

Differences in Reciprocal Behavior Between Children with Autism and Typically Developing Children: A Perspective of Self-Other Distinction

Authors: Zhang Jing, Sun Qingzhou, Zhu Hongying, Wang Qunlong, Chen Yuhang, Sun Qingzhou

Date: 2026-03-18T12:53:59+00:00

Abstract

There are numerous differences in reciprocal behavior between children with autism and typically developing children. Previous theories based on the perspective of others have presented various contradictions. Based on dual-process theory and introducing the perspective of self-other distinction, this paper proposes that the egocentric bias in children with autism and the allocentric bias in typically developing children jointly induce the differences in reciprocity between the two groups. If the perspective of others is highlighted for the former, it may induce an allocentric bias in this group, making their reciprocal behavior more similar to the latter, thereby narrowing the gap in reciprocity. Future research needs to further decouple the potential influence of task parameters, deeply analyze the differences in reciprocal pathways between the two groups of children, and develop scientific and efficient intervention models for reciprocal behavior.

Full Text

Preamble

Differences in Reciprocal Behavior Between Children with Autism and Typically Developing Children: A Perspective from Self-Other Distinction

Jing Zhang^{1,2}, **Qingzhou Sun**³, **Hongying Zhu**^{1,2}, **Qunlong Wang**^{1,2}, **Yuhang Chen**¹ (1 School of Public Administration, Zhejiang Shuren University, Hangzhou 310000) (2 Zhejiang Modern Service Industry Research Center, Hangzhou 310000) (3 School of Management, Zhejiang University of Technology, Hangzhou 310023)

Abstract

Reciprocity is a fundamental pillar of human social interaction and a key component of cooperative behavior. While typically developing (TD) children demonstrate a robust capacity for reciprocal exchange from an early age, children with Autism Spectrum Disorder (ASD) often exhibit significant challenges in this domain. This paper explores the underlying mechanisms of these differences, specifically focusing on the role of self-other distinction. We argue that the difficulties observed in ASD children regarding reciprocal behavior—such as reduced initiation of prosocial acts and inconsistent responses to the kindness of others—may be rooted in a fundamental impairment in distinguishing between the self and the other. By synthesizing current behavioral and neuroscientific evidence, this study examines how the blurring of self-other boundaries affects the cognitive and emotional processes necessary for reciprocity.

1. Introduction

Reciprocity, the social norm of responding to a positive action with another positive action, is essential for maintaining social cohesion and building long-term relationships. In the context of child development, reciprocal behavior evolves from simple turn-taking to complex social exchanges involving resource sharing and emotional support. For typically developing children, the ability to engage in reciprocity emerges early and matures alongside cognitive functions such as Theory of Mind (ToM) and executive function.

However, social communication deficits are a hallmark of Autism Spectrum Disorder (ASD). Research consistently indicates that children with ASD struggle with the nuances of reciprocal social-emotional interaction. While they may engage in basic instrumental helping, they often fail to exhibit the spontaneous, reactive reciprocity seen in their TD peers. Understanding the cognitive foundations of these deficits is crucial for developing effective interventions.

2. The Role of Self-Other Distinction in Reciprocity

Self-other distinction refers to the ability to differentiate between one's own mental states (thoughts, desires, and emotions) and those of others. This cognitive process is a prerequisite for empathy, perspective-taking,

摘要孤独症儿童与典型发展儿童互惠行为存在诸多差异。以往基于他人视角的系列理论存

There are several contradictions in existing research. Based on dual-process theory and the perspective of self-other distinction, this paper proposes that the egocentric bias in children with Autism Spectrum Disorder (ASD) and the allocentric (other-centered) bias in typically developing (TD) children jointly induce the observed differences in reciprocity between the two groups. If the perspective of the “other” is highlighted for children with ASD, it may induce

an allocentric bias in this group, making their reciprocal behavior more similar to that of TD children and thereby narrowing the gap in reciprocity. Future research needs to further isolate the potential influence of task parameters, conduct in-depth analyses of the divergent reciprocal pathways between these two groups of children, and develop scientific and efficient intervention models for reciprocal behavior.

Keywords: Autism, Reciprocal behavior, Self-other distinction, Perspective salience

Scenario 1: After receiving friendly or hostile treatment from someone else, how will you respond? Furthermore, how will you treat a third party?

Scenario 2: After observing friendly or hostile behavior between two strangers, how will you treat the initiator of the action? How will you treat the recipient? Furthermore, how will you treat a third party?

2005 年, Nowak 团队在 Nature 上首次根据个体在互惠中的角色、互惠条件、回应对象

Based on the differences in interaction patterns, reciprocity can be categorized into direct reciprocity, indirect (upstream) reciprocity, and observational reciprocity [?]. Direct reciprocity occurs when an individual, acting as a recipient, responds directly to the original initiator of a prosocial act. Indirect reciprocity occurs when the recipient responds by acting prosocially toward a third party. Observational reciprocity occurs when an individual acts as an observer and responds to either party after witnessing a reciprocal interaction between two strangers. Different forms of reciprocity impose varying cognitive demands on the individual. According to Piaget's theory of cognitive development, reciprocal behavior in typically developing (TD) individuals begins to emerge in early infancy and stabilizes during childhood as cognitive functions mature [?]. In contrast, children with Autism Spectrum Disorder (ASD) exhibit impaired social cognition, which may significantly impact the development of their reciprocal behaviors.

In recent years, the deviation of reciprocal behavior in children with ASD compared to TD children has become a critical issue, leading to frequent interpersonal marginalization and peer conflict [?]. Research indicates that children with ASD experience more frequent social bullying in mainstream environments than in specialized settings, with such experiences peaking during childhood. These adverse experiences have long-term effects on academic performance and mental health, and may even lead to high rates of suicidal ideation within this population (approximately 25.2%; [?]). Consequently, several fundamental scientific questions arise: What are the specific differences in reciprocal behavior between these two groups of children? What are the underlying mechanisms? How can we intervene effectively? The *Annual Review of Developmental Psychology* has identified the disparity in reciprocal behavior between ASD and TD children as a key factor influencing the future well-being of the ASD population [?].

Previous research regarding the differences in reciprocal behavior between children with ASD and TD children has yielded contradictory or inconsistent results. Some studies suggest that children with ASD are more generous than TD children, exhibiting an altruistic reciprocity effect [?]. Conversely, other studies find that children with ASD are more parsimonious, demonstrating a self-serving reciprocity effect [?]. Still, other research indicates no significant difference between the two groups, suggesting a convergence effect in reciprocity [?]. Theoretically, the understanding of reciprocal behavior in ASD has evolved from the “mind-blindness” hypothesis to the Empathizing-Systemizing (E-S) theory, and subsequently to the executive dysfunction hypothesis. While these theories can partially explain the behavioral differences between the two groups [?, ?], they face significant challenges in explaining the variability and the specific driving mechanisms of these reciprocal differences.

Whether focusing on the “mental states of others” (mind-blindness hypothesis), “understanding others’ emotional states” (E-S theory), or the “inhibitory control of imitating others’ behavior” (executive dysfunction hypothesis), these frameworks are all built upon the perspective of the “other.” These theories largely overlook a critical issue: self-other distinction, which is the ability to accurately distinguish between self-representations and the mental representations of others [?]. Previous studies using perspective-taking tasks, director tasks, and imitation-inhibition tasks have collectively verified that children with ASD exhibit an egocentric bias and impaired self-other distinction. However, these studies also found that children with ASD possess a similar capacity to TD children when making judgments based on “self” mental representations [?]. In contrast, TD children often exhibit a strong allocentric (other-centered) bias [?]. How these differing central biases influence reciprocal behavior remains an open question.

Dual-process theory provides a new perspective for exploring this issue. This theory posits that information processing occurs through two independent and parallel systems: a logical reasoning system and an intuitive reasoning system [?]. Research has found that children with ASD have a strong preference for logical reasoning, tending to process information deeply and consciously based on rule-based logical cues. In contrast, TD children show a preference for intuitive reasoning, tending to process information shallowly or unconsciously based on intuitive cues such as intentions and emotions [?]. We hypothesize that when a form of reciprocity requires individuals to make judgments based primarily on self-representations, the egocentric bias of children with ASD may facilitate logical reciprocal responses, making their behavior more similar to that of TD children and reducing the reciprocal gap. Conversely, when reciprocity requires judgments based on the mental representations of others, the allocentric bias of TD children may facilitate intuitive reciprocal responses, causing their behavior to deviate further from that of children with ASD and increasing the reciprocal gap.

Therefore, this study investigates the differences in reciprocal behavior between

these two groups of children from the perspective of self-other distinction. First, we summarize and refine the characteristics, theoretical interpretations, and current challenges regarding these behavioral differences. Subsequently, based on dual-process theory and the perspective of self-other distinction, we reveal the variable patterns and driving mechanisms of these reciprocal differences. Finally, based on these mechanisms, we analyze intervention pathways to improve reciprocal behavior in children with ASD. This research aims to delineate the variable patterns of reciprocal differences, uncover the driving mechanisms of perspective distinction, and develop feasible solutions to improve reciprocal behavior in children with ASD, thereby facilitating their social integration.

1.1 理论解析

The theoretical evolution of reciprocal behavior in children with Autism Spectrum Disorder (ASD) has progressed from the “mind-blindness” hypothesis to the empathizing-systemizing theory, and subsequently to the executive dysfunction hypothesis. The mind-blindness hypothesis posits that Theory of Mind (ToM) is a critical mechanism for individuals to respond effectively to others in social contexts. According to this view, impairments in ToM prevent children with ASD from identifying others’ motives or accurately understanding their intentions during interactions, leading to reciprocal patterns that differ significantly from those of typically developing (TD) children [?, ?, ?]. Research has demonstrated that higher scores on ToM tasks correlate with a stronger ability to employ reciprocal strategies in social settings. Furthermore, children with ASD who pass second-order false belief tasks are better equipped to recognize the intentions of others and reject unfriendly behavior compared to those who do not pass such tasks [?, ?, ?, ?].

The empathizing-systemizing (E-S) theory expands upon the unidimensional analysis of intentional cognition offered by the mind-blindness hypothesis, suggesting that the human mind is composed of two dimensions: “empathizing” and “systemizing.” In children with ASD, these dimensions are often imbalanced, characterized by low levels of empathy and high levels of systemizing; this imbalance may be the root cause of the differences in reciprocity observed between ASD and TD children [?, ?]. Specifically regarding empathy, when TD children learn that another person is disappointed by their actions, they tend to allocate more resources to soothe the other’s emotions. In contrast, children with ASD struggle to recognize the other person’s emotions and the underlying triggers, often responding with even more parsimonious behavior [?, ?]. Regarding systemizing, children with ASD often use the acquisition of resources as a primary cue for their behavioral responses. Consequently, even if they can identify their own negative emotions in disadvantageous situations, they may still consistently accept the stingy behavior of others. TD children, however, tend to express dissatisfaction with such behavior through rejection [?, ?, ?].

The executive dysfunction hypothesis approaches the issue from the perspective of behavioral regulation, proposing that difficulties in inhibitory control may be

the key factor driving the differences in reciprocal behavior between ASD and TD children [?, ?]. Specifically, during interactions, children with ASD often struggle to inhibit the automatic imitation of others' actions, resulting in atypical behavioral response patterns [?, ?]. For instance, in both instrumental and social imitation tasks, children with ASD exhibit more imitation of meaningless actions compared to TD children [?, ?]. Similarly, in direct reciprocity games, children with ASD frequently display automatic imitative behaviors—characterized by a “tit-for-tat” response where they mirror the kindness or unkindness of the partner [?, ?]. This automatic imitation, described as “I do what I see you do,” has also been observed in third-party reciprocity games [?, ?].

1.2 理论困境

Previous theories regarding the reciprocal behavior of children with Autism Spectrum Disorder (ASD) and Typically Developing (TD) children can explain the differences between these two groups to some extent, yet they struggle to account for the variability of these differences. For instance, the Mind-Blindness hypothesis can explain the egoistic and altruistic reciprocity effects observed in the behavior of children with ASD; however, it faces difficulties in explaining why children with ASD exhibit reciprocal response patterns similar to TD children despite having impaired Theory of Mind (Hartley & Fisher, 2018). Similarly, the Empathizing-Systemizing theory can account for the convergence of reciprocal effects between the two groups, but it fails to explain why children with ASD—who possess high levels of systemizing—cannot match the reciprocal responses of TD children (Jin et al., 2020). Furthermore, while the Executive Dysfunction hypothesis partially explains the egoistic, altruistic, and convergent reciprocity effects, it struggles to clarify why weaker executive function in children with ASD is associated with a higher tolerance for unfair distribution schemes (Woodcock et al., 2020).

Previous hypotheses and theories have largely been constructed from the perspective of the “other,” thereby overlooking a critical issue: self-other distinction, which refers to the ability to accurately differentiate between self-mental representations and those of others (Zhang et al., 2024). Specifically, the Mind-Blindness hypothesis emphasizes the cognition of the “other’ s” mental state while ignoring the impaired self-other distinction and the reality of egocentric bias in children with ASD. The Empathizing-Systemizing theory emphasizes the balance between perceiving the “other’ s” emotional state and systemization, yet it overlooks the enhanced systemizing preference in children with ASD and the dilemma of their systemizing reasoning being out of sync with relevant contexts. Finally, the Executive Dysfunction hypothesis emphasizes inhibitory control over the imitation of the “other’ s” behavior but neglects the obstacles children with ASD face in self-other perspective-taking and their impaired inhibitory control capabilities.

However, reciprocal contexts are relatively complex, and individuals vary in their focus on self-versus-other perspectives within these situations. The ego-

Figure 1

Figure 1: Figure 1

centric bias of children with ASD and the allocentric (other-centered) bias of TD children may be the root causes of the variability in their reciprocal behavior differences. Previous research has found that in both cognitive response tasks and syllogistic reasoning methods, children with ASD exhibit a strong preference for logical reasoning, whereas TD children demonstrate a strong preference for intuitive reasoning (Brosnan et al., 2017; Lewton et al., 2019). This raises the question: in reciprocal behavior, does the egocentric bias of children with ASD drive their systematic reciprocal responses, while the allocentric bias of TD children drives their intuitive reciprocal responses?

2 自我-他人区分的视角

Self-other distinction provides a novel perspective for analyzing the differences and underlying mechanisms of reciprocal behavior between children with Autism Spectrum Disorder (ASD) and Typically Developing (TD) children. According to dual-process theory, children with ASD exhibit a strong preference for logical reasoning, whereas TD children demonstrate a stronger preference for intuitive reasoning. We hypothesize that in various forms of reciprocity, the focus on a “self-perspective” serves as a critical cue for logical reasoning responses in the ASD group, thereby facilitating systematic reciprocal responses. Conversely, for TD children, a focus on the “other-perspective” serves as a key cue for intuitive reasoning, which in turn promotes intuitive reciprocal responses.

2.1 直接互惠：更关注“自我所得”还是更关注“他人意图”

In direct reciprocity, individuals must not only consider the outcomes and intentions of a progenitor’s behavior but also weigh the interests between themselves and the other party. Research has found that individuals with Autism Spectrum Disorder (ASD) exhibit impaired self-other substitution. In direct reciprocity tasks, such as perspective-taking tasks, they struggle to understand the mental states of others. Consequently, they prefer to respond based on behavioral gains from their own perspective as a cue, whereas typically developing (TD) children prefer to respond based on the behavioral motives of others as a cue (Zhang et al., 2025).

Studies have shown that in direct reciprocity, both children with ASD and TD children exhibit a response pattern of “you are good to me, I am good to you; you are bad to me, I am bad to you.” However, the underlying social logic differs between the two groups

. Specifically, children with ASD find it difficult to identify the intentions and motives behind others’ actions. Nevertheless, in this “tit-for-tat” form of direct

reciprocity, “self-gain” can be clearly mapped to the initiator; that is, all gains originate directly from the other party (Keifer et al., 2020).

The egocentric bias of the ASD group induces a preference for focusing on “self-gain,” which becomes the most intuitive reasoning cue for them in direct reciprocity. Therefore, children with ASD are more inclined to make non-social reciprocal responses based on the principle of “giving back what was received.” In contrast, TD children can rapidly extract the motives of others during interactions. Their allocentric bias induces a preference for focusing on “others’ intentions” (Zhang et al., 2024), which then serves as an intuitive reasoning cue in direct reciprocity. Consequently, TD children are more likely to make social reciprocal responses based on a “tit-for-tat” strategy.

For example, in direct reciprocity tasks, children with ASD focus more on whether they receive resources. Regardless of the amount received, this group shows higher acceptance rates and positive emotional experiences toward distribution schemes. They tend to use “self-gain” as a rule-based cue in the task, exhibiting a response pattern of “giving what they get” (Zhang et al., 2025). This is similar to previous findings by Humphrey and Symes (2011), which suggested that children with ASD tend to hide their social communication impairments by imitating others during social interactions. Conversely, TD children focus more on the intentions of others, using “others’ intentions” as an intuitive cue to reject unkind distributions and respond generously to friendly behavior (Woodcock et al., 2020). Although there are differences in the social nature of the direct reciprocal responses between the two groups, their valence and behavioral outcomes are consistent. Therefore, as the number of interactions increases, children with ASD become more proficient in deducing response rules, and the difference between their responses and those of TD children gradually narrows (Zhang et al., 2024; Hartley & Fisher, 2018; Jin et al., 2020; Pelligra et al., 2015).

2.2 传递互惠：更关注“自我规范”还是更关注“他人行为”

In generalized reciprocity, individuals do not need to consider the initiator’s behavior; instead, they must only weigh the interests between themselves and a third party. Consequently, an individual’s response depends on whether they can effectively detach themselves from the cognitive anchoring of the initiator’s prior actions (Rankin & Taborsky, 2009).

Compared to direct reciprocity, this single-chain reciprocal form dismantles the bidirectional “tit-for-tat” pattern when facing a third party. This shift brings the reciprocal responses of children with Autism Spectrum Disorder (ASD) closer to behavioral norms observed in natural settings (Zhang et al., 2023). In contrast, typically developing (TD) children are more susceptible to the cognitive anchoring effects of others’ behavior (Wörle et al., 2020).

Research has found that in generalized reciprocity, children with ASD often exhibit a strong tendency toward self-regulation, while TD children frequently demonstrate a robust behavioral transmission phenomenon

Figure 1

Figure 2: Figure 1

. Specifically, when interacting with a third party, the egocentric bias of children with ASD triggers a focus on “self-norms” (Zhang et al., 2024). Consequently, internalized cultural norms such as “equality” and “fairness” become the logical reasoning cues for their generalized reciprocity. This group, therefore, tends to provide fair responses to third parties, following a logic of “regardless of how you treat me, I am fair/kind to others.” Conversely, TD children are more influenced by the cognitive anchoring of others’ behavior during interactions (Wen et al., 2019). Their allocentric bias often triggers a focus on “others’ behavior,” which serves as an intuitive reasoning cue in generalized reciprocity. As a result, this group is more inclined to “pay it forward,” exhibiting a behavioral pattern of “if you are good to me, I am good to others; if you are mean to me, I am mean to others.”

For example, in generalized reciprocity tasks, children with ASD exhibit more generosity toward a third party after being treated stingily by an initiator, yet show more stinginess after being treated generously, when compared to TD children (Zhang et al., 2024). In contrast, TD children demonstrate a strong behavioral transmission effect, with the transmission of stingy behavior being more pronounced than that of generous behavior (Xie et al., 2018). Furthermore, Carter Leno et al. (2016), Chevallier et al. (2012), and Hepach et al. (2020) found that children with ASD show significantly reduced attention to social information (such as the friendly or hostile treatment by an initiator). This reduction weakens the role of others’ behavior in shaping and regulating their reciprocal responses, leaving self-norms as their primary cues in natural contexts. In comparison, TD children maintain a high level of attention to social information, which enhances the influence of others’ behavior on their reciprocal responses, leading to behavioral transmission driven by anchoring effects (Xie et al., 2018; Gray et al., 2014).

2.3 观察互惠：更关注“自我所见”还是更关注“他人声誉、境遇”抑或“社会规范”

In observational reciprocity, individuals must distinguish between different targets of response. Reciprocal responses depend on an individual’s perception of the initiator’s reputation, the recipient’s situation, and the third party’s identity. In real-world contexts, children with Autism Spectrum Disorder (ASD) experience impaired social understanding. However, compared to direct and upstream reciprocity, the role of a bystander in observational reciprocity further induces this group to focus on and imitate the initiator’s behavior [?, ?]. Consequently, the reciprocal responses of children with ASD stem more from the automatic imitation of others’ actions, leading to consistent responses across different targets. In contrast, the reciprocal responses of typically developing (TD) children are rooted in a social understanding of others’ behaviors, situations, or identities.

Figure 1

Figure 3: Figure 1

Figure 1

Figure 4: Figure 1

Specifically, children with ASD struggle to understand the social significance of others' actions. However, under the influence of their status as bystanders in observational reciprocity, their egocentric bias further induces a focus on "what I see." This visual input becomes the most intuitive reasoning cue for them in observational reciprocity; thus, children with ASD are more inclined to produce responses based on the principle of "giving what is seen"

. For instance, in tasks involving tool imitation, intentional imitation, over-imitation, and imitation inhibitory control, children with ASD exhibit more automatic imitation of meaningless movements and behaviors compared to TD children [?, ?, ?]. Similarly, in an adapted Cyberball game where participants acted as observers watching repetitive interactions among multiple players, peer exclusion was created by manipulating the direction and frequency of passes by specific players. When subsequently asked to join the game, TD children significantly decreased their passes to the excluder and increased passes to the excluded party, with no significant change in passes to a neutral third party. In contrast, children with ASD showed no significant changes in their passing behavior toward others [?, ?].

Conversely, TD children can rapidly identify the social meaning of others' behaviors during observational reciprocity and provide differentiated responses to various parties

. When facing an initiator, TD children form corresponding reputational beliefs. Their allocentric bias induces a focus on "the other's reputation," which serves as an intuitive reasoning cue. Consequently, TD children are more inclined to respond to the initiator based on the principle that "those who love others are loved in return, and those who hate others are hated in return" [?, ?]. When facing a recipient, TD children can quickly extract the recipient's situation. Their allocentric bias directs their attention to "the other's circumstances," serving as a reasoning cue that leads them to respond with, "I help you because you are disadvantaged; I do not help you because you are advantaged" [?, ?]. When facing a third party, compared to upstream reciprocity, TD children act as observers rather than direct participants and do not receive reciprocal acts themselves. This weakens the cognitive anchoring effect of others' behaviors. Due to the lack of direct reciprocal experience, TD children may rely more on "the other's identity" as an intuitive reasoning cue, which is linked to their strong allocentric bias. Research indicates that in such contexts, TD children are more likely to make "fair and equal" reciprocal responses based on the identity of the

Figure 1

Figure 5: Figure 1

other person [?, ?].

Path diagram of differences in reciprocity between children with ASD and TD children

3 自我-他人区分的应用

Recent research suggests that the variability in the differences between two types of reciprocal behaviors in children may stem from the specific requirements that different forms of reciprocity place on an individual's self-other mental representations [?, ?]. Children with Autism Spectrum Disorder (ASD) exhibit impaired self-other distinction and a strong egocentric bias; therefore, modulating the degree of self-other distinction in this population may provide a new perspective for their social integration.

According to the Social Information Processing model, the primary step in an individual's processing of information during social interaction is situational encoding. This process involves both the identification of others' behaviors and the processing of others' emotions, both of which jointly determine subsequent behavioral responses [?, ?]. Consequently, the degree of self-other distinction in children with ASD can be modulated through two dimensions: the cognitive and the affective.

3.1 认知视角凸显

At the cognitive level, the egocentric bias often observed in children with Autism Spectrum Disorder (ASD) frequently leads them to prioritize cognitive encoding from their own perspective during reciprocal interactions—focusing on factors such as self-gain, personal norms, and self-perception. Consequently, they tend to produce behavioral responses consistent with this internal perspective (e.g., giving based solely on what they have received or seen). According to dual-process theory, children with ASD exhibit a strong preference for logical reasoning. Therefore, providing these children with additional cognitive cues regarding others' behaviors may trigger the identification and attribution of others' states. This could lead to reciprocal behaviors that more closely align with those of typically developing (TD) children, thereby narrowing the behavioral gap between the two groups.

Previous research has demonstrated that manipulating cognitive perspectives—through the introduction of external cues or the presentation of competitive cues—can effectively improve the ability of children with ASD to identify and attribute the behavioral states of others. For instance, in the Dictator Game, children with ASD typically show a high acceptance of extremely unfair distri-

butions [?, ?, ?, ?]. However, when a rule-based cue is introduced stating that “if the partner’s distribution is rejected, neither party receives resources,” it can prompt them to understand the correlation between their own response and the partner’s behavior, leading them to reject extremely unfair offers [?, ?, ?]. Similarly, when cues are presented as “competitive distribution schemes” alongside a partner’s actual offer, it can induce a spontaneous comparison between the two schemes. This comparison highlights the relative kindness of the partner’s behavior, subsequently leading the child to reject hostile distributions and accept friendly ones [?, ?, ?].

Based on these findings, researchers have applied the highlighting of others’ cognitive cues to reciprocity interventions for children with ASD. This approach has been found not only to facilitate the identification of others’ intentions in social contexts but also to improve the use of reciprocal strategies. Specifically, when implicit social information is presented as explicit and objective rules, it supports the rational reasoning processes of children with ASD [?, ?, ?]. For example, Caldwell et al. [?] effectively enhanced the visual-spatial perspective-taking abilities of children with ASD through an objective block-building game, thereby improving their identification and understanding of others’ mental states. Furthermore, when implicit social information is presented via behavioral evaluations of different attributes, it helps regulate the social properties of the behavior of children with ASD [?, ?]. For instance, introducing positive or negative evaluative cues from bystanders during interactions can prompt children with ASD to adjust their behavior, such as becoming more generous following positive evaluations or more parsimonious following negative ones [?, ?].

3.2 情感视角凸显

At the emotional level, the egocentric bias of children with Autism Spectrum Disorder (ASD) often leads them to focus more heavily on emotional encoding from a self-centered perspective (e.g., what they themselves feel). Consequently, they tend to produce behavioral responses consistent with their own emotional state, such as responding generously to others only when they themselves feel happy. According to dual-process theory, children with ASD exhibit a strong preference for logical reasoning. Theoretically, providing these children with more emotional cues regarding others’ behavior should induce recognition of others’ emotions, thereby narrowing the gap in reciprocal behavior between ASD and typically developing (TD) children. However, previous research has focused primarily on the ability of children with ASD to identify and judge the emotions of others, while neglecting their impaired emotional adaptive aftereffects—specifically, the inability to adjust their own behavior in response to others’ emotions, or even the tendency to over-empathize with others’ emotions to the detriment of their subsequent behavioral responses (Dunfield et al., 2019; Klapwijk et al., 2017).

Recent studies have found that for children with ASD, highlighting emotional cues from others does not necessarily help them develop the ability to adjust

their behavior; instead, it may trigger an “over-empathy effect” (Shalev et al., 2022). For instance, a meta-analysis of neuroimaging data revealed that when the pain of others is made salient, children with ASD can recognize it but struggle to inhibit over-empathy toward that pain, leading to an enhanced sense of personal distress (He et al., 2025). Therefore, the effectiveness of interventions that emphasize emotional perspectives depends on the valence consistency between the group’s over-empathy aftereffects and their emotional adaptive aftereffects. When the valences are consistent, the difference in reciprocity between the two groups of children narrows; when the valences are inconsistent, the difference increases (Zhang et al., 2024). For example, in direct reciprocity tasks, when a partner’s disappointment resulting from the subject’s stingy behavior is highlighted, TD children become more generous in subsequent tasks to appease the partner. In contrast, children with ASD experience blocked emotional adaptive aftereffects and are more likely to over-empathize with the partner’s emotion (e.g., feeling disappointment themselves), which leads to even stingier behavioral responses (Klapwijk et al., 2017).

Based on these findings, researchers have applied the highlighting of others’ emotional cues to interventions for reciprocal behavior in children with ASD. They found that when the over-empathy aftereffects induced by cues are consistent with the valence of emotional adaptive aftereffects, it can effectively promote the recognition and understanding of others’ emotions in social contexts. For example, researchers created various interaction scenarios for children with ASD (acting as observers) that induced different emotional states in a protagonist (e.g., happiness, sadness, anger, fear). By asking the children about the protagonist’s current emotional experience to highlight those emotions, researchers found that both human-to-human and human-computer interventions effectively promoted the recognition and understanding of others’ emotions (Li et al., 2025). However, when children with ASD are placed in social situations as active participants, their personal emotional involvement influences their behavioral decision-making. For instance, in sharing games where children with ASD acted as the initiators and were matched with partners of varying wealth, researchers highlighted the partners’ emotional states by displaying either luxurious or dilapidated houses. The results suggested that children with ASD might be influenced by over-empathy, leading them to prefer sharing more resources with wealthy partners and fewer with impoverished ones. Furthermore, this disparity in sharing behavior intensified as their autistic traits increased (Paulus & Rosal-Grifoll, 2017).

4 总结与展望

From the perspective of self-other distinction, we propose that the egocentric bias observed in children with Autism Spectrum Disorder (ASD) and the allocentric (other-centered) bias observed in Typically Developing (TD) children collectively drive the differences in reciprocal behavior between these two groups. Children with ASD exhibit a strong preference for logical reasoning; therefore,

highlighting cues related to the perspectives of others should theoretically induce an allocentric bias in this population. Such an intervention could bring their reciprocal behavior closer to that of TD children, thereby narrowing the gap in reciprocity. Future research should further isolate the potential influence of task parameters on children's reciprocal behavior, conduct in-depth analyses of the divergent pathways underlying reciprocal responses in both groups, and develop scientifically rigorous and efficient intervention models for reciprocal behavior.

4.1 剥离任务参数对儿童互惠行为的潜在影响

According to dual-process theory, children with Autism Spectrum Disorder (ASD) exhibit a strong preference for logical reasoning. The explicit rules of a task may interfere with this group's ability to capture social information to varying degrees, thereby influencing their reciprocal performance. For instance, compared to single-trial tasks, repetitive tasks may lead this population to develop response patterns specific to the context rather than using the reciprocal responses of typically developing (TD) children as a reference (Hartley & Fisher, 2018; Jin et al., 2020). Furthermore, the salience of outcome cues—such as the fact that rejecting another's behavior results in neither party receiving resources—may activate a punishment mechanism in children with ASD rather than intention recognition (Townsend et al., 2021). Similarly, the predictability of human-computer interaction is more likely to activate logical cue recognition in children with ASD compared to human-human interaction (Horstmann et al., 2022).

In addition, the behavioral responses of children with ASD may be influenced by various factors, including verbal communication impairments (such as a reduced understanding of rules; Zhang et al., 2022) and perceptual abnormalities (such as diminished sensitivity to peers at different social distances; Olson & Spelke, 2008).

Therefore, future research should further isolate the potential impact of task parameters and participant heterogeneity on the aforementioned conclusions.

4.2 深入剖析两类儿童互惠回应的路径差异

This paper adopts the perspective of self-other distinction to explain the variability and driving mechanisms underlying the differences in reciprocal behavior between the two groups of children. However, previous measurements of self-other distinction in children with Autism Spectrum Disorder (ASD) have frequently relied on external behavioral tasks—such as perspective-taking, self-other perspective differentiation, and imitation inhibition control—while often overlooking the internal neural mechanisms of this population.

Recent research into these neural mechanisms has revealed significant functional or structural abnormalities in brain regions associated with social rewards in

children with ASD, such as the striatum and the anterior cingulate cortex. Conversely, their behavioral and neural responses to non-social rewards, such as material incentives, remain relatively preserved [?, ?]. This discrepancy may lead to a reduced attentional bias toward social stimuli in this group, causing them to focus more on egocentric cues, such as whether they personally received a reward or their own emotional state [?, ?, ?].

These findings pose a challenge to the conclusions of the present study: is the egocentric bias in children with ASD a direct result of diminished self-other distinction, or is it induced by impaired social motivation? Consequently, future research should conduct in-depth analyses across multiple levels—including behavioral and biological mechanisms—to further clarify the response pathways and differences in various forms of reciprocity between these two groups of children.

4.3 开发科学高效的互惠行为干预模式

Reciprocity contexts are complex and diverse, and the reciprocal responses of children with Autism Spectrum Disorder (ASD) are influenced by multiple factors, including the form of reciprocity, the conditions of the interaction, and the nature of the interaction partner. Previous intervention studies on the reciprocal behavior of children with ASD have often been conducted in “human-to-human” interaction formats, which tend to overlook the unpredictability and fluidity of human behavior in real-world settings. Recent research has also found that the variability of information output by individuals can increase encoding difficulties for children with ASD (Hansen et al., 2017). In contrast, the predictability of robotic behavior (Horstmann et al., 2022), the implementability of algorithms (Alnafjan et al., 2025), and the potential for robots to supplement human labor (Ramirez-Duque et al., 2020) provide new avenues for reciprocity interventions in this population. For example, through “human-robot” interaction, machines can be programmed with the behavioral characteristics of children across various forms of reciprocity. When a machine detects that the reciprocal behavior of a child with ASD deviates from that of typically developing (TD) children, it can precisely highlight perspective-taking cues and adjust the child’s degree of self-other distinction, thereby narrowing the gap in reciprocity between the two groups. Consequently, future research could leverage the systematic rules of machines to develop more efficient and precise human-robot interaction intervention models.

Kou, J., Yang, M. Y., Wei, Z. J., & Lei, Y. (2023). Social motivation theory of autism spectrum disorder: Mechanisms and intervention exploration. *Advances in Psychological Science*, 31(1). Su, Y. J., & Ma, T. S. (2014). Fairness decision-making in children with autism: The roles of theory of mind and self/other emotion recognition. *Psychological Science*, 37(04). Wei, Y. X., Wang, Z. D., Zhou, R., Kang, Q., & Bi, R. Y. (2019). A comparative study on the imitation ability of children with autism and typically developing children. *Chinese Journal of Special Education*, (10), 26-33.

- Xie, D. J., Lu, H., & Su, Y. J. (2018). The transfer effect of distribution patterns in preschool children: The roles of theory of mind and empathy. *Acta Psychologica Sinica*, 50(9).
- Xu, H., & Wang, T. (2022). Social motivation deficits in individuals with autism spectrum disorder. *Advances in Psychological Science*, 30(05), 1050-1061.
- Zhang, J., Lin, Q., Chen, L. F., Sun, Q. Z., & Yang, F. Y. (2024). Characteristics of reciprocal behavior in children with autism: A perspective of self-other distinction. *Chinese Journal of Applied Psychology*, 30(01), 44-55.
- Zhang, J., Yang, F. Y., & Sun, Q. Z. (2023). Distributive equality in children with autism from the perspective of dual-process theory. *Chinese Journal of Applied Psychology*, 29(01), 60-70.
- Akin-Bulbul, I., & Ozdemir, S. (2023). Imitation performance in children with autism and the role of visual attention in imitation. *Journal of Autism and Developmental Disorders*, 53(12), 4604-4617.
- Alnafjan, A., Alghamdi, M., Alhakbani, N., & Al-Ohali, Y. (2025). Improving imitation skills in children with autism spectrum disorder using the NAO robot and a human action recognition. *Diagnostics*, 15(1), 60.
- Baez, S., Rattazzi, A., Gonzalez-Gadea, M. L., Torralva, T., Vigliecca, N. S., Decety, J., ... & Ibanez, A. (2012). Integrating intention and context: assessing social cognition in adults with Asperger syndrome. *Frontiers in Human Neuroscience*, 6, 302.
- Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Sciences*, 6(6), 248-254.
- Baron-Cohen, S. (2009). Autism: the empathizing-systemizing (E-S) theory. *Annals of the New York Academy of Sciences*, 1156(1), 68-80.
- Brosnan, M., Ashwin, C., & Lewton, M. (2017). Brief report: Intuitive and reflective reasoning in autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 47(8), 2595-2601.
- Caldwell, M. P., Cheung, H., Cheung, S. K., Li, J. B., & Carrey Siu, T. S. (2022). Visuospatial perspective-taking in social-emotional development: enhancing young children's mind and emotion understanding via block building training. *BMC Psychology*, 10(1), 264.
- Carter Leno, V., Naples, A., Cox, A., Rutherford, H., & McPartland, J. C. (2016). Common and distinct modulation of electrophysiological indices of feedback processing by autistic and psychopathic traits. *Social Neuroscience*, 11(4), 455-466.
- Chang, J. C., Lai, M. C., Chang, S. S., & Gau, S. S. F. (2024). Factors mediating pre-existing autism diagnosis and later suicidal thoughts and behaviors: A follow-up cohort study. *Autism*, 28(9), 2218-2231.

Chevallier, C., Kohls, G., Troiani, V., Brodtkin, E. S., & Schultz, R. T. (2012). The social motivation theory of autism. *Trends in Cognitive Sciences*, 16(4), 231-239.

Dahary, H., Rimmer, C., Kaedbey, M., & Quintin, E. M. (2023). A systematic review of shared social activities for children on the autism spectrum and their peers. *Review Journal of Autism and Developmental Disorders*, 10(4), 771-792.

Dawson, G., Rieder, A. D., & Johnson, M. H. (2023). A developmental social neuroscience perspective on infant autism interventions. *Annual Review of Developmental Psychology*, 5(1), 89-113.

Dodge, K. A., & Crick, N. R. (1990). Social information-processing bases of aggressive behavior in children.

Personality and Social Psychology Bulletin, 16(1), 8-22.

Dunfield, K. A., Best, L. J., Kelley, E. A., & Kuhlmeier, V. A. (2019). Motivating moral behavior: Helping, sharing, and comforting in young children with Autism Spectrum Disorder. *Frontiers in Psychology*, 10, 25.

Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality and Social Psychology*, 71(2), 390-405.

Forbes, P. A., Chaliani, I., Schilbach, L., & Kalenscher, T. (2024). Autistic adults show enhanced generosity to socially distant others. *Autism*, 28(4), 999-1009.

Gray, K., Ward, A. F., & Norton, M. I. (2014). Paying it forward: Generalized reciprocity and the limits of generosity. *Journal of Experimental Psychology: General*, 143(1), 247-254.

Hansen, S. G., Frantz, R. J., Machalicek, W., & Raulston, T. J. (2017). Advanced social communication skills for young children with autism: A systematic review of single-case intervention studies. *Review Journal of Autism and Developmental Disorders*, 4(3), 225-242.

Hartley, C., & Fisher, S. (2018). Do children with autism spectrum disorder share fairly and reciprocally? *Journal of Autism and Developmental Disorders*, 48(8), 2714-2726.

He, J., Bore, M. C., Jiang, H., Gan, X., Wang, J., Li, J., ...& Becker, B. (2025). Neural basis of pain empathy dysregulations in mental disorders: A preregistered neuroimaging meta-analysis. *Biological Psychiatry*:

Cognitive Neuroscience and Neuroimaging, 10(2), 127-137.

Hepach, R., Hedley, D., & Nuske, H. J. (2020). Prosocial attention in children with and without autism spectrum disorder: Dissociation between anticipatory gaze and internal arousal. *Journal of Abnormal Child Psychology*, 48(4), 589-605.

Hill, E. L. (2004). Evaluating the theory of executive dysfunction in autism. *Developmental Review*, 24(2), Horstmann, A. C., Mühl, L., Köppen, L., Lindhaus, M., Storch, D., Bühren, M., ...& Krajewski, J. (2022).

Important preliminary insights for designing successful communication between a robotic learning assistant and children with autism spectrum disorder in Germany. *Robotics*, 11(6), 141.

Humphreys, C., Novy, L., Cergovski, N., Lai, H. C., & McVilly, K. (2023). The impact of COVID-19 lockdown on parents and young people with autism spectrum disorder (ASD). *Australian Social Work*, 77(2), 183–195.

Humphrey, N., & Symes, W. (2011). Peer interaction patterns among adolescents with autistic spectrum disorders (ASDs) in mainstream school settings. *Autism*, 15(4), 397–419.

Jin, P., Wang, Y., Li, Y., Xiao, Y., Li, C., Qiu, N., ...Ke, X. (2020). The fair decision-making of children and adolescents with high-functioning autism spectrum disorder from the perspective of dual-process theories.

BMC Psychiatry, 20(1), 1–11. Keifer, C. M., Mikami, A. Y., Morris, J. P., Libsack, E. J., & Lerner, M. D. (2020). Prediction of social behavior in autism spectrum disorders: explicit versus implicit social cognition. *Autism*, 24(7), 1758–1772.

Klapwijk, E. T., Aghajani, M., Lelieveld, G. J., van Lang, N. D. J., Popma, A., van der Wee, N. J. A., Colins, O. F., & Vermeiren, R. R. J. M. (2017). Differential fairness decisions and brain responses after expressed emotions of others in boys with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 47(8), Lewton, M., Ashwin, C., & Brosnan, M. (2019). Syllogistic reasoning reveals reduced bias in people with higher autistic-like traits from the general population. *Autism*, 23(5), 1311–1321.

Li, X. H., Lui, M., Song, X. K., Li, Y. R., Liu, X. Y., Pi, R., & So, W. C. (2025). Comparative effectiveness of human-and robot-based interventions in increasing empathy among autistic children. *Journal of Autism and Developmental Disorders*, 1–14.

McAuliffe, K., Raihani, N. J., & Dunham, Y. (2017). Children are sensitive to norms of giving. *Cognition*, 167, Ni, P., Xue, L., Cai, J., Wen, M., & He, J. (2021). Improving visual perspective-taking performance in children with autism spectrum conditions: Effects of embodied self-rotation and object based mental rotation strategies.

Autism, 25(1), 125–136. Nowak, M. A., & Sigmund, K. (2005). Evolution of indirect reciprocity. *Nature*, 437(7063), 1291–1298.

Olson, K. R., & Spelke, E. S. (2008). Foundations of cooperation in young children. *Cognition*, 108(1), 222–231.

Papageorgopoulou, E., Jones, E. J., Johnson, M. H., Charman, T., Green, J.,

Wan, M. W., & BASIS-STAAARS Team. (2024). Parent-infant interaction trajectories in infants with an elevated likelihood for autism in relation to 3-year clinical outcome. *Autism Research*, 17(10), 2018-2029.

Paulus, M., & Rosal-Grifoll, B. (2017). Helping and sharing in preschool children with autism. *Experimental Brain Research*, 235(7), 2081-2088.

Pelligra, V., Isoni, A., Fadda, R., & Doneddu, G. (2015). Theory of mind, perceived intentions and reciprocal behaviour: Evidence from individuals with autism spectrum disorder. *Journal of Economic Psychology*, 49, Peters, O., & Adamou, A. (2022). The ergodicity solution of the cooperation puzzle. *Philosophical Transactions of the Royal Society A*, 380(2227), 20200425.

Ramirez-Duque, A. A., Bastos, T., Munera, M., Cifuentes, C. A., & Frizera-Neto, A. (2020). Robot-assisted intervention for children with special needs: A comparative assessment for autism screening. *Robotics and Autonomous Systems*, 127, 103484.

Rankin, D. J., & Taborsky, M. (2009). Assortment and the evolution of generalized reciprocity. *Evolution*, 63(7), Shalev, I., Warrier, V., Greenberg, D. M., Smith, P., Allison, C., Baron-Cohen, S., ...& Uzefovsky, F. (2022).

Reexamining empathy in autism: Empathic disequilibrium as a novel predictor of autism diagnosis and autistic traits. *Autism Research*, 15(10), 1917-1928.

Silva, C., Jover, C., Da Fonseca, D., Esteves, F., & Deruelle, C. (2020). Acting on observed social exclusion and pro-social behaviour in autism spectrum disorder. *Autism*, 24(1), 233-245.

Steinbeis, N. (2016). The role of self-other distinction in understanding others' mental and emotional states:

Neurocognitive mechanisms in children and adults. *Philosophical Transactions of the Royal Society B:*

Biological Sciences, 371(1686), 20150074. Townsend, L., Robeson, A., Vonk, J., & Rohrbeck, K. (2021). Autism does not dictate children's lack of sharing in a prosocial choice test. *Journal of Autism and Developmental Disorders*, 51(6), 2029-2035.

Van Hoorn, J., Van Dijk, E., Crone, E. A., Stockmann, L., & Rieffe, C. (2017). Peers influence prosocial behavior in adolescent males with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 47(7), Wen, N. J., Clegg, J. M., & Legare, C. H. (2019). Smart conformists: Children and adolescents associate conformity with intelligence across cultures. *Child Development*, 90(3), 746-758.

Woodcock, K. A., Cheung, C., Marx, D. G., & Mandy, W. (2020). Social decision making in autistic adolescents:

The role of theory of mind, executive functioning and emotion regulation. *Journal of Autism and Developmental Disorders*, 50(7), 2501-2512.

Wörle, M., Essler, S., & Paulus, M. (2020). Paying it back and forward: The impact of experiencing and observing others' sharing and stinginess on preschoolers' own sharing behavior and expectations. *Journal of Experimental Child Psychology*, 198, 104886.

Zhang, J., Sun, Q., Liu, X., & Yang, F. (2022). Ultra-light clay intervention improves responsiveness and initiates the communication of children with ASD. *Frontiers in Psychology*, 13, 804488.

Zhang, J., Sun, Q., Zhu, H., & Wang, Q. (2025). Same behavior, different perspectives: direct reciprocity differences between children with autism and children with typical development. *BMC Psychiatry*, 25(1), Differences in reciprocal behavior between children with autism spectrum disorder and typically developing children:

From the perspective of self-other distinction ZHANG Jing^{1,2}, SUN Qingzhou³, ZHU hongying^{1,2}, WANG qunlong^{1,2}, CHEN yuhang¹ (1School of Public Affairs Zhejiang Shuren University, Hangzhou 310000, China) (2Zhejiang Modern Service Industry Research Center, Hangzhou 310000, China) (3School of Management, Zhejiang University of Technology, Hangzhou 310023, China) Abstract: Deviations in reciprocal behavior between children with Autism Spectrum Disorder (ASD) and typically developing (TD) children often give rise to challenges in inclusive settings.

Previous theoretical frameworks based on the perspective of others have presented several contradictions. From the dual-process theory perspective, and by introducing the concept of self-other distinction, it is proposed that the self-centered bias in children with ASD and the other-centered bias in TD children jointly contribute to the differences in reciprocity between the two groups. If the perspective of others is highlighted for the former group, it may induce an other-centered bias, making their reciprocal behavior more similar to that of TD children, thereby reducing the difference in reciprocity. Future research should disentangle the potential influence of task parameters, conduct in-depth analyses of the differences in reciprocal pathways between the two groups, and develop scientific and effective intervention models for reciprocal behavior.

Keyword: Autism Spectrum Disorder, Reciprocal Behavior, Self-Other Distinction, Perspective Highlighting

Source: *ChinaXiv* – Machine translation. Verify with original.