted E2 or E3.

3.2. Results and discussion

An independent sample t test comparing the pretest performance between the TD and ASD groups indicated that TD children were more likely to distrust the deceptive informant than children with ASD, $t(15.18) = -2.56$, $p = .021$, $\eta^2 = .30$.

In Generalization Task 1, children's responses were compared to chance levels (i.e., 33%) using one-sample t tests. Distrust scores of both ASD and TD groups were significantly higher than chance (33%) in the old experimenter condition, $t(12) = 6.15$, $p < .001$, $\eta^2 = .76$, and $t(17) = 10.71$, $p < .001$, $\eta^2 = .87$, respectively, and in the new experimenter condition, $t(12) = 8.64$, $p < .001$, $\eta^2 = .86$, and $t(17) = 6.76$, $p < .001$, $\eta^2 = .73$, respectively (see Fig. 4a).

Children's responses in Generalization Task 2 were also compared to chance level (i.e., 50%) using one-sample t tests. The distrust scores of children with ASD were significantly lower than chance (50%) in the old experimenter condition, $t(12) = -7.60$, $p < .001$, $\eta^2 = .83$, and the new experimenter condition, $t(12) = -4.80$, $p < .001$, $\eta^2 = .66$. In contrast, TD children's distrust scores were significantly higher than chance (50%) in the old experimenter condition, $t(17) = 3.23$, $p = .005$, $\eta^2 = .38$, but did not differ from chance in the new experimenter condition (see Fig. 4b).

Thus, both groups of children could generalize their distrust to a different person with the same hide-and-seek game or the same person in a different hide-and-seek game. However, only TD children could generalize their distrust of E2 to a completely novel situation. It should be noted, however, that TD children did not over-generalize their distrust, as evidenced by their chance level rate of distrust toward E3, a new person who had never deceived them, in a novel trust game. Children with ASD, on the other hand, failed to distrust E2, when E2, who had been previously deceptive in the original trust game, now played a new and different trust game.

Children's responses were also compared between tasks, groups, and conditions with a 2 (Subject Group) × 2 (Task) × 2 (Experimenter) ANOVA. Results showed significant effects of Group, $F(1, 20) = 7.45$, $p = .013$, $\eta^2 = .27$, Task, $F(1, 20) = 7.87$, $p = .011$, $\eta^2 = .28$, a Group × Task interaction, $F(1, 20) = 7.67$, $p = .012$, $\eta^2 = .28$, and a Group × Experimenter interaction, $F(1, 20) = 5.28$, $p = .033$, $\eta^2 = .21$. Simple effect analysis showed that (a) both ASD and TD groups distrusted the experimenters more in the Generalization Task 1 than the Generalization Task 2, $F(1, 22) = 34.68$, $p < .001$, $\eta^2 = .61$, $F(1, 22) = 7.10$, $p = .014$, $\eta^2 = .24$, respectively; (b) TD children were more likely to distrust the old experimenter than the new experimenter, $F(1, 22) = 7.86$, $p = .010$, $\eta^2 = .26$, while children with ASD did not distinguish the two experimenters, $F(1, 22) = .69$, $p = .42$, $\eta^2 = .02$; (c) children with ASD were more likely to trust both the old and the new experimenters than TD children in Generalization Task 2, $F(1, 20) = 15.55$, $p < .001$, $\eta^2 = .44$. There was no significant Group effect for either the old or the new experimenter conditions in Generalization Task 1, $F(1, 20) = .10$, $p = .75$, $\eta^2 = .01$.

These findings indicate that, similar to TD children, children with ASD were able to generalize their distrust to a new person in an old setting and to a previously untrustworthy person in a new, yet similar, setting (Generalization Task 1). However, when encountering a new situation (Generalization Task 2), TD children could also selectively generalize their distrust of a previously untrustworthy person to a completely new situation. TD children also showed more trust in a new person with no contact history compared to the old untrustworthy person with a deceptive history. In contrast, children with ASD did not generalize their distrust of a previously untrustworthy person to a new situation, as if with a change of setting, an originally untrustworthy person would become trustworthy again. TD children, but not children with ASD, could distinguish the originally untrustworthy person from the new person with no contact history. Overall, children with ASD were not as flexible as TD children to generalize their distrust into different situations.

4. General discussion

The current research examined the extent to which elementary school-aged children with ASD would show a trust bias whereby they would believe any information provided by an informant who had been labeled as deceptive and who had repeatedly provided misinformation. We compared the responses of children with ASD to those of ability-matched, younger TD peers in a hide-and-seek game.

Results of Experiment 1 revealed that although both ASD and TD groups displayed an overall tendency to distrust a confederate who had repeatedly provided them with misinformation, children with ASD were more likely to trust and therefore to be more easily misled by the deceptive confederate than TD children. When the whereabouts of the hidden prize was unknown to them, most children with ASD and TD children were initially inclined to trust the information provided by the confederate. When this trust was violated, most TD children learned quickly from the feedback and adjusted their strategies accordingly in order to win the prize. TD children learned to mistrust the confederate only after a couple of trials. In contrast, most children with ASD never learned to deceive after receiving feedbacks for all 10 trials. They tended to be misled by the confederate and continued to look for the prize where the deceptive confederate pointed and thus repeatedly failed to find the prize. These findings suggest that although children with ASD were similar to their ability-matched, younger TD peers in their initial trust shown for the confederate, they differed from TD children in that they remained trusting toward the confederate even when their trust was repeatedly violated. This trust bias in school-aged children with ASD is similar to the trust bias previously reported in 3-year-old TD children (Jaswal et al., 2010).

In the deception task, after they received feedback that the confederate won the prize, most TD children could adapt and begin to deceive the confederate in order to prevent the confederate from winning the prize. In contrast, most children with ASD had difficulty adapting and engaging in deception in this task. This finding is consistent with findings from studies that used a similar paradigm with 3-year-old TD children (Russell et al., 1991), and it indicates that children with ASD have difficulty engaging in deception even after their trust in another individual has been repeatedly violated and they have experienced repeated failure to win a prize. Together, these findings suggest that when compared to ability-matched TD children, children with ASD as a group have deficits in both distrust and deception.

Correlational analyses found that their learning time cost in the deception task was correlated with their learning time cost in the trust task after controlling for the effects of age and VMA. Those children with ASD who were faster to learn to distrust the deceptive confederate were also faster to learn to use retaliatory deceptive strategies against them. This finding suggests that although children with ASD are, on average, less skilled at distrust and deception than ability-matched TD children, some children with ASD are not oblivious to others' untrustworthy behaviors, nor are they entirely devoid of the ability to seek revenge by deceiving the person who has "wronged" them.

It is perhaps the same deficit in ToM understanding and deception among ASD children that prevent them from displaying a healthy level of skepticism. The correlation analyses for TD children differed from those for children with ASD. Whereas EF and ToM scores were not significantly correlated with performance in the trust and deception tasks for TD children, the learning time cost for the trust and deception tasks were correlated with the DCCS performance in children with ASD. These findings regarding DCCS performance are consistent with our expectations. Executive function in general and inhibitory control in particular are necessary cognitive functions that play a key role in suppressing our natural tendency to trust others, and shifting into a state of distrust toward an untrustworthy person. However, after controlling for the age and VMA, these correlations were no longer significant, since DCCS performance was strongly correlated with their VMA. It should be noted that one should not conclude that executive function does not play an important role in the trust and deception performance of children with ASD as VMA itself may also have executive function components.

It is, however, surprising that ToM and EF scores did not uniquely predict TD children's retaliatory deception scores. It is well established that deception is closely linked to false belief understanding and executive functioning (e.g., Carlson et al., 1998; for a review, see Lee, 2013). Indeed, the deployment of deception to dupe others requires the understanding and manipulation of beliefs, suppression of actions based on a true belief, and the generation and execution of actions as if a false belief is true. One possibility might be that most of the TD children deceived the deceptive confederate within a couple of trials in the deception task and thus their deception performance might be too limited in their variability to reveal significant relations to EF and ToM scores.

An alternative explanation for the trust bias in children with ASD is that children with ASD are less likely to rely on or be affected by their prior experiences (Pellicano & Burr, 2012), so that they are less able to learn from the prior experiences of being deceived by others than typical children. Another possibility is that, even though children with ASD may have similar abilities as TD children to learn from the prior experiences, their experience has largely been of reliable adults.

Experiment 2 examined the extent to which ASD and TD groups would generalize their distrust. We found that the distrust formed by both ASD and TD groups could be generalized to different persons and settings. That is, ASD and TD groups displayed similar distrust toward a new person performing the same task using the same materials as a known untrustworthy person who had performed the same task with different materials. They did so even though the trustworthiness of the former was entirely unknown. Also, both groups generalized their distrust to a previously deceptive person who was performing the same task but with new materials. TD children distrusted the same person who had been deceptive when performing one task but was now performing a brand new task more than a new person who was performing the brand new task. Children with ASD, on the other hand, failed to generalize their distrust of a previously deceptive person to a new task setting. They acted as if the originally untrustworthy person had somehow become trustworthy again in the completely new situation. This lack of generalization might be due to the limited cognitive flexibility of children with ASD, a consistent finding from previous studies (for a review, see Hill, 2004). Nevertheless, it is worth noting that the children with ASD included in the Experiment 2 had to pass a pretest. They were not representative of the whole ASD population, but rather a subset of more capable children with ASD who already were able to distrust others. Thus, our results from Experiment 2 represent the "best-case scenario" levels of generalization.

One limitation of the current research is the relatively wide age range of children with ASD due to the difficulty to recruit relatively high-functioning children with ASD. Since trust and deception are closely related to chronological age and mental age, future studies may consider dividing children into different age groups or following up longitudinally to explore the developmental trajectory of trust and deception in children with ASD. It should also be noted that we used both verbal testimony and pointing in the current trust task to provide as much information as possible to make trust decisions. Previous research with typical children has found that TD children could rely on either pointing or verbal testimony to make trust decisions (e.g., Couillard & Woodward, 1999; Jaswal et al., 2010). It is unclear whether children with ASD could rely on either cue alone to perform trust tasks, an issue that needs to be addressed in future studies. Another noteworthy issue is that since the current study only included Chinese children, caution needs to be taken when generalizing the conclusions to ASD populations in other cultures. To date, no study has been conducted to directly compare trust behaviors of children with ASD in Western and Eastern cultures. However, recent studies have also found that Eastern and Western children evaluate antisocial and prosocial deception in highly similar ways (Fu, Xu, Cameron, Leyman, & Lee, 2007; Xu, Bao, Fu, Talwar, & Lee, 2010), since both cultures generally encourage honesty and discourage deceit (Fu et al., 2010). Also, a recent study found that Chinese children could consider both honesty and benevolence in their selective trust from 7 years of age onward (Xu et al., 2013), which is consistent with the developmental trajectory of trust in the current literature for Western children. Subtle cultural differences of children's trust and deception behaviors, however, may exist due to the emphasis on group harmony (Rothbaum, Pott, Azuma, Miyake, & Weisz, 2000) and collectivism in Chinese culture (Xu et al., 2010). Future studies need to address these limitations so as to obtain deeper understanding of the differences in trust and deception between TD children and children with ASD and the mechanisms underlying these differences.

In summary, the current research revealed that ASD and TD groups show differential behaviors in trust and retaliatory deception. Compared to TD children, children with ASD are less inclined to distrust an informant even after repeatedly being deceived by the informant, and are less likely to retaliate by deceiving the informant in return. Children with ASD are less likely than TD children to generalize their distrust of a deceptive person to different situations. Much research is still needed to gain a fuller understanding of the developmental pattern of trust in children with ASD. For example, because our study was limited to school-aged children with ASD, it is unclear whether their indiscriminant trust tendency is as robust at older ages as selective trust has been shown to develop very quickly from 3 years of age onward among TD children (e.g., Jaswal, 2004; Koenig & Harris, 2005). Future studies should also examine whether children with ASD will have difficulty in demonstrating selective trust whereby they may selectively trust or distrust information depending on the nature of the information and the characteristics of the informants.

The findings from the present study, taken together with future studies, may lead to a comprehensive picture of how trust develops among children with ASD. Future research should further investigate how the developmental trajectory of children with ASD differs from, or is similar to, that of TD children with similar IQ and VMA; and what cognitive and social factors contribute to potentially atypical trust development in children with ASD. The findings of the current study have several practical implications. First, our findings provide parents, clinicians, and educators with new information regarding potential problems that children with ASD may have regarding the issue of trust and deception. Second, our findings suggest that children with ASD can be trained to detect deception and make appropriate trust decisions so as to improve the quality of their everyday social interactions with others. For example, ASD-specific training method can be developed based on the current findings such that children with ASD can be trained to show some level of suspicion to ensure safety. Although addressing all these questions will probably take years, the present study represents a first step in the right direction.

Acknowledgments

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