Grateful giving: Affective influences on children's upstream reciprocity

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Introduction

Individuals benefit from cooperative partnerships by helping with child rearing, mutual exchange of goods and services, and working together to obtain food. Although individuals benefit from these cooperative partnerships, the evolution of our large-scale cooperative society necessitates extending cooperation beyond repeated encounters between the same two individuals. It is this predisposition to engage in cooperation with both established cooperative partnerships and novel individuals that account for our success as a species (Tomasello, 2009). What mechanisms might encourage individuals to seek out and engage in novel cooperative partnerships? The understanding of this question is crucial to disentangling the roots and evolution of cooperation. It is therefore this question that motivates the current work. Specifically, we focus on one vital prerequisite for the evolution of cooperation: extending cooperative tendencies toward novel individuals. We propose that gratitude plays a crucial role in perpetuating cooperation beyond the original cooperative partnership. The mechanisms underlying cooperative behavior are most apparent in children who, with limited socialization, show significant predispositions for cooperative behaviors (Warneken & Tomasello, 2009). Thus, to understand the foundations of cooperation we must understand the development and prosocial functions of gratitude.

Cooperative behavior manifests itself in many forms. Direct reciprocity is the concept that 'I help you and you help me'. That is, individuals act cooperatively towards another individual who provided them a benefit. Though costly in the moment, it is the recurrent interactions of the cooperative partnership that leads to the long-term benefits for both partners (Nowak & Sigmund, 1992; Trivers, 1971). Developmental research has demonstrated that preschoolers understand and engage in direct reciprocity. By as early as three years old, children share more resources with previously cooperative partners and also expect others to be more

cooperative if they had previously shared with them (Paulus, 2016; Warneken & Tomasello, 2013).

Indirect reciprocity concerns cooperative behavior towards novel individuals, either in response to their prosocial behavior toward a third party (downstream) or after being the recipient of prosocial behavior (upstream; Rankin & Franziska, 2009). Indirect reciprocity can explain how cooperation with novel individuals develops and spreads from the original partnership to groups (Nowak & Sigmund, 1998; Nowak & Sigmund, 2005; van den Berghe & Alexander, 1987). Indirect reciprocity has two potential forms: downstream and upstream (Nowak & Roch, 2007). Downstream reciprocity means an individual who helps is more likely to receive help from a new individual in the future (Brandt & Sigmund, 2004; Olson & Spelke, 2008). Indirect downstream reciprocity is the idea 'I help you and somebody else helps me.' Early in development infants show an understanding and expectation for indirect downstream reciprocity. When viewing third party interactions, 10-month-old infants show surprise and look longer when an individual chooses to share a resource with a person the individual had witnessed unfairly distribute resources with a previous partner (Meristo & Surian, 2013). Later in development, children engage in indirect downstream reciprocity. By 3.5 years of age, children are more likely to share with individuals who have previously shared with others (Kato-Shimzu, Onishi, Kanazawa, & Hinobayashi, 2013; Olson & Spelke, 2008).

Both direct reciprocity and indirect downstream reciprocity can easily be explained by the rule of rewarding a positive act. That is, they convey 'you did something good for someone, then someone should do something good for you.' Countless research studies have shown how robustly children engage in both direct and indirect downstream reciprocity, but far less is known about children's upstream indirect reciprocity (House, Henrich, Sarnecka, & Silk, 2013; Olson & Spelke, 2008; Nowak & Sigmund, 1998; Warneken & Tomasello, 2013). Upstream indirect

reciprocity is the idea that when a person has just received help they have an urge to pay it forward and help someone too. One reason for the lack of research about upstream reciprocity may be that upstream indirect reciprocity is more difficult to understand from an evolutionary or reward-based perspective (Boyd & Richerson 1989; Pfeiffer, Rutte, Killingback, Taborsky, & Bonheffer, 2005).

Importantly, this form of reciprocity is thought to be useful for the evolution of cooperation and promotion of cooperation within groups, by motivating individuals to engage in cooperative behavior with novel individuals, which increases the level of cooperation within the group (Nowak & Roch, 2007). Examples of upstream reciprocity have been observed in adult economic and psychology experiments. For instance, in economics, a player who had received help from another player was more likely to help a new anonymous partner and, in some cases, opportunities for upstream reciprocity motivated more prosocial behavior than direct reciprocity (Greiner & Levati, 2005; Stanca, 2009). Psychology laboratory studies show that those who have been helped tend to be more monetarily generous with strangers and more likely to volunteer to help strangers (Bartlett & DeSteno, 2006; DeSteno, Bartlett, Baumann, Williams, & Dickens 2010). These studies demonstrate that adults readily engage in upstream reciprocity but, to our knowledge, limited developmental work has been conducted about upstream reciprocity.

One study has addressed whether children engage in upstream reciprocity. Leimgruber and colleagues (2014) have demonstrated that 4-year-olds, as well as capuchins, pay forward both positive and negative outcomes. In their study, the distributing child was allowed to choose between two distinct distributions: either a positive outcome (four resources for themselves and four resources for the recipient child) or a negative outcome (four resources for themselves and only one resource for the recipient child). Each child was first the recipient of either a positive or a negative distribution, and then was given the opportunity to distribute resources to a new child.

Children and capuchins were more likely to pay forward similar outcomes. Recipients who had received a positive outcome (four resources) were more likely to choose that distribution for the new recipient and those who received a negative outcome (only one resource) were more likely to choose to distribute only one resource to the new recipient.

Leimgruber et al. interpret the paying forward of both positive and negative outcomes to be indicative of a basic "give what you get" strategy for upstream. However, Leimgruber and colleagues' results could also be explained by children choosing the distribution they received because they believe that distributing in this way is the norm of a new game. That is, children may assume the distributor of this new game is supposed to select a particular distribution, the one they had received, rather than being motivated to pay forward the similar outcomes and engage in true upstream reciprocity. One way to rule out this explanation is to is to control for in-kind reciprocity (paying forward the same outcome) by creating a mismatch between the resource received and the resource that is distributed. It has been empirically demonstrated that upstream reciprocity in adults is also motivated by a variety of prosociality that is distinct from, and at times unrelated to, the behavior to be paid forward (Barlett & DeSteno 2006a; Barlett & DeSteno 2006b; DeSteno et al., 2010; Tsang 2006; Tsang 2007). Thus, it is important to control for in-kind reciprocity to understand the development of true upstream reciprocity. Additionally, this work by Leimgruber and colleagues shows that children may engage in upstream reciprocity by at least by 4 years of age, but further work is necessary to explore the developmental trajectory of this behavior.

Their results broke new ground on the study of upstream reciprocity in children, but a key question still remains that is the principal interest of this paper: What mechanism motivates children's upstream reciprocity? We propose that the answer to this question may lie in emotions. Emotions solve survival-relevant problems, such as attachment formation, maintaining

cooperative relations, or avoiding social threats (Johnson-Laird & Oatley, 1992; Levenson, 1994; Oatley & Jenkins, 1992; Rozin, Lowery, Imada, & Haidt; 1999). Emotions facilitate cooperative behavior by influencing an individual's attention and directly motivating cooperative action (Fessler &Haley, 2003). For instance, the experience and display of disgust corresponds to the recognition of norm violations and has been shown to lead to avoidance of the disgust-eliciting stimulus in early childhood (Rottman, 2014; Tybur, Lieberman, Kurzban, & DeScioli, 2013). As early as the preschool years, the experience and display of guilt, a complex social emotion, aids in the maintenance of group norms and repairing relationships (Vaish, 2018). While researchers have begun to explore the role, emotions play in children's cooperative behavior, the focus of this exploration has been negative emotions: spite, guilt, and anger (LoBue, Nishida, Chiong, DeLoache, & Haidt, 2009 McAuliffe, Blake, & Warneken, 2014).

The broaden-and-build theory of positive emotions advocates for the importance of positive emotions in human adaptation (Fredrickson, 2004). According to this theory, positive emotions, such as gratitude, broaden an individual's awareness and can inspire novel and varied thoughts or actions (Fredrickson, 2001). Gratitude is the positive emotion one experiences when another person has intentionally given one something of value (McCullough, Kilpatrick, Emmons, & Larson, 2001). As the definition implies, gratitude is more complex than a general positive mood or emotion, such as happiness. Unlike happiness, gratitude relies on more than the positive feeling that arises with a positive outcome, but also requires the appreciation of another's actions (Ortony, Clore, & Collins, 1990). Among adults, gratitude motivates not only direct reciprocity (repaying one's benefactor) but also upstream reciprocity (acting prosocially towards new individuals); it thus not only enhances one's current relationships but also fosters new ones (Barlett & DeSteno 2006a; Barlett & DeSteno 2006b). Moreover, the propensity to engage in upstream reciprocity is predicted by the degree the participant feels a sense of

gratitude, rather than general positive affect, for the help received previously (Bartlett & DeSteno, 2006a; Barlett & DeSteno 2006b, DeSteno et al., 2010; Tsang, 2006, Tsang 2007). However, almost nothing is known about the ontogeny of this function of gratitude. The present studies were designed to examine this question.

More specifically, these studies seek to ask the questions: When might children first engage in upstream reciprocity? Does upstream reciprocity begin at 4 or is it evident earlier? Is early upstream reciprocity only in-kind reciprocity (providing the same resource) or can it be motivated by other prosocial behavior, such as receiving help, as in adults? Is children's upstream reciprocity driven by a gratitude-like mechanism similar to adults? To address these questions, we conducted two studies to investigate the development and motivations behind children's upstream reciprocity behavior. In Study 1, 3- and 4-year-olds played a novel game meant to elicit upstream reciprocity, while limiting the potential for children to provide the same benefit they had received. We asked when in development children begin to engage in upstream reciprocity and whether a more general prosocial behavior can motivate upstream reciprocity. Study 2 examined whether a gratitude-like mechanism motivated children's upstream reciprocity in Study 1.

The general procedure for both studies was as follows: In a between subjects design, children played a purportedly difficult game, in which they had to find a key that was hidden in one of four boxes. The key unlocked a box containing five stickers. Before playing, children received a note from the child who had previously played the game (Sally). Half the children received a helpful note telling them which box the key was hidden in (gratitude condition), whereas the other half received a positive but non-helpful note (positive condition). In the positive condition, the key was hidden in all four boxes ensuring that all children found the key on their first attempt maintaining consistent effort across conditions (assuming children in the

helpful benefactor condition looked in the box specified in the note). Additionally, all children found the key and received the five stickers, ensuring that all children had a similar positive outcome and positive affect and thus controlling for the possibility that children's upstream reciprocity may result from general positivity caused by a positive outcome. Once the key was found the children had the option of sharing stickers with a *new* child (not Sally).

Study 1

In Study 1, 3- and 4-year-olds (n=40 per age group) played the game described above to find a key after having received either a helpful note (gratitude condition) or a non-helpful note (positive condition). We predicted that children who had received help would be more likely to share stickers with the *new* child.

Method

Participants

The study was between-subjects with two conditions (gratitude and positive). Participants were 3-year-olds (n = 40; 18 girls and 22 boys, 20 per condition) between 36 months and 47 months (M = 41 months, 21 days; SD = 110.53 days) and 4-year-olds (n = 40; 20 girls and 20 boys) between 48 months and 59 months (M = 52 months, 11 days; SD = 84.59 days) from a medium-sized Mid-Atlantic city were recruited from a database of families who volunteered to participate in child development studies. Participants were all native English speakers and came from mostly middle-class backgrounds. Of the families that provided information about race (n = 72), 81.9% of the parents were Caucasian. Seven additional 3-year-olds were tested but excluded because of not passing comprehension checks (3), refusal to participate (3), and parents not following instructions (1). Five additional 4-year-olds were tested but excluded because of not

passing comprehension checks (2), refusal to participate (1), parents not following instructions (1), and experimenter error (2).

Materials and Setting

Prior to playing the "key game," each child completed a practice round with the experimenter in the waiting room. The following materials were used during the practice round: orange plastic bin filled with orange foam blocks and cotton balls, timer, and a green crayon. In the subsequent "key game", the child sat at a table at the center of a testing room directly across from the experimenter. The setup is shown in Figure 1.

On the table facing the child was a locked Plexiglas box, which contained five identical stickers. There were differently colored plastic bins (red, green, yellow, and blue) filled with foam blocks and cotton balls in each corner of the room approximately 4 feet from the child. A note "from the previous child who played the game" was written on a 3" by 2.5" note card. In the gratitude condition, the key that unlocked the Plexiglas box was hidden in the colored bin mentioned in the note. In the positive condition, a key was hidden in all four boxes. After the Plexiglas box was unlocked, the children completed an anonymous distribution task in which a white envelope with the child's name was placed 10 inches to the child's right and a green envelope for a "new child" was placed 10 inches to the child's left. Gender for both note writer and sticker recipient were matched to the gender of the participant child.

Procedure

After playing warm up games with the child in the waiting room, the experimenter introduced the components of the practice game. The child was told the actual game they would play had bins similar to the bin in the practice game. The child was shown a green crayon and told that an identical crayon was hidden inside the bin filled with orange foam blocks and cotton

balls. The experimenter set a timer for 8 seconds and the child searched for the crayon. In fact, there was no crayon hidden in the box in order to ensure that children believed that the subsequent game was difficult, and the help received was beneficial. The experimenter asked the children if they had found the key and then commented that the difficulty of the game may be why they had not found the key.

After the practice game, the child was escorted to the testing room for the "key game." The child was seated in a chair facing the locked Plexiglas box in the center of the table. The components of the key game were introduced. All children were familiarized with the components of the game in the same way. First, the experimenter drew the child's attention to the stickers in the Plexiglas box, then he counted the number of stickers and demonstrated that the box was locked. The child was then told that they "would need to play the really hard game we played outside, in order to find the key." The experimenter then drew the child's attention to the four colored boxes around the room and said that the key was hidden in one of those boxes. Starting with the red box, the experimenter asked the child to identify the color of each box moving counterclockwise around the room. Children who could not identify the color of the boxes were excluded from the analyses.

After familiarization with the game components, the experimenter said that the previous child who played the game (Sally) had written a note for the participant child and read the note out loud to the child. The content of the note was different depending on the condition: In the gratitude condition, Sally's note was helpful: "This game was so hard, but I found the key. I really want you to get the cool stickers, so I'll tell you where I found the key. It was in the blue box. You should look in the blue box." In the positive condition, Sally's note was equally positive but not helpful: "This game was so hard, but I found the key. These stickers are so cool. I'm excited that I found the key. I had fun playing the game." After reading out the note, the

experimenter asked the child an open-ended comprehension question about the note ("What did Sally want to tell you?") and two questions about the specifics within the note (gratitude: "Did Sally want you to have these stickers?" and "What box did Sally tell you to look in?" positive: "Did Sally think the stickers were cool?" and "Did sally have fun playing the game?") If children answered incorrectly or could not answer the comprehension questions, the experimenter reread the note. If the note was repeated twice and the children could still not answer the comprehension questions, the child was excluded from the analyses.

Next, the child was given the opportunity to search in whichever box or boxes she wanted. Importantly, the key was always hidden in the appropriate (blue) box in the gratitude condition and hidden in all boxes in the positive condition. This ensured that children had to make a similar amount of effort across conditions (assuming children in the gratitude condition would look in the box specified in the note, which 80% of 3-year-olds and 95% of 4-year-olds did). Once the child found the key, the experimenter extended a hand to request the key and in an excited tone, provided a reminder about the note (gratitude: "You found the key! It was in the blue box just like Sally said." positive: "You found the key! It looks like you had fun just like Sally said.")

After the child returned to their seat at the table, the experimenter unlocked the box and presented the envelopes for the distribution task. A white envelope with the child's name and a blank green envelope for a "new child" were placed on either side of the opened Plexiglas box containing the stickers. Children were told they could keep all of the stickers by putting them in their own (white) envelope, or if they wanted to, they could give any stickers to the new child and to should put those stickers in the green envelope. The child was told it was their decision and the experimenter would step out while they put the stickers away. Comprehension questions were asked to ensure the children understood the intended recipient of each envelope. If the

children could not correctly identify to whom the envelopes belonged, the experimenter corrected the children and repeated the entire distribution task instructions. If the child was unable to answer the comprehension after two reminders of the child was excluded from the analysis. The experimenter then stepped out of the room and the child distributed the stickers. The experimenter used a hidden camera to ensure that children distributed all of the stickers. If the children did not distribute some (or all) stickers the experimenter reentered the room and repeated the task instructions. If the child did not distribute the stickers, the study was ended, and the child was not included in the analyses. To test for in-kind reciprocity, children were given the opportunity to write a note to the *new child*. The experimenter asked the child, "would you like to write a note to next child who is playing the game?" If the child said yes, the experimenter asked what the child would like the note to say and transcribed their message on a 3" x 5" notecard. The note was open ended, and the experimenter wrote down everything the child indicated. Once the note was written or if the child indicated they did not want to write a note this concluded the study. Children were then thanked for playing the game and asked to collect their envelope. Children were then taken to their parents and were given a gift for their participation. The experimental procedure took approximately 10 min.

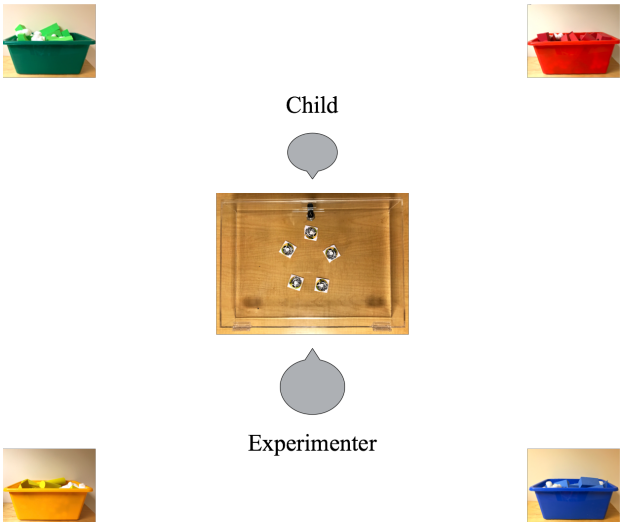


Figure 1. Experimental setup for both conditions.

Coding and Reliability

The primary coder (the first author) used the video recording of the participants to code whether children responded correctly to the comprehension questions and to code whether children gave 0, 1, 2, 3, 4, or 5 stickers to the new child's. A second coder (unaware of condition and hypotheses) coded a randomized 50% of the sample from the videos for both comprehension questions and sticker distributions. Reliability was perfect on for both coding of comprehension questions and number of stickers shared (all κs = 1.00).

The primary coder (the first author) used transcriptions to code the message in the note to next child to play the game. The message of the note was scored 0 if the child chose not to write a note, 1 if the note was not meant to be helpful ("Because I love my mommy"), and 2 if the note was meant to be helpful ("I found the key. I found it in the blue box.").

Results

As preliminary analyses revealed no gender effects, gender was not included in further analyses. All reported p-values are two-tailed. A Mann-Whitney *U* test of 3-year-olds in the gratitude condition (*M = 0.55, SD* = 1.28) and positive condition (*M* = 1.1, *SD* = 1.83) demonstrated no significant effect of condition on the number of stickers shared (*U* = 169, *p* = .285; *Figure 2A*). In contrast, a Mann-Whitney *U* test of 4-year-olds in the gratitude condition (*M = 1.6, SD* = 1.28) and positive condition (*M* = 0.45, SD = 1.83) demonstrated a significant effect of condition on the number of stickers shared (*U* = 113.5, *p* = .008; *Figure 2B*). Secondary analyses using chi-square tests were calculated to examine if there was a difference in the proportion of children choosing to share stickers in each condition. For the 3-year-old children, there was no significant difference in the proportion of children who shared, X^2 (1, *N* = 40) = 1.129, *p* = .288, *V*=.16 (*Figure 3A)*. However, for the 4-year-olds, there was a significant

difference, indicating that a greater proportion of children shared stickers in the gratitude condition than the positive condition, X^2 (1, N = 40) = 6.67, p =.010, V= .41(*Figure 3B)*.

Chi-square tests were calculated to determine if there was a difference in the types of notes children chose to leave in each condition. For both 3-year-olds and 4-year-olds, there was no significant difference in the proportion of children who chose to leave a particular type of note (both *ps > .11).*

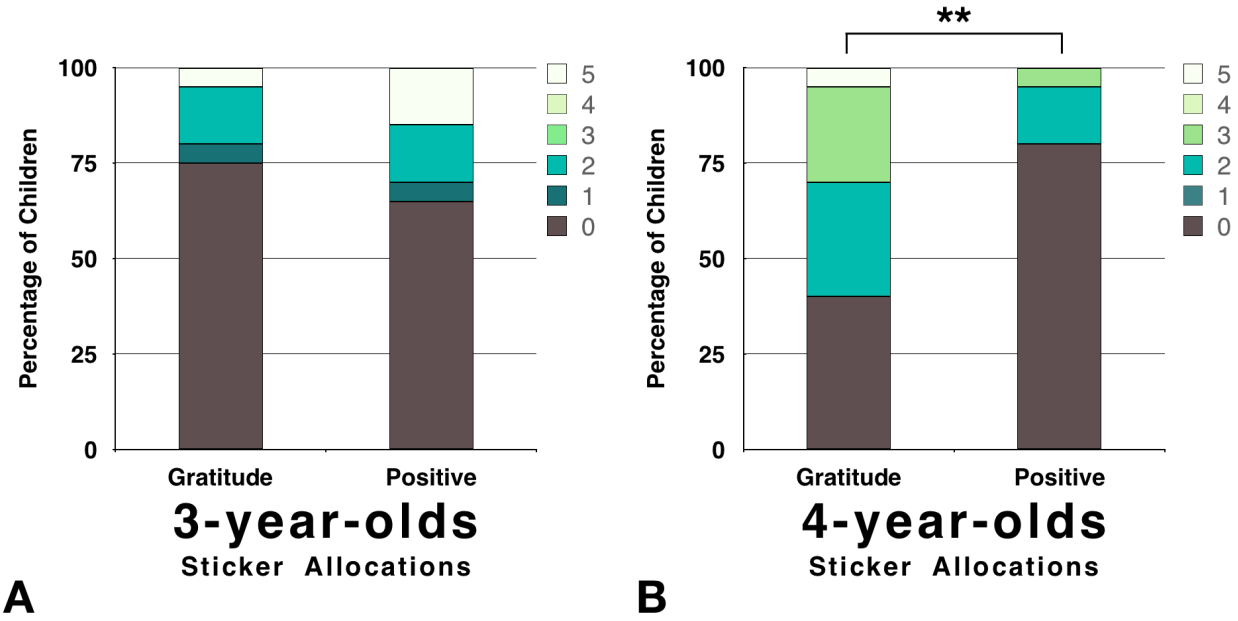


Figure 2. Percentage of 3-year-olds (A) and 4-year-olds (B) in Study 1 who shared a given number of stickers.

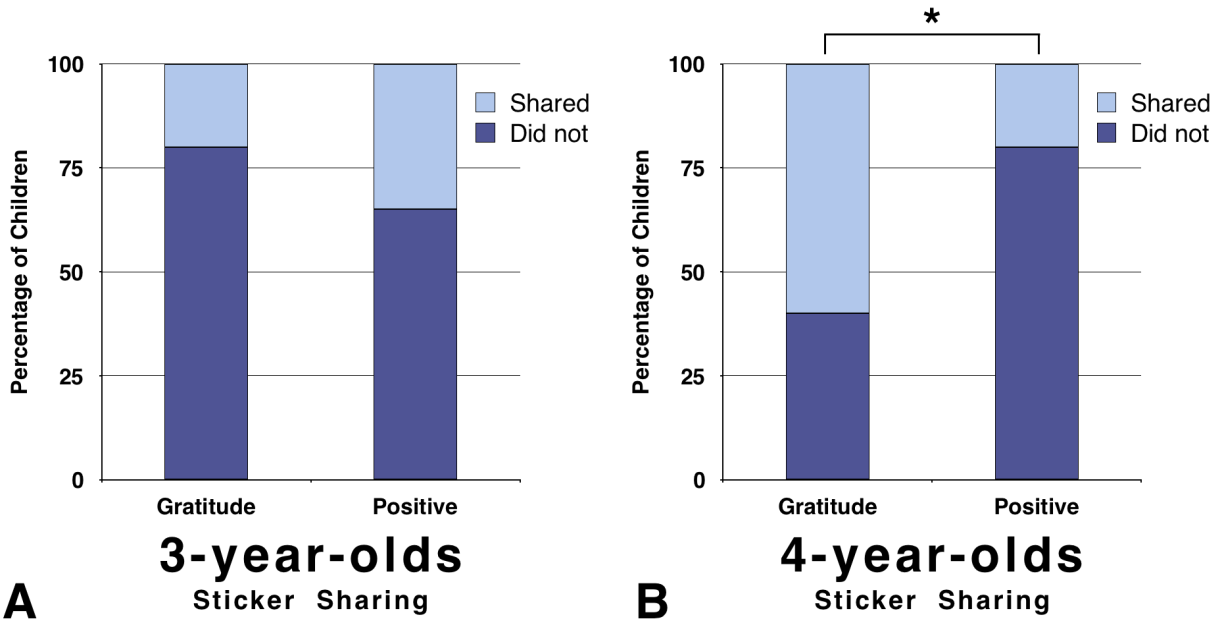


Figure 3. Percentage of 3-year-olds (A) and 4-year-olds (B) in Study 1 who chose to share any stickers.

Discussion

We examined whether children's early upstream reciprocal behavior can be motivated by other forms prosociality different from the outcome distributed, such as receiving help from a benefactor. Additionally, we investigated when children may begin to engage in upstream reciprocity. Using a novel paradigm, we tested 3- and 4-year old children to determine the ontogeny of upstream reciprocity and what may motivate this form of reciprocity. We found that 4-year-olds, but not 3-year-olds, are more likely to share resources and share more resources with a new person when they have previously received help from someone. These results suggest that children begin to engage in upstream reciprocity from around the age of 4.

Prior work with adults had demonstrated that individuals who are the recipients of another's positive actions are more likely to pay forward that kindness and prosocially engage with a stranger (Bartlett & DeSteno, 2006b; DeSteno et al., 2010). Furthermore, research has indicated that adult upstream reciprocal behavior is motivated by a sense of gratitude and not

encouraged by general positive affect alone (Bartlett & DeSteno, 2006a, 2006b; Tsang, 2006, 2007). Importantly, the novel paradigm utilized here begins to address the role that affect may play in children's upstream reciprocity. Since children in both conditions received the same positive outcome (finding the key and receiving the stickers) after investing similar effort, children in both conditions should have experienced similar levels of positive affect; it is thus unlikely that it was positive affect alone that motivated children's higher sharing in the gratitude condition. Rather, the four-year-olds' prosocial behavior seems to have been motivated by the help provided to them by the previous child who played the game.

In Study 1, 4-year-olds who received help from one individual were more likely to act prosocially towards another individual. Though this upstream reciprocity could not be due to positive affect alone, it remains unclear if it is motivated by a gratitude-like mechanism, as is found in adults. The critical question of whether emotion might be encouraging children's upstream reciprocity was addressed in Study 2.

Study 2

The evolutionary success of humanity has been driven by skills, cognitive mechanisms, and emotional responses that make cooperation within large groups of genetically unrelated individuals possible. These emotional responses are subjective evaluations (automatic and unconscious, or controlled and deliberate) of events, agents, and objects. It is these evaluations that distinguish one emotion from another (Clore & Ortony, 2013). It is possible to use these appraisals and their requisite situational components (i.e., consequences of events, actions of agents, and aspects of objects) to better identify the emotion that may be driving children's upstream reciprocity.

One potential emotion that might be motivating upstream reciprocity is gratitude. Gratitude is the positive emotion one experiences when another person has intentionally given

one something of value (Wood, Maltby, Stewart, Linely & Joseph, 2008). Gratitude is a complex emotion, that according to the OCC model, involves the beneficiary (recipient of the benefit) positively evaluating specific situational components (Ortony, Clore, & Collins, 1990). Specifically, the beneficiary is pleased with the personal outcome of the situation and approves of the benefactor's actions, which lead to positive evaluations of the benefactor (Uhlmann, Pizarro, & Diermeier, 2015). It is the simultaneous positive appraisals of the benefactor's actions and the outcome that causes the emotional experience of gratitude.

Research has established the important role gratitude plays in cooperation. Computational models of cooperation have shown that the emotion of gratitude is a key component in reinforcing and increasing cooperative behavior through stimulating upstream reciprocity (Nowak & Roch, 2007). In adults, behavioral research has demonstrated that after having received help, individuals are more likely to engage in upstream reciprocity and that likelihood is contingent on individuals having felt a sense of gratitude (Bartlett & DeSteno, 2006a; Barlett & DeSteno 2006b, DeSteno et al., 2010; Tsang, 2006; Tsang 2007).

Little is known about the development of gratitude. Research on gratitude has found that 7-year-old children display expressions of gratitude in order to engage and connect with a benefactor (Wang, Wang, & Tudge, 2015). As early as 6 years of age, children begin to incorporate mental state information of both the benefactor and beneficiary into their understanding of gratitude (Poelker & Kuebli, 2014). By age 5 years, children begin to understand the situational properties of gratitude in a third-person context. For instance, when asked about emotional vignettes children associated gratitude with both a positive emotional experience and positive feelings for the benefactor (Nelson, Beatriz de Lucca Freitas, O'Brien, Calkins, Leerkes, & Marcovitch, 2013). These studies focus on children's understanding of

gratitude but the developmental trajectory and causes of children's experience of gratitude and its function in cooperation remains unclear.

In Study 2, we operationalized gratitude according to its evaluative components, namely, the concurrent positive evaluation of the outcome and the benefactor (Ortony et al., 1988). In particular, we asked the children questions about their evaluations of the outcome, as well as their preference for and evaluations of the person who had written them a note. Similar to Study 1, we predicted that children in the gratitude condition should be more likely to share stickers and share more stickers than children in the positive condition. Crucially, if children's upstream reciprocity is motivated by the situational factors related to gratitude, then we should see positive evaluation of both the outcome and the individual who provided the help. Due to the similarity in outcome and effort between the positive and gratitude conditions, the two conditions should show no difference in their ratings of happiness and reasons for happiness. On the other hand, children in the gratitude condition should endorse more positive attributes to the person who provided them help and these positive evaluations should predict the number of stickers the children choose to share.

Method

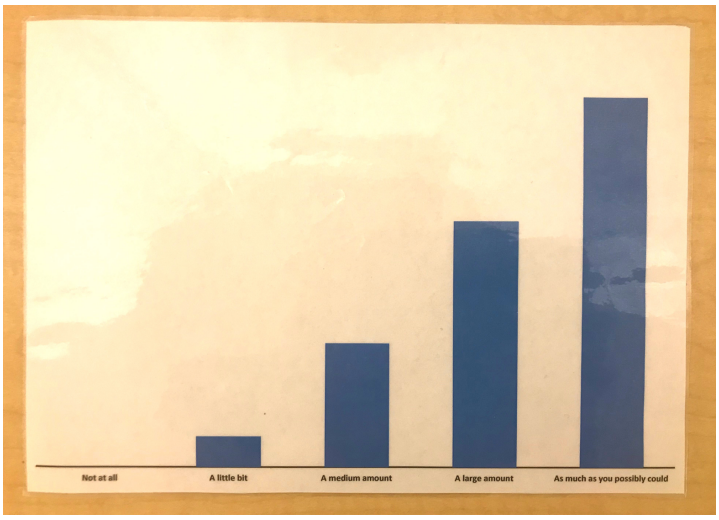
Participants

Due to the 3-year-olds showing no effect of condition in Study 1, only 4-year-olds were tested in Study 2. A power analysis using the effect size for 4-year-olds obtained in Study 1 (*Cohen's d= 0.916)* indicated that a sample size of 46 would be sufficient to detect a significant effect for Study 2 with a power of .80 and an alpha of .05. We adjusted the number of participants accordingly for Study 2. Participants in Study 2 were thus 46 4-year-olds (25 girls and 21 boys) between 47 months 29 days and 59 months (M = 51 months 28 days, SD = 105.81 days). Six additional children were tested but excluded because of not passing comprehension

checks (3), refusal to participate (2), and experimenter error (1). Participant recruitment, the samples ethnicity, and socioeconomic backgrounds were the same as in Study 1. The same experimenters played the same roles as in Study 1.

Materials and Settings

The materials in Study 2 were the same as Study 1 with a few additions. In between the practice round and the key game, children were familiarized with a response scale based on the work by McLoughlin, Tipper, and Over (2016), who used it to assess 5- to 6-year-old children's perception of humanness of out-group faces. The adapted response scale was a bar chart with five bars representing 'Not at all', 'A little bit', 'A medium amount', 'A large amount', and 'As much as possible' (see *Figure 4A*). The scale was first used in the familiarization stage to identify differing liquid measurements (see *Figure 4B*). Children in our study also used the scale to answer questions during the key game about their positive affect and their evaluations of the note writer.



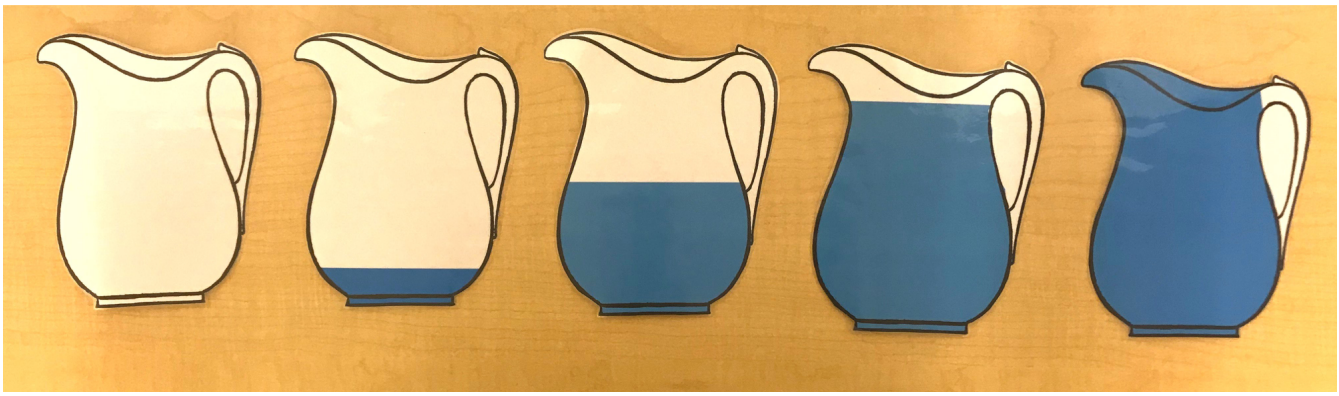


Figure 4. Response scale (A) and "jugs of juice" used for scale familiarization (B) in Study 2.

Procedure

As in Study 1, the child sat across the table from the experimenter. The child was then introduced and familiarized with the response scale. In sequential order, the experimenter pointed to each item on the scale explaining what each bar in the graph represented. Then the children were trained on the response scale by being asked to make judgments about simple liquid measurements (see *Figure 4B*). The experimenter next randomly presented the child with one of the five pictures of jugs filled with juice that directly correlated with different amounts on the scale. The experimenter then asked the child to point to the bar that represented how much juice was in each jug. At the end, one of the jugs was repeated to ensure that children understood that their answers on the scale could be repeated. Next, the children were asked to use the scale to discuss different preferences (favorite/least favorite food) and activities they might want to participate in (clean their room/draw a picture) to verify the children could use the scale for more abstract prompts. According to our pre-specified inclusion criteria, children who made more than two errors during the scale training were excluded from analyses.

The scale was then placed under the table and the child played the "key game" as in Study 1. Once the child found the key but before unlocking the box, the experimenter placed the

response scale in front of the child and asked her to indicate how happy she felt ("how happy are you?" and "why do you feel happy?"). The child was then asked to justify why she was happy. The box was then unlocked, and as in Study 1, the child was given the opportunity to share stickers with a new child while the experimenter was outside the room. When the experimenter returned, the child was asked a series of questions about the note writer (Sally). The first question gauged the child's preference for Sally ("Whom you would rather play with? The girl who wrote you the note or the girl you could share stickers with?"). Next, the child was asked to evaluate the character of Sally ("Do you think Sally is good, bad, or just ok?"). The order of 'good,' 'bad,' and 'just ok' were counterbalanced across children. Finally, the child was asked if she would like to write a note to Sally. Given that we found evidence of generalized (not just in-kind) upstream reciprocity in Study 1, we no longer included the note to new child; instead, we used the note task to see how children felt about/responded to Sally. If the child said they would like to write a note, the child dictated the note to the experimenter, who wrote what the child said onto a 3" x 2.5" notecard. The note was open ended, and the experimenter wrote down everything the child indicated. Upon completion of the note or if the child did not want to write a note, the study was finished. As in Study 1, children were then thanked for playing the game and taken to their parents in the waiting room where they were given a gift for their participation. The experimental procedure took approximately 25 min.

Coding and Reliability

The primary coder (the first author) used the video recording of the participants to code whether children responded correctly to the comprehension questions and to code whether children gave 0, 1, 2, 3, 4, or 5 stickers to the new child's. A second coder (unaware of condition and hypotheses) coded a randomized 50% of the sample from the videos for both comprehension

questions and sticker distributions. Reliability was perfect on both coding of comprehension questions and number of stickers shared (all κs = 1.00).

To determine whether children differed in their reasons for happiness between condition, the primary coder (the first author) used transcriptions to code the justifications for happiness ("why do you feel happy?") and the language of the note to Sally. The justifications for happiness were scored 0 if no justification was given ("I don't know"), 1 if the answer was not game related ("Because I love my mommy"), and 2 if the answer was related to the outcome of the game ("Because I found the key" or "Because I get the stickers").

The language of the note was coded to investigate whether condition impacted the way children chose to interact with the letter writer. The language of the note was scored both for affiliative language ("I love you. Let's make a heart because you're my best friend") and appreciative language ("Thanks for helping me"). The affiliative language was scored 1 if no note was written or if the note was not affiliative ("Lucie found the key") and 2 if the note used affiliative language. The appreciative language was coded 1 if no note was written or the note contained no appreciative language ("I found the key") and 2 if the note included appreciative language. The second coder scored the same randomized 50% of the sample for the justifications of happiness and language of the note. Reliability was perfect for the justifications of happiness, as well as the affiliative language and appreciative language of the note (all κs = 1.00).

Results

Sticker Sharing

As preliminary analyses revealed no gender effects, gender was not included in further analyses. All reported p values are two-tailed. As in Study 1, a Mann-Whitney *U* test of 4-year-olds in the gratitude condition (M = 1.57, SD = 1.65) and positive condition (M = 0.48, SD = 0.89) demonstrated a significant effect of condition on the number of stickers shared (U = 159.5,

p = .011; *Figure 5A*). A secondary analysis using a chi-square test was calculated to examine if there was a difference in the proportion of children choosing to share stickers in each condition. The results indicated that a significantly greater proportion of children shared stickers in the gratitude condition than the positive condition, X^2 (2, N = 46) = 5.66, p = .017, V = *.35* (*Figure 5B)*. Thus, we replicated the results of Study 1 demonstrating that children who have received help are more likely to act prosocially towards a new individual than children who have not received help.

Positive Affectivity

As expected given that children in both conditions had identical positive outcomes, the Mann-Whitney U test of the happiness ratings in the gratitude (M = *4.52, SD* = 0.73) did not demonstrate a significant effect of condition on the number of stickers shared (U= 216.5, p = .17). Children's reasons for their happiness were analyzed using a chi-square test. Again, aligned with our hypotheses, the chi-square test demonstrated no significant relationship between condition and the reason for children's happiness, X^2 (2, N = 46) = .523, p = .77 V = .11 *(See Table 1)*. These results suggest that children's sharing behavior was not motivated by general positivity or positive affect alone, but rather motivated by additional situational components.

	No Justification (0)	**Not Game Related** (1)	**Game Related** (2)
Gratitude	13 (3)	26.1 (6)	60.9 (14)
Positive	2.7 (2)	34.8 (8)	56.5 (13)

Table 1. The values represent the percentage of children (raw numbers in parentheses) who provided no justifications for their happiness (score of 0), a happiness justification not related to the key game (score of 1), or a happiness justification related to the key game (score of 2).

Evaluations of Note-writer

A chi-square test was used to examine whether there was a difference across conditions in the proportion of children who preferred to play with Sally versus the new child. This revealed a marginally significant effect of condition, X^2 (1, N = 46) = 3.29, p =.07, V = *.27* with children

in the gratitude condition preferring Sally more often (74%) than children in the positive condition (48%). Further, a Mann-Whitney U test indicated a significant difference across conditions in children's evaluations of Sally, with children in the gratitude condition evaluating her more positively than those in the positive condition (Mann-Whitney $U = 168.5$, $p = .011$; *Figure 5C*).

A negative binomial regression with a link function was calculated (which accounts for the count structure of the sticker distribution) to test if condition and character evaluation correlated significantly with the number of stickers shared. This yielded main effects both for character evaluation and condition but no character evaluation by condition interaction (Akaike's Information Criterion [AIC] = 124.787; all p-values < 0.04). This indicates that both condition and the character evaluations significantly predicted the number of stickers children shared.

Note Data

Of the children who played the key game, 89% chose to write a note to Sally (gratitude: 100%; positive: 80%). Two chi-square tests were performed to assess whether there was a difference across conditions in the proportion of children who used affiliative (e.g., "I want to be your friend.") and appreciative language (e.g., "Thank you for helping me.") in their note to Sally. The first chi-square test demonstrated no relationship between condition and the frequency of children's affiliative language in their note, X^2 (1, $N = 46$) = .087, p =.768, $V = .04$. The second chi-square demonstrated a marginally significant relationship between condition and the frequency of children's use of appreciative language, X^2 (1, $N = 46$) = 3.067, p =.08, V = .26 with children in the gratitude condition using appreciative language more often (21.7%) than children in the positive condition (4.3%).

	No Affiliative Language (1)	**Affiliative Language** (2)
Gratitude	78.3 (18)	21.7 (5)

Positive	95.7 (22)	4.3 (1)

Table 2. The values represent the percentage of children (raw numbers in parentheses) whose note to Sally did not use affiliative language (score of 1) or used affiliative language (score of 2).

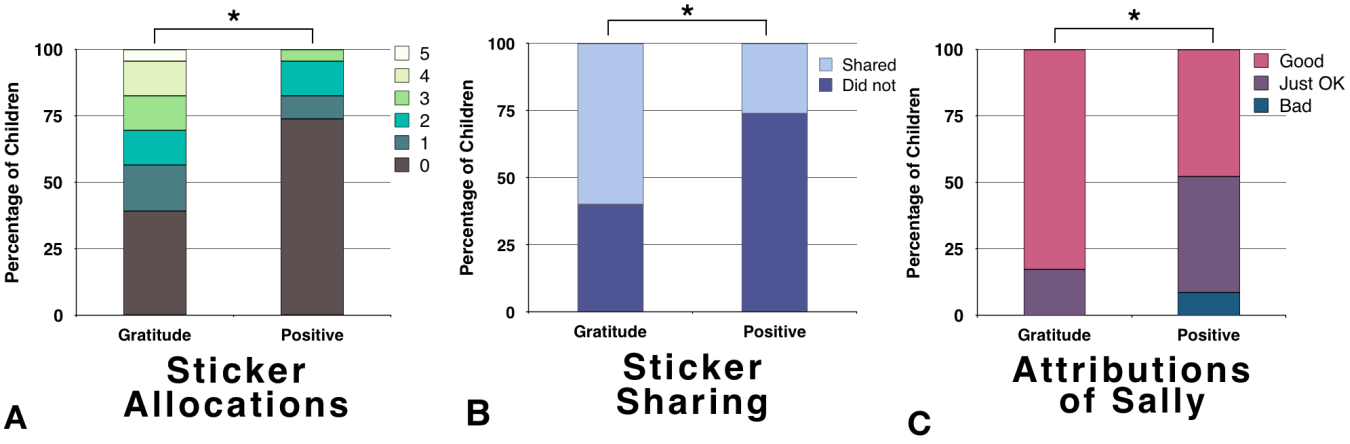


Figure 5. (A)Percentage of 4-year-olds in Study 2 who shared a given number of stickers. (B) Percentage of 4-year-olds in Study 2 who chose to share any stickers. (C) Percentage of children attributing negative, neutral or positive qualities to note writer.

Discussion

Replicating Study 1, 4-year-olds in the gratitude condition were more likely to share stickers and shared more stickers with the new child than those in the control condition. As expected given the similarity in outcomes and effort between conditions, the children's ratings of happiness and reasons for happiness did not differ. Importantly, however, the children in the gratitude condition were more likely to attribute positive qualities to their benefactor (Sally). Moreover, the positive evaluations of Sally were marginally predictive of the number of stickers children shared. These findings suggest that children's upstream reciprocity may not be driven by positive affect only but also by the attributional component of positive evaluation of those who have provided a benefit.

Study 2 contributes to the cooperation literature, as it is the first to suggest that as early as 4 years, children's cooperative behavior may be motivated by a gratitude-like mechanism, as

indicated by children's positive evaluations of both the outcome and the benefactor. Study 2 aligns with previous adult research that has demonstrated the vital role gratitude plays in upstream reciprocal behavior, which motivates the propagation and evolution of cooperation in groups (Bartlett & DeSteno, 2006b; DeSteno et al., 2010; Nowak & Roch, 2007). By the age of 4 years, children may be experiencing the emotional reactions that aid cooperation.

General Discussion

The present studies demonstrate that young children's upstream reciprocity is motivated by receiving help from another individual. Extending the work of Leimgruber and colleagues (2014), Study 1 found that 4-year-olds, but not 3-year-olds, showed evidence of upstream reciprocity. These results begin to highlight the developmental trajectory of upstream reciprocity. By controlling for outcome, Study 1 further improves upon the work of Leimgruber and colleagues by demonstrating that children's upstream reciprocity can be motivated by more than paying forward that same resource received ("give what you get" strategy); rather children take other's kindness into account when engaging in upstream reciprocity.

It could be argued that children's upstream reciprocity may be motivated by a general positive affect. However, adult research has demonstrated that upstream reciprocity requires a sense of gratitude and is not motivated by positive affect alone (Bartlett & DeSteno, 2006a; Bartlett & DeSteno, 2006b; Tsang, 2006; Tsang 2007). In these studies, children's outcomes and efforts were consistent between conditions, ensuring similar positive affect across conditions. Moreover, children's endorsement of similar levels of and reasons for their happiness speaks against the possibility that positive affect alone motivates upstream reciprocity. Consistent with the adult literature on upstream reciprocity, the results of Study 2 indicate that children's upstream reciprocity is not motivated by positive affect alone, as 4-year-olds in that study took the important situational components of gratitude into account when engaging in upstream

reciprocity (Bartlett & DeSteno, 2006b; DeSteno et al., 2010; Ortony et al., 1990). Thus, by 4 years of age, a gratitude-inducing situation (receiving help) motivated upstream reciprocity. Moreover, receiving help increased children's positive evaluation of the helper, and this positive evaluation was related to their upstream reciprocity, providing evidence for a gratitude-like mechanism. This suggests that gratitude may serve to enhance cooperation from early in development.

One alternative motivator for the upstream reciprocity found in these studies could be a sense of indebtedness, or normative expectation of returning a favor. Indebtedness is a negative experience that generates aversive long-term relational outcomes and motivates negative evaluations of the benefactor (Greenberg & Shapiro, 1971; Greenberg, 1980). Indebtedness is motivated by the beneficiary's understanding of the intentions of the benefactor, in particular whether the intentions were malevolent or involved an expectation of reciprocity (Tsang, 2006; Tsang 2007). Interestingly, adult's experiences of gratitude are direct results of the benefactor's intentions and not solely the benefactor's responsibility in the outcome (McCullough, Kilpatrick, Emmons, & Larson, 2001; Tesser, Gatewood & Driver, 1968). Furthermore, indebtedness is thought to motivate direct reciprocity, paying back a kindness, and not contribute to the more generalized reciprocal behavior of upstream reciprocity (Peng, et al., 2017). It is the understanding of the benefactor's intentions that motivates the individual to either feel the positive emotion of gratitude or the negative emotion of indebtedness, each of which has a related but distinct role to play in social exchange (Gray, Emmons, & Morrison, 2001; Peng, Nelissen, & Zeelenberg, 2017; Tsang, 2006; Tsang 2007). In both studies, the benefactor's intention was benevolent, hoping to help the child find the key and earn the stickers, suggesting that indebtedness may not be motivating children's upstream reciprocity. We argue that the positive affect and positive evaluations of the benefactor in Study 2 limit the possibility of

indebtedness being a motivating factor, due to indebtedness being a negative experience that leads to negative evaluations of an individual (Greenberg & Shapiro, 1971; Greenberg, 1980). Further work is necessary to understand the complexity of situational information that is influencing children's upstream reciprocity and how other emotions may contribute to reciprocity in children.

A limitation of the current studies is that children had to give up a portion of their stickers in order to donate them to the next child. Therefore, these results can be generalized to how gratitude influences children's donation behavior but perhaps not to children's general resource distribution. Further work is needed to know how gratitude may impact additional economic decision making beyond donation behavior.

Our results are further limited to gratitude's relationship to children's sharing with an anonymous peer and may not be generalizable to face-to-face interaction with their peers. Numerous authors have observed that anonymity influences children's sharing behaviors, such that children who give anonymously give less than children who feel their behavior is being monitored (Englemann & Rapp, 2018; Fujii, Takagaishi, Koizumi, & Okada, 2015; Takagishi, Fujii, Koizumi, Schug, Nakamura, & Kameshima, 2015; Vaish, Kelsey, Tripathi, & Grossmann, 2017). It is possible that face-to face interaction may impact the propensity for children to act generously. We would anticipate that the presence of a peer may affect children in the gratitude condition but would have a more significant effect in the positive condition by increasing children's propensity to act generously.

A final limitation is that these studies only address the gratitude experienced when the benefit is desired and provided intentionally. The level of gratitude experienced is directly related to the cost to the benefactor, the intentions of the benefactor, and the desirability of the outcome (McCullough et al., 2001; Poelker & Kuebli, 2014; Tsang, 2006; Tsang 2007). These

results only begin to address the complexity of children's experience of gratitude. More research must be conducted in order to better grasp how differing levels of gratitude may impact upstream reciprocity.

Although we tested the impact of gratitude on children's reciprocal behavior, we acknowledge that other strategies, emotions, and feelings may motivate children's reciprocal behavior. Our results do not attempt to counter the possibility of a "give what you get" strategy, but rather indicate that children's early upstream reciprocal decisions also appear to be influenced by other's prosociality that is distinct from the resource that is paid forward (Leimgruber et. al., 2014). Our results suggest that children's upstream reciprocity is related to their positive evaluation of another's involvement in the outcome. Overall, these results indicate that from early in development, children engage in upstream reciprocity and thus actively expand their realm of cooperation to new partners.

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