The Effect of Anthropomorphism on Human-Robot Trust in 4- to 6-Year-Old Children

Authors: Yang Yijin, Jiang Yuwei, Mao Keyu, Li Tingyu, Chen Yiqun, Zhu Liqi, Li Tingyu

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Abstract

Through two trust game experiments, this study investigated the development of trust in robots among 4- to 6-year-old children in economic games, while simultaneously examining anthropomorphic factors that may influence children' s trust in robots, including appearance anthropomorphism (human-like appearance) and behavioral anthropomorphism (verbal feedback and social contingency interaction). Experiment 1 examined children' s trust behaviors toward humans, the NAO robot, and the JIBO robot (high vs. low appearance anthropomorphism) in anonymous trust games, revealing that 4-year-old children' s trust in robots was significantly lower than that of 5- and 6-year-olds; furthermore, appearance anthropomorphism only affected 6-year-old children, with a significant positive correlation between the degree of appearance anthropomorphism and children' s trust. Experiment 2 utilized WeChat video calls with humans, NAO, and JIBO to imbue robots with behavioral anthropomorphism features, and investigated children' s trust behaviors toward different trust objects in anonymous trust games, discovering that robots possessing behavioral anthropomorphism features could significantly enhance children' s trust. The trust of 4- to 6-year-old children in robots is not only related to age but also influenced by robot anthropomorphism (appearance anthropomorphism and behavioral anthropomorphism), with the degree of anthropomorphism positively correlated with children' s trust behaviors.

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(1) Previous research has primarily focused on robot development and design, neglecting the psychological processes and development of young children as active agents in human-robot interaction, especially lacking direct investigation of human-robot relationships. This study is the first to explore the development of trust in robots among 4–6-year-old Chinese children through economic game paradigms.

(2) Anthropomorphism is an important influencing factor in human-robot trust. Past research has focused on how robot appearance affects trust while neglecting the role of behavioral anthropomorphism. This study manipulates both appearance and behavioral anthropomorphism of robots to systematically examine their effects on 4–6-year-old children' s trust in robots.

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Answer: This study is an experimental study; there is no need for common method bias testing.

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Answer: All planned sample sizes in this study were determined using G*Power software and reference to previous literature. According to G*Power 3.1, with a significance level of $\alpha = 0.05$ and effect size w = 0.30, a minimum sample of 88 participants was required to achieve 80% statistical power. The actual sample size was 90 participants.

6. [Question missing in original]

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The Influence of Anthropomorphism on 4-6-Year-Old Children' s Trust in Robots

Abstract

This study investigated the development of 4–6-year-old children' s trust in robots through two trust game experiments, while examining anthropomorphic factors that may influence this trust, including appearance anthropomorphism (human-like appearance) and behavioral anthropomorphism (verbal feedback and socially contingent interaction). Experiment 1 examined children' s trust behaviors toward a human, robot NAO, and robot JIBO (high vs. low appearance anthropomorphism) in an anonymous trust game. Results revealed that 4-year-olds' trust in robots was significantly lower than that of 5- and 6-year-olds, while appearance anthropomorphism only affected 6-year-olds, showing a significant positive correlation between appearance anthropomorphism and children' s trust. Experiment 2 endowed robots with behavioral anthropomorphic features through WeChat video calls with the human, NAO, and JIBO, then examined children' s trust behaviors toward different trustees in an anonymous trust game. The findings demonstrated that robots with behavioral anthropomorphic characteristics could significantly enhance children' s trust. Thus, 4–6-year-old children' s trust in robots is not only age-related but also influenced by robot anthropomorphism (both appearance and behavioral), with the degree of anthropomorphism positively correlating with children' s trust behaviors.

Keywords: 4–6-year-olds; trust; trust game; robots; anthropomorphism

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1. Introduction

With the development and application of artificial intelligence technologies, various educational robots have emerged to provide intelligent support for learning scenarios, including intelligent robot learning companions, toys, and special education assistants that teach children language (Movellan et al., 2009; Tanaka & Matsuzoe, 2012), mathematics (Wei et al., 2011), and social skills (Belpaeme et al., 2018; Ricks & Colton, 2010). As opportunities for children to interact with robots increase, social relationships between humans and robots will inevitably become more common and increasingly important in the future. These changes raise new research questions: How do human-robot relationships form and develop, and what factors influence them?

Trust is defined as the beliefs or expectations one holds about others during social interactions (Straten et al., 2018). Trust is not limited to interactions between organisms; human-robot trust exists in human-robot interaction (Hancock et al., 2011). Human-robot trust is one prerequisite for effective human-robot interaction and forms the foundation for successful human-robot collaboration (Christoforakos et al., 2021). Trust in robots is considered a primary indicator of robot acceptance; excessive trust can lead to inappropriate reliance on and misuse of intelligent robots, while lack of trust is often seen as a major barrier to robot usage (黄心语 et al., 2023). Therefore, trust plays a crucial role in children' s interactions with robots. On one hand, children' s trust in robots may manifest similarly to their trust in humans—for example, treating robots as people, attributing social categories to robots, and experiencing social emotions toward them. To the extent that machines are endowed with human-like features, they may elicit human-like treatment from individuals (Nielsen et al., 2022). On the other hand, children' s trust in robots may influence learning and interaction outcomes based on robots (Li et al., 2023). When robots are highly controllable yet share many similarities with humans, examining the factors influencing human-robot trust can contribute to developing robots that better align with human psychology and adapt to human cognition, emotion, and behavior, thereby achieving more harmonious and efficient human-robot interaction. Thus, exploring the development of young children' s trust in robots holds both theoretical and applied value.

Previous research indicates that children' s trust in robots is developmental, and individuals' trust in robots may change with age. On one hand, most studies demonstrate that children' s sensitivity to robot interaction patterns seems to increase with age. For example, when interacting with robots, 6-7-year-olds are less likely than 8-11-year-olds to notice behavioral differences between robots with different personalities (Martinez-Miranda et al., 2018). When robots exhibit rule-violating behaviors, younger children (ages 4-6) show fewer emotional reactions than older children (ages 7-10), and during conversations with robots, older children in continuous memory conditions show greater gains in liking for robots than younger children (Leite & Lehman, 2016). On the other hand, previous research examining young children' s epistemic trust in robots found that younger children trust robots more—for example, 3-year-olds are more willing than older children (ages 5, 7, and 9) to believe clues provided by robots when guessing which box an item is under (Di Dio et al., 2020). This may be because younger children' s perception of robots is more appearance-based, while as children grow older and gain more social experience, they consider more factors when evaluating trust in robots, such as robot functionality and knowledge (Brink et al., 2019; Cameron et al., 2015). Given that epistemic trust tasks focus more on children' s trust in information provided by robots rather than trust in robots themselves, the developmental trajectory of children' s trust in robots remains to be examined. Although some studies have used "questionnaire methods" to investigate children' s emotional responses and preferences toward robots (Martínez-Miranda et al., 2018; Shahid et al., 2010), no research has directly examined children' s trust behaviors toward robots. Therefore, this study is the first to use economic games as a trust assessment method to explore the development and characteristics of human-robot trust behaviors. Building on recent findings that 6-year-olds show higher trust levels toward partners than 4-year-olds in trust games (Rosati et al., 2019), this study hypothesizes that in trust games, older 6-year-olds may trust robots more than younger children.

Beyond individual factors, human-robot trust also varies with different robot attributes, particularly robot anthropomorphism, which plays an important role in trust. Anthropomorphism refers to the psychological tendency of humans to engage in social interactions with non-human entities (e.g., technology, animals, plants, supernatural entities, natural or social phenomena) as if these entities were human (Epley et al., 2007). This study defines robot anthropomorphism as the process of attributing human characteristics to robots. The process of establishing social interactions in young children may involve the ability to recognize that interaction partners are "like me" (Marchetti et al., 2018). Research has found that increased robot anthropomorphism leads to more positive interaction experiences (Duffy, 2003) and may also influence children' s trust in robots (Zguda et al., 2019). Von Zitzewitz et al. (2013) distinguished between two forms of robot anthropomorphism: appearance anthropomorphism and behavioral anthropomorphism. Appearance anthropomorphism is relatively straightforward to implement, typically by endowing robots with human-like facial and bodily features during product design. Appearance can profoundly affect interactions between robots and humans, with appearance anthropomorphism influencing trust in human-robot interaction (Kok & Soh, 2020; Billings et al., 2012). Previous research has found that robots with human-like features are often perceived as more trustworthy (Natarajan & Gombolay, 2020), and 5–7-year-olds treat robots with human-like appearance features using human interaction patterns (Cameron et al., 2017).

Behavioral anthropomorphism refers to endowing non-human entities like robots with human behavioral characteristics, enabling them to simulate human movement (resulting in behaviors) or communication in certain environments, and to interact with environmental or social properties, including language and action communication (von Zitzewitz et al., 2013). Behavioral anthropomorphism can be implemented through various approaches, one of which is social contingency, understood here as robots' attention to and appropriate responses toward others (Okanda & Itakura, 2008). Research has found that contingent interaction can enhance children' s attention and engagement levels, facilitating the formation of joint attention between children and interaction partners. A study using gaze turn-taking cues with socially functional robots found that robots' gaze turn-taking functions increased adults' perception of robot anthropomorphism, leading to greater trust in robots (Van Pinxteren et al., 2019). Atarajan and Gombolay (2020) found that robots' anthropomorphic appearance and behavior are key predictors of people' s trust in and compliance with robots. However, most of these studies indirectly demonstrate that trust in robots is influenced by anthropomorphic features—for example, children feel happier when interacting with anthropomorphic robots, which facilitates anthropomorphic emotions and helps establish trust. They provide clues about trust establishment or change but lack direct evidence of how robot anthropomorphism affects human-robot trust. Moreover, most previous research on robot effectiveness in children' s education (Li et al., 2010; Manzi et al., 2020) has neglected the role of behavioral anthropomorphism in human-robot trust. Therefore, it is necessary to simultaneously examine the effects of appearance and behavioral anthropomorphism on human-robot trust.

In summary, with the support of various AI technologies, robots are increasingly becoming learning companions and teachers in children' s lives. The development of children' s trust in robots and the influencing factor of robot anthropomorphism constitute a worthwhile research question. Based on previous research limitations, this study focuses on the following questions: First, the development of 4-6-year-old children' s trust in robots in economic games, with the expectation that human-robot trust may strengthen with age. Second, the influence of robot anthropomorphic features (appearance vs. behavior) on human-robot trust, by manipulating different human-like appearance features (presence vs. absence of face and limbs) and contingent interactive behaviors (demonstrating attention and appropriate responses to children during video calls), to examine children' s trust in robots, with the expectation that robot anthropomorphism will influence human-robot trust.

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2. Experiment 1: 4-6-Year-Old Children' s Trust Behaviors Toward Robots in Economic Games

This experiment employed a 3 (age: 4-year-olds/5-year-olds/6-year-olds) × 3 (trustee: human vs. robot NAO vs. robot JIBO) mixed factorial design. Age was a between-subjects variable, and trustee was a within-subjects variable. The dependent variables were children' s trust willingness (whether willing to give coins and how many) and expectations (how many coins they expected to be returned).

2.1 Participants Based on G*Power 3.1 calculations, with a significance level of $\alpha = 0.05$ and effect size w = 0.30, a minimum sample of 88 participants was required to achieve 80% statistical power (Li et al., 2023). This study recruited 90 children from kindergartens in a provincial capital city in southern China, including 45 boys and 45 girls. Children were divided into three age groups: 30 four-year-olds (15 girls, mean age = 54.3 months, SD = 4.4), 30 five-year-olds (15 girls, mean age = 67.7 months, SD = 4.2), and 30 six-year-olds (15 girls, mean age = 80.2 months, SD = 3.1).

2.2 Materials The experiment adapted the trust game task used by Berg et al. (1995) and Evans et al. (2013) to study trust in young children. Interpersonal trust is typically measured using the Trust Game (for participants generally 8+ years) and the Trust Game Task ("surprise bag" version) (for participants 4+ years) (Evans et al., 2013; 李婷玉 et al., 2017). In the trust game, participants are randomly assigned to roles A (trustor) and B (trustee) who never meet. Trustor A decides how much of their initial endowment X ($0 \leq X \leq S$) to give to anonymous trustee B, who receives 3X. After receiving this amount, B decides how much Y ($0 \leq Y \leq 3X$) to return to A. The final payoffs are S-X+Y for A and S+3X-Y for B (Berg et al., 1995). X reflects A' s trust level, while Y indicates B’ s trustworthiness (池丽萍, 2013). In this study, child participants served as trustors, with a human, robot NAO, and robot JIBO as trustees (see Figure 1 [Figure 1: see original paper]).

To allow children to physically manipulate and intuitively experience monetary changes, this study adapted materials from Siddique et al. (2022). Considering that previous trust game studies used an initial amount of 1, which meant children risked losing everything if they made a trusting decision—potentially discouraging trust—and to compare differences in trust toward various trustees, this study presented the initial endowment as concrete objects (4 gold coins). Materials also included stickers, researcher-made opaque “magic boxes,” and trays for each participant and trustee (4 total). During the experiment, trustee photos were presented both on PowerPoint slides and as printed vertical cards placed next to corresponding trays (see Figure 2 [Figure 2: see original paper]).

2.3 Procedure The experiment was conducted in a quiet room at the kindergarten, with one experimenter working individually with each child for approximately 10 minutes. The research process is shown in Figure 3 [Figure 3: see original paper]. The experimenter engaged in simple interactions with the child (discussing favorite cartoons, friends, sports, etc.) to help them relax. The experimenter then introduced the trustees using their photos: human “Chen Chen” (a male university student), robot NAO (an intelligent bipedal humanoid robot developed by Aldebaran Robotics), and JIBO (a home social robot created by MIT scientist Cynthia Breazeal), explaining they would play a game together.

Next, the experimenter explained the rules using PowerPoint and desktop materials (see Figure 4 [Figure 4: see original paper]): Four gold coins were placed in the child’ s tray. The child could keep these coins or share them with “XX” (the virtual game partner/trustee). If the child gave coins to “XX,” they would pass through a “magic box” that tripled them—1 coin became 3, 2 became 6, 3 became 9, and 4 became 12 (demonstrated via PowerPoint animation). The trustee might then return some coins or none at all.

Finally, the experimenter had the child practice one round as each role to ensure understanding of the rules, and reminded them that coins could be exchanged for stickers after the game.

2.4 Testing Phase After children understood the rules, the experimenter presented trustee photos (in counterbalanced order), placed four gold coins in the child’ s tray, and asked the willingness question: “Are you willing to give him/it any coins?” Willingness was scored as 1 (yes) or 0 (no). If the child placed coins in the opaque box, the experimenter operated the props, removed triple the number of coins, placed them in the trustee’ s tray, had the child count them, and asked the expectation question: “How many coins do you think he/it will return to you?” Scores ranged from 0–12 based on expected returns. If the child refused to give coins, the expectation question was not asked and the expectation score was recorded as 0.

2.5 Debriefing The experimenter briefly explained the study' s purpose, thanked the child, allowed them to exchange coins for stickers, gave a gift, and escorted them back.

2.6 Results and Discussion All data were entered and analyzed using SPSS 21.0. Generalized linear models (GLM) were used for statistical analysis. Trust levels of 4–6-year-olds toward different trustees are shown in Table 1 .

With trust willingness as the dependent variable, the final model showed a significant main effect of age (^{2} = 14.712, df = 2, $p = 0.001$), no significant main effect of trustee (^{2} = 2.952, df = 2, $p = 0.229$), and no significant age × trustee interaction (^{2} = 4.743, df = 4, $p = 0.315$). Pairwise comparisons revealed that 4-year-olds scored significantly lower than 5-year-olds ($p < 0.001$) and 6-year-olds ($p = 0.022$), while 5- and 6-year-olds did not differ significantly ($p > 0.05$). Post-hoc tests showed that, when age was fixed, 6-year-olds trusted robot NAO significantly more than JIBO ($p = 0.021$).

With expectation as the dependent variable, the GLM final model showed a significant main effect of age (^{2} = 14.657, df = 2, $p = 0.001$), no significant main effect of trustee (^{2} = 2.416, df = 2, $p = 0.229$), and no significant age × trustee interaction (^{2} = 4.479, df = 4, $p = 0.314$). Post-hoc comparisons found that 5-year-olds scored significantly higher than 4-year-olds ($p = 0.01$) and 6-year-olds ($p = 0.01$), while 4- and 6-year-olds did not differ significantly ($p > 0.05$). Post-hoc tests showed that, when age was fixed, 6-year-olds expected significantly more returns from robot NAO than from the human ($p = 0.034$).

These results demonstrate that children' s trust in robots in economic games strengthens with age: 4-year-olds gave significantly fewer coins than 5- and 6-year-olds and expected significantly fewer returns than 5-year-olds; 5-year-olds expected significantly more returns than 6-year-olds. Robot appearance anthropomorphism did not significantly affect 4–5-year-olds' trust in robots, but significantly affected 6-year-olds' trust, who gave more coins to and expected more returns from NAO than from JIBO or the human.

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3. Experiment 2: 4–6-Year-Old Children' s Trust Behaviors in Economic Games with Video Interaction

This experiment used a 3 (age: 4-year-olds/5-year-olds/6-year-olds) × 3 (trustee: human vs. robot NAO vs. robot JIBO) mixed factorial design. Age was a between-subjects factor, and trustee was a within-subjects factor. The dependent variables were children' s trust willingness (whether and how many coins to give) and expectations (expected returns).

3.1 Participants A new sample of 90 kindergarten children was randomly recruited, including 45 boys and 45 girls. Children were divided into three age groups: 30 four-year-olds (15 girls, mean age = 54.9 months, SD = 4.3), 30 five-year-olds (15 girls, mean age = 69.1 months, SD = 4.7), and 30 six-year-olds (15 girls, mean age = 81.2 months, SD = 2.7).

3.2 Materials Materials were largely the same as in Experiment 1, with the difference that trustees were presented not as photos but through WeChat video calls, a familiar format for children (see Figure 5 [Figure 5: see original paper]). Dialogue audio and content were pre-recorded (voice matched character image and evaluated by university students). During the experiment, the experimenter controlled video playback timing and content to simulate real-time attention and appropriate responses to children.

3.3 Procedure The experiment was conducted in a quiet kindergarten room, with one experimenter working individually with each child for approximately 10 minutes. The process is shown in Figure 6 [Figure 6: see original paper]. The procedure was similar to Experiment 1, except the experimenter said, “We’ ll play this game through a video call on the phone” when introducing the game.

After children understood the rules, the experimenter presented trustee photos (in counterbalanced order) and informed the child they would have a WeChat video call. The experimenter then pretended to make a video call on the phone:

Trustee: Hello
Experimenter: Hello, I’ ve invited this child to play the gold coin game with us. I’ ve given him/her four coins. He/she might give you some or none at all. If willing to give, his/her coins will multiply through this magic box, and you’ ll receive this many coins. The rules are as shown here. (Shows phone to PowerPoint)
Trustee: Um···okay
Experimenter: After receiving coins, you can give him/her some, all, or none. If he/she is willing to give later, please tell me how many you’ re willing to give.
Trustee: Okay, you ask first, I’ ll tell you later.
Experimenter: Okay, goodbye!

After the video interaction, the experimenter placed four gold coins in the child’s tray and asked the willingness and expectation questions. Scoring was identical to Experiment 1.

3.4 Debriefing Identical to Experiment 1.

3.5 Results and Discussion Using GLM analysis as in Experiment 1, trust levels of 4–6-year-olds toward different trustees are shown in Table 2 . With trust willingness as the dependent variable, the final model showed no significant main effect of age (^{2} = 0.465, df = 2, p = 0.793), no significant main effect of trustee (^{2} = 1.544, df = 2, p = 0.462), and no significant age × trustee interaction (^{2} = 1.139, df = 4, p = 0.888).

With expectation as the dependent variable, the final model showed no significant main effect of age (^{2} = 4.122, df = 2, p = 0.127), no significant main effect of trustee (^{2} = 3.181, df = 2, p = 0.204), and no significant age × trustee interaction (^{2} = 5.869, df = 4, p = 0.209). In the interactive context, no significant age differences emerged in children' s trust toward robots with different appearance anthropomorphism levels.

Experiment 2 added video interaction to Experiment 1, creating a "with vs. without interaction" variable between the two experiments. GLM analysis comparing both experiments is shown in Figures 7 [Figure 7: see original paper] and 8 [Figure 8: see original paper]. With trust willingness as the dependent variable, the final model showed a significant main effect of interaction (^{2} = 14.277, df = 1, $p < 0.001$), with trust significantly lower in the no-interaction condition ($p < 0.001$). The interaction × age interaction was significant (^{2} = 9.937, df = 2, p = 0.007): 4-year-olds showed significantly lower trust in the no-interaction versus interaction condition ($p < 0.001$). The interaction × trustee interaction was not significant (^{2} = 0.963, df = 2, p = 0.618). When trustee was fixed, trust was significantly lower in the no-interaction than interaction condition for both robot JIBO (p = 0.003) and NAO (p = 0.04). The three-way interaction was not significant (^{2} = 1.453, df = 4, p = 0.835).

With expectation as the dependent variable, the final model showed a significant main effect of interaction (^{2} = 12.969, df = 1, $p < 0.001$), with expected returns significantly lower in the no-interaction condition ($p < 0.001$). The interaction × age interaction was significant (^{2} = 11.278, df = 2, p = 0.004): 4-year-olds ($p < 0.001$) and 6-year-olds (p = 0.024) expected significantly fewer returns in the no-interaction versus interaction condition. The interaction × trustee interaction was not significant (^{2} = 0.777, df = 2, p = 0.65). These results indicate that robots' behavioral anthropomorphic features influence children' s trust.

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4. General Discussion

Compared with previous research, this study adapted Berg et al.' s (1995) trust game paradigm to directly examine 4-6-year-old children's trust in robots and its development, and explored the influence of anthropomorphism on human-robot trust. The results largely support our hypotheses.

First, this study confirmed significant age differences in 4–6-year-old children' s trust in robots: 4-year-olds showed significantly lower trust willingness than 5- and 6-year-olds, while 5-year-olds showed significantly higher expectations than 4- and 6-year-olds. These findings supplement previous research on the relationship between age and human-robot trust in young children. Among 4–6-year-olds, younger children do not always trust robots more than older children. Because this study used economic trust game tasks, it could directly measure children' s trust behaviors toward robots and infer the degree of human-robot trust from their decisions. Interestingly, compared with 4–5-year-olds, 6-year-olds showed greater willingness to trust robots than humans, consistent with Cinzia et al. (2020), who found that older children (age 3 vs. 7) were more willing to trust robots than humans. Their study using mental state attribution scales suggested this may be because children' s trust in others is influenced by "emotional" factors, whereas older children' s trust in robots is based on cognitive rationality rather than emotion. Additionally, 6-year-olds' increasing familiarity with artificial devices may contribute to their greater willingness to trust robots.

Second, robot anthropomorphic features exerted different influences on human-robot trust. First, this study affirmed previous findings on robot appearance anthropomorphism, confirming a positive correlation between appearance anthropomorphism and children' s trust in robots. Appearance anthropomorphism did not significantly affect 4-5-year-olds'human-robot trust but significantly affected 6-year-olds, who trusted the more anthropomorphic robot NAO more. This may be because human-like robot appearance more naturally attracts children' s attention (Jamet et al., 2018; Manzi et al., 2020), and children' s perception of appearance attractiveness is developmental—only from age 6 can children consistently evaluate attractiveness (徐芬 et al., 2015). Older children are better able to perceive and judge robot appearance anthropomorphism, making appearance anthropomorphism effective only for 6-year-olds' human-robot trust.

Second, this study found that robots' behavioral anthropomorphic features influence children' s trust in robots. After viewing video calls where robots exhibited behavioral anthropomorphism through actions and language, 4–6-year-olds were willing to trust robots and gave more coins or expected more returns. This indicates that robots' behavioral anthropomorphic features strengthen children' s trust. While no other research has directly proven this, previous related studies show that behavioral anthropomorphism facilitates effective human-robot interaction—for example, 4–6-year-olds show higher engagement in language games with robots that use gestures (Wit et al., 2020), and children share more stickers with robots exhibiting prosocial behaviors (Peter et al., 2021). Robots capable of responding to bystanders or directly interacting with people seem to better elicit children' s prosocial behaviors than robots without such capabilities (Oliveira et al., 2021). Additionally, behavioral anthropomorphism' s influence on children' s trust was not affected by robot appearance anthropomorphism—regardless of appearance anthropomorphism level, robots gained more trust from children after adding anthropomorphic behaviors. Van Pinxteren et al. (2019) found similar results, showing that especially when human-robot interaction comfort is low, robot gaze turn-taking behavior contributes more to anthropomorphism perception and trust than appearance. Thus, behavioral anthropomorphism appears more effective than appearance anthropomorphism in promoting human-robot trust.

This study has several limitations for future improvement. First, the manipulation of robot anthropomorphism was limited. Robot anthropomorphism also includes uniquely human mental capacities such as consciousness, intention, secondary emotions like pride, hope, and guilt (Demoulin et al., 2004), and higher-order cognitive abilities like analysis and imagination (Nick et al., 2005). Future research should examine human-robot trust from more perspectives of robot anthropomorphism features.

Second, this study did not examine individual differences affecting children' s trust in robots, such as gender (Tung, 2011), attractiveness perception (Andreoni & Petrie, 2008), and theory of mind. Future research should incorporate other subject-related factors that may influence interpersonal trust and explore interactions between different factors. Finally, this study used video calls to manipulate behavioral anthropomorphism but did not create natural, real human-robot interaction scenarios, which may have affected children's trust due to media as an information source (Danovitch & Alzahabi, 2013). Future studies could attempt real-time economic game interactions between children and robots.

Conclusions: (1) 4–6-year-old children' s trust in robots shows age differences, with human-robot trust increasing with age.
(2) Robot appearance anthropomorphism affects 4–6-year-old children' s trust in robots, with older children more influenced by appearance anthropomorphism, showing stronger trust toward more anthropomorphic robots.
(3) Robot behavioral anthropomorphism affects human-robot trust, with 4–6-year-olds trusting robots with behavioral anthropomorphic features more.

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Note: Figure translations are in progress. See original paper for figures.