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Explaining Reciprocal Sharing in Repeated Dictator Game: The Role of Theory of Mind

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Abstract

This study investigated children's development in reciprocal sharing behavior and the relationship between theory of mind and children's reciprocal sharing. We presented 3-, 4- and 5-year-old children with reciprocal and non-reciprocal conditions in repeated dictator games. Results showed that when making decisions about how much to share, all three groups of children shared more resources when their partners have opportunity to reciprocate. However, only 5- and 4-year-old groups showed a statistical significance. Furthermore, the ability of theory of mind is positively related to children's reciprocal sharing. Children who were better at false-belief tasks shared significantly more resources with their partner in a reciprocal sharing condition, but not a non-reciprocal sharing condition.

Keywords

Sharing, Reciprocity, Theory of Mind, Children

1. Introduction

Reciprocity, the tendency to repay positive and negative behavior to others, is considered one pivotal explanation for social cooperation between non-kin (Beeler-Duden & Vaish, 2020). For the greater benefits, people are more willing to cooperate and exchange resources with others than effort alone (Wörle et al., 2019). Further, reciprocity makes cooperation stable in the long run because each individual needs to benefit from a reciprocal interaction (Chernyak et al., 2019; Zhang et al., 2019). In the perspective of development, reciprocity was arose in the interpersonal sharing situations firstly (Warneken & Tomasello, 2013). Therefore, reciprocal sharing was focused on because it is crucial for the early emergence of contingent reciprocity among children (Wörle & Paulus, 2019).

In reciprocal sharing, two individuals allocate resources over repeated interactions and both of them pay some current costs. However, two individuals can benefit in a long run in ways that take turns paying costs and receiving benefits (Warneken, 2018). Different with altruism sharing—defined as a general prosocial behavior that aimed to increase others' fitness at the cost of the performers' benefit (i.e. costly to the actor and beneficial to the recipient), individuals may be more concerned with the potential cooperation and their own long-term returns in a reciprocal sharing. That is, reciprocal sharing is a cooperative behavior that is beneficial to both actor and recipient (Bull & Rice, 1991).

Although it is known that children cooperate in a reciprocal way from an early age (Warneken & Tomasello, 2013), we currently know little about how cognitive abilities mediate children's reciprocity, especially in regard to reciprocal sharing. Thus, the current study aimed to determine the role of theory of mind (ToM) in children's reciprocal sharing. To assess this hypothesis, we first review studies on the early development of reciprocity and describe research on children's emerging ability to ToM and its relation to reciprocal sharing.

1.1. Early Development of Reciprocal Sharing

The models of reciprocity are of two main types: partner control and partner choice (Baumard et al., 2013). And, in a view of development, the sensitivity to the reciprocity principle of children might emerge much earlier in partner choice model than partner control model (Sebastián & Warneken, 2015). Wörle and Paulus (2019) described two models as "strategic expectations and normative evaluations".

In partner choice model, reciprocity is defined as the act of selecting of partners as targets to cooperate (Baumard et al., 2013). Partner choice describes how children decide with whom to interact. Previous studies suggested that children's reciprocal sharing in this model emerged during toddlerhood or early childhood (Hepach et al., 2019). In an experiment with partner choice model, children were presented with two antithetical behaviors that an actor (or a puppet) exhibited either generous or selfish behaviors. Subsequently, the children were asked to make a decision about the amount of resources that they would share with the actor. Children's decision or allocation would be seen as a kind of normative evaluation. Previous studies found that children's normative evaluation was related to the extent to which their partner had shared before. They returned more resources to their partners when they received candies from the partner previously (Vogelsang & Tomasello, 2016).

In contrast, partners are given rather than chosen in partner control models. In this model, reciprocity is defined as matching one's behavior with their partner's behavior in subsequent repeated interactions and the one who fails to cooperate with their partners will be punished (Baumard et al., 2013). Reciprocal sharing with this model describes the choices that children make about how to act (e.g., how much to share), and the actor would be benefited in the long run,

although at a temporary cost (Zhang et al., 2019). Children's decision or allocation would be seen as strategic expectations. Recent studies provided further evidence that children's reciprocal sharing in a partner control model had a remarkable development in the period of preschool (Paulus, 2016). For example, it was found that 5-year-olds wished to share more resources when they knew that others had been afforded the opportunity to reciprocate than when explicit information about the reciprocity norm was absent (Xiong et al., 2016). Sebastián and Warneken (2015) found that 5-year-olds shared more resources with a partner who had an opportunity to reciprocate than with one who had not.

Taken together, choosing the right partner is the central issue in partner choice models. However, in partner control models, children perform reciprocal sharing to prevent cheating (Baumard et al., 2013). Children only have the decision between cooperating or not with their current partner in partner control models, and, they have the "outside option" of cooperating with someone else in partner choice models. Thus, two models describe different types of reciprocal situations and might be motivated by different factors (Martin & Olson, 2015; Paulus, 2014). Thus, the current study aimed to investigate the development of children's strategic expectations in partner control models and to explore its motivated factor, such as the abilities to mentally connect one's beliefs to their future behavior, which is suggested to play an important role in individuals' reciprocity (Nowak & Sigmund, 2005; Stengelin et al., 2020).

1.2. Relationship between Children's Theory of Mind and Sharing

ToM, the ability to explain other's behavior on the basis of their minds, is essential for children's social interaction and constitutes a core aspect of young children's social-cognitive development (Misailidi & Tsiara, 2021). Normally developing children attain ToM at roughly 4-year-old with the awareness that other people, as well as themselves, may have beliefs that are different from reality (i.e. first-order false beliefs).

Several studies have assessed that children's ability to understand false beliefs play an important role in their sharing behaviors. Interestingly, this influence has produced different results in different studies. For example, it was suggested that preschool children who had acquire ToM (defined as the understanding of false beliefs) really share more resources than those who do not have ToM (Liu et al., 2016; Takagishi et al., 2010). In contrast, Cowell's team (2015) found that children with ToM are more selective in their sharing and they tend to share less resources with unknown peers. Author suggested that because there is no subsequent cooperation and children acquire ToM can better recognize an opportunity for strategic gain at no cost to the self.

Compare with the resourceful of evidence for an association between cognitive abilities and sharing behavior, yet little is known about the cognitive mechanisms that give rise to children's reciprocal sharing. Taken all previous findings together, here we rise the hypothesis that ToM had a positive relationships with

children's reciprocal sharing.

2. Materials and Method

2.1. Participants

The participants of this study were 64 5-year-old children (M_{age} = 63.56 months, SD = 2.06 months, range = 60 - 66 months), 68 4-year-old children (M_{age} = 52.06 months, SD = 2.79 months, range = 48 - 54 months), and 66 3-year-old children (M_{age} = 39.81 months, SD = 2.21 months, range = 36 - 42 months). Following recruitment, children were randomly assigned to the reciprocal or non-reciprocal condition as they became available until a count of at least 30 children per age group or condition was achieved. This number was chosen based on the sub-sample sizes used in similar studies (Sebastián & Warneken, 2015: 36 children; Vaish et al., 2017: 21 children). Finally, we modify the quantity of each group for participant to 33 according to the analysis of G-power. Additionally, seven children were tested, but they were excluded either because they were inattentive (n = 3) or unwilling to participate (n = 3) or because of technical problems (n = 1). The informed consent was obtained from all parents or adult relative caretaker. All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was conformed to ethical standards and approved by the institutional research committee (LL2022008).

2.2. Design

In the sharing task, a 3 (age: 3, 4, 5) × 2 (condition: reciprocal sharing or non-reciprocal sharing) between-participants design was deployed. In each age group, 33[1] children participated in each condition. The basic scenario in this study is that the child played with a partner to share game tokens. Specifically, participants shared their resources with a partner who either had access to reciprocate resources in a subsequent interaction (reciprocal sharing condition) or did not have the opportunity to reciprocate (non-reciprocal sharing condition). Here, a turn-taking version of a sharing game was used in the reciprocal sharing condition (i.e. players alternately played the role of a donor and recipient across several trials). It is designed to assess whether children orient their sharing behaviors towards their partners over repeated dilemmas. The number of token of children served as the dependent measure.

2.3. Setup and Materials

The experimental materials in ToM task were picture-book and a box printed cookies. The setup in sharing task consisted of two small tables with two chairs each, coloured pencils, and game machines with tokens. One token indicated

[1]In the process of data analysis, it was found that 2 children in the 5-year-old group were under five because they reported their nominal age. Therefore, the final number of participant was 64 in the 5-year-old group and 68 in the 4-year-old group.

that the player had an opportunity to catch a "surprise toy egg" from the game machine.

2.4. Procedure

Researchers visited each child at the laboratory of kindergarten individually for 30 minutes. Prior to the commencement of the experiment, there was a 5-minute warm-up period (e.g. the child could choose a toy and play with the experimenter), which served to relieve stress and help the children become acquainted with the experimenter. All children participated in a ToM task and a sharing task. The order of two tasks was counter balanced. Scoring on the ToM and sharing task was conducted by an experienced experimenters. Toys in the surprise eggs were given to children as a gift of thanks.

Theory of mind task

ToM task includes an unexpected contents false belief task and a changed-location false belief task. It is not the contention herein that a single measure of false-belief is entirely encompassing of ToM abilities, yet the task does differentiate between children with very rudimentary early belief-understanding and those without.

Unexpected contents task. Children were shown a box printed some cookies. Experimenter asked children what they thought was inside: "Look! A box! What do you think is inside the box?" After children gave the anticipated response, the experimenter showed them the actual contents of the box, which was not cookies but some stickers, and asked: "What is really inside the box?" (control question). Stickers were then put back inside the box and children were asked: "When you first saw this box, what did you think was inside it?" (own false belief question). Then, children were presented with a photo of a child (gender balanced) and were told that the child in the photo had never seen this box before. Children were asked the other false belief question: "What does he/she think is inside this box?"

Object-transfer task. Children were read a story about a child named Yoyo, who had placed some balls in a green box and another child (named Yiyi) who had come into the room and placed the balls in another location (yellow box) after Yoyo had left. Then children were asked the control question: "where are the balls?" Subsequently, Yoyo had returned. The children were asked to indicate where Yoyo would look to find the balls (other false belief question) and where would themselves look to find the balls if they never seen Yiyi before (own false belief question). To answer the question, children had to respond to the questions by either pointing to the green/yellow box or stating "green box/yellow" verbally.

Children were awarded 1 point when they responded to all these questions correctly in each false belief task. The score of ToM task was ranged from 0 to 2.

Sharing task with repeated dictator game

Sharing task had four trials in total and each trial consisted of two separate

game (i.e. blue table game and pink table game). Each table represented different and consecutive steps. Children always started with the blue table and then moved on to the pink table. The procedure of two table game was exhibited I Table 1.

Here, children were advised to join in a computer online game with an anonymous child actor, whose age was the same as the participants and gender was randomly assigned. Specifically, the performance of child actor was pre-recorded and one of the experimenter played video clips according to different condition. After experimenter instructed them about how they should use the game machine with a token, the sharing task begin and children were randomly assigned to the reciprocal or non-reciprocal condition (see Figure 1).

Reciprocal sharing condition. In the blue table game, participants received all three tokens and acted as the allocator. We used three tokens here to prevent the effect of other social preferences (i.e. equal sharing). They could decide to share some of their tokens with the partner to play with the green game machine. Standard instructions at blue table: "Hello, (children's name). Now, you are the 'blue table donor' here. You might get three tokens (shake hand and count: 'one, two three'). Would you like to allocate these tokens between you and that child (point to the child in the screen)? You could allocate in any way you pleased. The child (point to the screen) is 'pink table donor' and he/she would allocate at pink table." After instructions, the experimenter asked children two comprehension questions: 1) what could you do at blue table? 2) What could child partner

Table 1. Experimental procedure.

Sharing condition	Trail 1	Trail 2 Trail 3 Trail 4
Reciprocal sharing condition	Blue table game(allocator: participant) Pink table game(allocator: child actor)	Same as trail 1
Non-reciprocal Sharing condition	Blue table game(allocator: participant) Pink table game(drawing game)	Same as trail 1

The procedure of sharing task was consisted of four trials and each trial conclude a blue table game and a pink table game.

Figure 1. Reciprocal condition (left) and non-reciprocal condition (right).

do at pink table? The instructions were repeated if children have any question or get any of the comprehension questions wrong. To avoid understanding bias, the experimenter gives no suggestion (except the standard instructions) in the sharing assessment. Once participants had finished allocating, the experimenter told them that they were going to deliver the tokens to the child in the video and left the laboratory for 30 seconds. When the experimenter returned to the laboratory, participants were told that the tokens had been given to that child. Then both of participant and child actor began to play the green game machine. After all the tokens had been used, experimenter invited both of two players move to the pink table, where the roles of donor and recipient were reversed. The participants saw their partners got three tokens and, therefore, switched to be the allocator. Here, the child actor made sharing decisions using a tit-for-tat strategy. Specifically, the child actor shared the same number of tokens (i.e. at the pink table) that the children had previously shared with him/her at the blue table. Because the video was pre-recorded, there were four variations of the video clip (3 - 0, 2 - 1, 1 - 2, and 0 - 3). Then, the experimenter played one of the four (i.e. based on the number of shared tokens) video clips and left. 30 seconds later, the experimenter returned to the laboratory and gave the pre-prepared tokens to participants. After the 30 seconds period, the experimenter moved on to the next trial. The procedure for the remaining three trials was identical to that for Trial 1 with the exception that in Trials 3 and 4 no more comprehension questions were asked.

Non-reciprocal sharing condition. The procedure at blue table was identical to that of the reciprocal sharing condition. However, there was no description of "pink table donor" in the standard instructions. Instead of the pink game machine, two identical sets of drawing papers were placed on pink table. The experimenter explained that they had one minute to colour the picture or do some drawings at pink table. That is, participants' partners had no opportunity to reciprocate. The same procedure was used for the remaining trials with the exception that for Trials 3 and 4 no comprehension questions were formulated.

Supplementary information: 1) If participants did not understand how to allocate, the experimenter closed three tokens to children and told them that all these tokens were theirs but that if they wanted they could give some of tokens to the child. 2) To eliminate the effect of monitoring, the experimenter faced away from them and pretended to write when the participants were allocating their resources. 3) When the participants had made a 3 - 0 or 0 - 3 allocation, one of the players had no token with which he/she could play; therefore, he/she was instructed to stay in his/her chair until the other player finishes playing the game.

3. Result

3.1. Theory of Mind Task

The mean scores of ToM task are shown in **Table 2**. An initial 3 (age) × 2 (gen-

der) analysis of variance (ANOVA) was conducted by giving children a score of total number correct. This revealed a significant main effect only for age, $F = 11.18$, $p < 0.001$. As age increased, children were more likely to pass the tasks. No gender difference was found ($F = 1.21$, $p = 0.273$).

3.2. Sharing in Repeated Dictator Game

The mean proportion of resources that children shared in the sharing task (both reciprocal and non-reciprocal condition) is presented in Figure 2.

As shown in the figure, more resources shared in the reciprocal condition (M = 3.53, SD = 2.19) than in the non-reciprocal condition (M = 0.93, SD = 1.11). The mean of number for tokens among four trials were shown in Table 3.

First, we tested whether there was a difference in the mean number of tokens shared between the two conditions. A significant main effect of condition was found in 5-year-old group, $F(1, 63) = 29.38$, $p < 0.001$, $\eta_p^2 = 0.32$, and 4-year-old group, $F(1, 67) = 7.69$, $p = 0.007$, $\eta_p^2 = 0.11$, but not 3-year-old group, $F(1, 65) = 3.48$, $p = 0.068$, $\eta_p^2 = 0.06$. A higher number of tokens was shared in the reciprocal condition among 4-and 5-year-old children.

Next, the effect for age group was tested, $F(2, 97) = 5.75$, $p = 0.004$, $\eta_p^2 = 0.11$ (reciprocal condition), and $F(2, 97) = 2.90$, $p = 0.061$, $\eta_p^2 = 0.06$ (non-reciprocal condition). Post Hoc showed a significant difference between 3- and 4-year-olds

Table 2. Mean scores on ToM task.

Age group	3 years old Mean (SD)	4 years old Mean (SD)	5 years old Mean (SD)	Between-group Difference
ToM score (0 - 2)	0.68 (0.83)	1.12 (0.84)	1.38 (0.88)	11.183***

***$p < 0.001$.

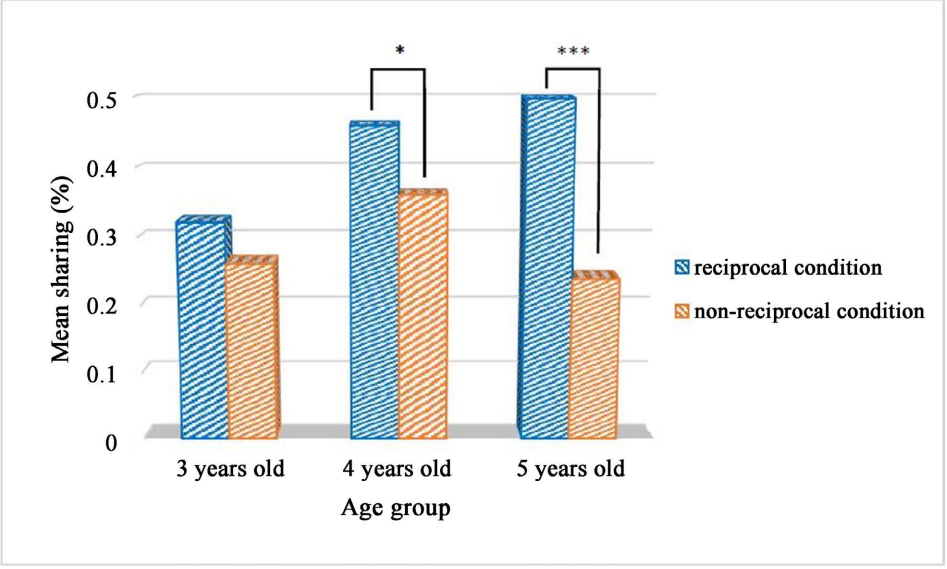

Figure 2. Mean proportions of children's allocations to share token as a function of age and different condition (reciprocal sharing and non-reciprocal sharing condition).

Table 3. The mean of resources that children shared among trials

Mean number of sharing	Reciprocal sharing condition				Non-reciprocal sharing condition				Between-group Difference
Trial number	Trail 1	Trail 2	Trail 3	Trail 4	Trail 1	Trail 2	Trail 3	Trail 4	
3-year-olds	0.82	1.03	1.00	1.06	0.83	0.80	0.80	0.70	3.48
4-year-olds	1.24	1.45	1.48	1.33	1.09	1.12	1.09	1.03	7.69**
5-year-olds	1.31	1.55	1.67	1.45	0.78	0.67	0.75	0.67	29.38***

***$p < 0.001$, **$p < 0.01$.

($p = 0.014$), and 3- and 5-year-olds ($p = 0.002$) in the reciprocal condition. Last, we test the differences between trials. The mean of resources that children shared in four trials of dictator game (both reciprocal and non-reciprocal condition) is presented in Figure 3.

In both of reciprocal sharing and non-reciprocal sharing condition, no differences were found across four trials. $F(3, 96) = 1.99$, $p = 0.115$, $\eta_p^2 = 0.015$ in reciprocal sharing condition and $F(3, 96) = 0.59$, $p = 0.621$, $\eta_p^2 = 0.005$ in non-reciprocal sharing condition. However, it is interesting that the tokens 4 and 5-year-olds shared in the first three trials showed an increasing trend but decreased in the last trial. It may contribute to the consideration of fairness and it is interesting for further research to explore it.

3.3. Theory of Mind and Reciprocal Sharing

To examine the relationship between children's ToM score and their amount of sharing, a linear regression was performed entering the ToM score, gender and age as predictor variables and amount shared as a dependent variable. The results shown in Table 4, showed that the acquisition of ToM was positively related to children's sharing behavior in the reciprocal condition ($\beta = 0.64$, $p = 0.000$), $R^2 = 0.46$, specifically, those who obtained higher scores on the ToM tasks also shared more tokens in the reciprocal sharing tasks. While no effect of age or gender was observed.

4. Discussion

The current study aimed to investigate whether reciprocity represents a kind of strategic expectation in partner control models and whether such behavior develops during the preschool year. We explored how children would act if their partners have or have not an opportunity to reciprocate. Results showed that children of all age groups shared more resources when their partner in the reciprocal sharing condition (i.e., partners have the opportunity to feedback), but only children among the group of 4- and 5-year-olds showed the statistical differences. Additionally, this study investigated the motivated factor behind children's reciprocal sharing. ToM was assessed in conjunction with a behavioral economics sharing game in a sample of preschool children. Consistent with our

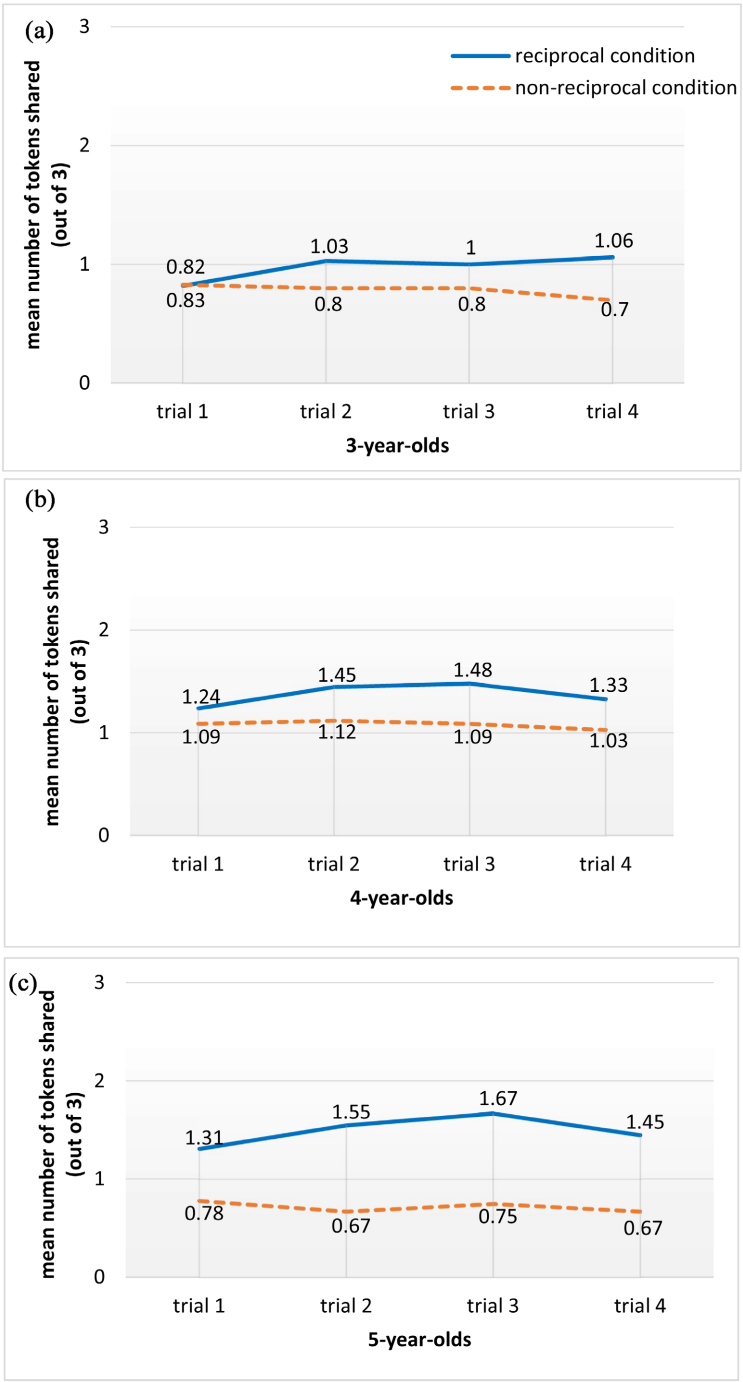

Figure 3. Mean proportions of children's allocations among trials. (a) 3-year-olds group; (b) 4-year-olds group; (c) 5-year-olds group.

Table 4. Relation between assessed variables and reciprocal sharing.

Independent variables	*B*	*SE*	*β*	*t*	*p*	95%CI
Age	0.34	0.25	0.11	1.41	0.16	−0.14 - 0.84
Gender	−0.32	0.39	−0.06	−0.82	0.42	−1.09 - 0.45
ToM score	1.84	0.23	0.64	7.85	0.000	1.37 - 2.30

hypotheses, the ability of ToM (as measured by the false-belief tasks) was related to generosity in reciprocal sharing of children.

4.1. The Development of Children's Reciprocal Sharing

The first aim of the present study was to investigate the development of reciprocity among 3, 4, and 5-year-olds. To check for it, we compared the differences of children's sharing between reciprocal and non-reciprocal condition. It is demonstrated that there were different age-related changes in children's reciprocal sharing. From a developmental perspective, the relationship between children's sharing and the possibility of reciprocation is subject to developmental changes and such strategic reciprocity emerges in the period of preschool. This pattern is consistent with our predictions and previous findings. That is, in partner control models, the possibility for reciprocity is a heavily influence expressions of children's sharing.

When making decisions about how much to share, all three groups of children shared more resources when their partner have the opportunity to reciprocate but less resources in non-reciprocal condition. However, only 5- and 4-year-old groups showed a statistical significance and this difference was quite pronounced among 5-year-olds. From our data, 5-year-olds shared most resources in the reciprocal condition but least in the non-reciprocal condition on average. Consist with previous findings, 5-year-old children might weigh their own interests strategically in a long run and their sharing behaviors, which they exhibited in the reciprocal condition, were motivated by the possibility of receiving rewards in the future (Kenward et al., 2015; Sebastián & Warneken, 2015). In this study, 4- and 5-year-olds invested more resources in the first step (blue table game) in which they could obtain partners' resources in the subsequent step (pink table game) in the reciprocal sharing condition. As a strategic behavior, they could adhere to the reciprocity norm even when it is in conflict with their self-interest. From the view of socialization, as the giver in the interactions, they acted as social norm performer that conformed to the cooperation and exchange rules.

Interestingly, 4-year-olds almost shared the same resources with 5-year-olds in the reciprocal condition. However, the number of resources 4-year-olds shared in the non-reciprocal was the most among all three groups. As described in the reciprocity is secondary model (Warneken & Tomasello, 2013), a general inclination of young children to share with others in partner control models gets complemented by reciprocal expectation during the development. Therefore, the reciprocal sharing of children contains both prosocial and reciprocal considerations. At the age of 4, children shared more resources in the reciprocal condition because they have already established the expectation of reciprocal strategic behavior. At the same time, they also shared more resources in the non-reciprocal condition because of pro-sociality. Thus, the reciprocal expectation motivated children's sharing partly, but not replaced the prosocial consideration during

development.

Differently, 3-year-olds shared very few resources in both conditions. It is suggested that they are strongly present-oriented in their sharing, and they do not share for the sake of a more rewarding future (Sebastián & Warneken, 2015). According to the reciprocity is secondary theory, young children initially show a spontaneous tendency to share that is unaffected by future and reciprocal consideration (Warneken & Tomasello, 2013). With age increased, this tendency gets shaped by the consideration of reciprocity. Thereby, children become selective and direct their sharing specifically toward those who could be prosocial to them. This trend points to a more cognitive ability to make sharing and allocation based on their future needs.

4.2. Role of Theory of Mind in Reciprocal Sharing

What could account for the developmental difference in the generosity of children? It is unlikely that 3-year-olds shared very few tokens because they cannot understand the reciprocity norm. A number of previous studies have demonstrated that young child could take the norm of reciprocity into account when sharing with their partner (Vaish et al., 2017). In this study, the challenge for younger children was that they needed to cognitively balance the cooperate belief of their partner against actual loss when deciding how much to share. It requires developed cognitive competencies such as ToM to perform a better understanding of another individual's mind.

Thus, the second goal of this study was to assess the relationship between ToM and children's sharing behavior. Consistent with our hypothesis, ToM show a predictive association with children's reciprocal sharing in the repeated dictator games. Overall, children who were better at false-belief tasks shared significantly more resources with their partner. This relationship was only found in the reciprocal sharing condition, but not in non-reciprocal condition. That is, the ability of ToM likely influences perceived expectations of cooperation and reciprocity, rather than general generosity. To better explain this result, we discussed the relationship in more details.

In partner control models, the choices that children make about how to act and children need to make decision first. Reciprocity emerges from balance between current loss and future benefit across several trials of giving and receiving. Noë and Hammerstein (2001) demonstrated the utility of viewing cooperation using the metaphor of investment and exchange. In this theoretical framework, children's reciprocal sharing behavior is contingent on not only an understanding of gains and losses but also partners' beliefs of cooperation. In other words, reciprocal sharing in repeated dictator games is equivalent to making planned self-consuming investments with an expectation of a future reward (Stevens et al., 2005). Thus, reciprocal sharing requires children to keep track of partners' beliefs and assess the likelihood of cooperation. The costs of current sharing are outweighed by future benefits, which are estimated based on the likelihood of

future interactions (Leimgruber, 2018). Therefore, the abilities to ToM, or mentally connect partners' own current behavior to the potential future behavior and children's generosity in reciprocal sharing are particularly relevant. However, 3-year-olds do not performed different generosity in different sharing conditions. We inferred that it may be limited with the development of ToM. Recent evidence supports this view. Schug and his colleagues (2016) stress that who passed a false belief task were more likely to make generous offers in a dictator game. That is, ToM modulates their prosocial responses toward a given partner who would (or would not) be able to reciprocate. Children who obtain ToM may actually understand that acquiring the benefits of cooperation is better than one-shot resource hoarding (Cowell et al., 2015).

Importantly, no significant correlation was found between children's ToM and their generosity in the non-reciprocal sharing condition. According to the classified forms of Hamilton, both altruism sharing and reciprocal sharing are cooperate behavior that is beneficial to the recipient. However, altruism sharing is costly to the actor and beneficial to the recipient, and, reciprocal sharing is beneficial to both the actor and the recipient (Baumard et al., 2013). It is suggested that reciprocal and non-reciprocal sharing in repeated dictator games may require distinct social-cognitive, motivational, and other psychological constituents. Because of the lack of possibility for return, the motivation that underlies children's non-reciprocal sharing behaviors varies and may be a combination of both altruistic and selfish. It is interesting for further research to explore these possibilities.

The limitation should be acknowledged. First, the sharing task required the children to interact with actors in a video rather than real people. It is important for future studies to use alternative approaches to establish the robustness and generalisability of the present findings. Second, to be consistent with previous studies, our work on children's ToM focused on binary measures (e.g., passing/failing false belief tasks). Future studies may benefit from a more scaled measurement of ToM, enabling finer-grained examinations of the developing relation between ToM and reciprocity. Third, some other skill should be test, such as executive function (EF). A recent meta-analysis showed a moderate but significant association between normative variation (approximately 15%) in EF and in ToM among children (Jones et al., 2018). Thus, more detailed variable control is needed in the future study.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Informed Consent

All participants participated voluntary and informed consent was obtained from each child by his or her parent or adult relative caretaker.

Ethics Approval Statement

The informed consent was obtained from all parents or adult relative caretaker. All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was conformed to ethical standards and approved by the institutional research committee of LNNU (LL2022008).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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