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Extrinsic Rewards Diminish Costly Sharing in 3-Year-Olds

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Two studies investigated the influence of external rewards and social praise in young children's fairness-related behavior. The motivation of ninety-six 3-year-olds' to equalize unfair resource allocations was measured in three scenarios (collaboration, windfall, and dictator game) following three different treatments (material reward, verbal praise, and neutral response). In all scenarios, children's willingness to engage in costly sharing was negatively influenced when they had received a reward for equal sharing during treatment than when they had received praise or no reward. The negative effect of material rewards was not due to subjects responding in kind to their partner's termination of rewards. These results provide new evidence for the intrinsic motivation of prosociality—in this case, costly sharing behavior—in preschool children.

Children begin to behave prosocially very early in development. Studies have documented infants' tendencies to comfort or help others in need (e.g., Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011; Liszkowski, Carpenter, Striano, & Tomasello, 2006; Warneken & Tomasello, 2006) as well as toddlers' inclination to share resources equally with others in collaborative situations (Hamann, Warneken, Greenberg, & Tomasello, 2011; Warneken, Lohse, Melis, & Tomasello, 2011). The fact that prosocial behavior emerges so early and irrespective of any benefits or encouragement from adults (e.g., Warneken & Tomasello, 2006, 2013a) suggests that infants have a natural bias toward prosocial behavior (Eisenberg, Fabes, & Spinrad, 2006; Warneken & Tomasello, 2009).

Interestingly, intrinsic motivation can be undermined by external incentives, which is known as the *overjustification effect* (Deci, 1971; Deci, Koestner, & Ryan, 1999; Lepper, Greene, & Nisbett, 1973). This effect is an implication of self-perception theory (Bem, 1972), proposing that a person's inference about their own behavior is based on the perception of sufficient external contingencies. If individuals are induced to engage in an activity in order to receive a reward, they often conclude that their actions were primarily motivated by the external incentive rather than by any intrinsic interest in the activity itself (Lepper, 1981; Lepper et al., 1973). Another possibility is that they perceive the external reinforcement as a coercive force, controlling or bribing their behavior (Deci, 1975). As a result, the new extrinsic motivation replaces the initial intrinsic motivation, so that when the extrinsic reward is no longer forthcoming, the motivation for the activity decreases.

In a seminal study of the overjustification effect in children, Lepper et al. (1973) investigated preschoolers' intrinsic motivation to perform a drawing task. Children were assigned to one of the three conditions in which they (a) expected a reward for performing the task, (b) received a reward unexpectedly afterward, or (c) neither expected nor received a reward. Only children who expected and eventually obtained a reward were less motivated to continue drawing afterward. Crucially, children's intrinsic interest in drawing remained stable and did not differ between conditions in which subjects received an unexpected reward or no reward at all. This finding has been repeatedly replicated with preschool as well as elementary school children using different tasks and reward types (Boggiano & Ruble, 1979; Dollinger & Thelen, 1978; Fabes, Eisenberg, Fultz, & Miller, 1988; Greene & Lepper, 1974).

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Evidence for the undermining effect of extrinsic rewards particularly on prosocial behavior derives from studies addressing helping behavior in children (Fabes, Fultz, Eisenberg, May-Plumlee, & Christopher, 1989; Warneken & Tomasello, 2008). It has been shown that 20-month-old infants already are less likely to engage in further helping if they have received a material reward in a previous treatment phase as compared to infants who received praise or no reward at all (Warneken & Tomasello, 2008). These findings support the claim that even the earliest altruistic acts like helping behavior in young children are intrinsically motivated rather than socialized via material rewards.

By contrast, social rewards such as praise that communicate positive competence information are conceived as having either no or a positive effect on children's intrinsic motivation (e.g., Anderson, Manoogian, & Reznick, 1976; Danner & Lonky, 1981; Henderlong & Lepper, 2002). Addressing prosocial behavior in particular, Grusec and Redler (1980) studied 5- to 8-year-old children's willingness to donate part of their winnings from a game to poor children. They found that subsequent donations were increased if the children had been praised for their behavior or for their helpful personality earlier as compared to children who had received no reinforcement at all.

To our knowledge, there has been no study examining the effects of material rewards and praise on sharing behavior specifically. In the current two studies, therefore, we investigated the influence of material and verbal rewards on children's fairness-related behavior. Fairness was operationalized by children's willingness to share resources generously with others at some cost to themselves in three different situations (sharing after collaboration, sharing after windfall, and sharing in a dictator game scenario).

In the treatment phase, children were paired with a puppet and learned to retrieve marbles by collaborative work. "Accidently," marbles were distributed unequally, such that the child received three but the puppet only one marble. Based on previous findings, children were expected to often give one marble to the puppet and thus to equalize the outcome (Hamann et al., 2011). Crucially, children were randomly assigned to one of the three conditions that differed in the puppet's (Study 1) or the experimenter's (Study 2) response to their sharing: offering a material reward, providing verbal praise, or a neutral response. In the test phase, we observed children's subsequent sharing behavior if they received no reinforcement anymore. Furthermore, we administered a second test in which child and puppet faced another unequal resource distribution, although this time resources were provided by windfall rather than by collaboration. A third test used the dictator game paradigm, such that only the child received a number of valuable items and decided whether to share any of them or not.

If young children are intrinsically motivated to treat a collaborative partner fairly and to share resources equally, receiving material rewards should undermine this intrinsic inclination relative to children receiving no rewards at any time. In contrast, receiving praise should sustain or increase children's willingness to engage in costly sharing. Consistent with related work on helping behavior (see Warneken & Tomasello, 2008), this finding would provide further evidence for the intrinsic motivation of prosocial behavior. Furthermore, by studying this effect in three different yet related sharing tasks (collaboration, windfall, dictator game), we aim to make statements about the generalizability of the effect.

Study 1

Method

Participants

We tested forty-eight 3-year-old children (24 girls, 24 boys; age range 36 months and 0 days to 48 months and 30 days; M = 42 months and 22 days). All subjects were native German speakers, were recruited in urban day-care centers in a middle-sized town in Germany, and came from mixed socioeconomic backgrounds. Four additional children were tested but excluded from final analysis because they did not pass criterion to proceed to the test phase (see Procedure). Data were collected in the fall of 2013.

Design

Each child underwent a treatment and a test phase. For the treatment phase, children were randomly assigned to one of the three conditions (baseline/praise/reward; n = 16 per condition). The test phase was nearly identical for all conditions and consisted of three consecutive sharing tasks (collaborative task, windfall task, and dictator game task).

Procedure

Children were tested in a quiet room in their daycare centers. All testing was done by one female

experimenter who explained and structured the game (E1) and another female experimenter who operated a 25-cm tall bee hand doll ("Bella" for girls, "Eddie" for boys). We used a puppet to be able to control and determine their reaction in cases of an unfair resource distribution. Each session was videotaped and lasted about 25 min.

Demonstration 1. Child and puppet were placed opposite each other and introduced to two special boxes representing hungry marble monsters that needed to be fed with marbles. In order to make the marbles more valuable, we created a slightly competitive setting by telling participants that whoever feeds their monster best is going to win the game. More marbles were visible but not directly reachable inside an apparatus. Child and puppet learned that they had to pull two ends of a single, long rope simultaneously to move a large block closer, which then caused four marbles to roll toward two access holes, such that two marbles rolled to the child's side and two to the puppet's side (see Figure 1a, for details on the mechanism and the setup). This procedure was repeated once with E1 absent. All subjects successfully handled the apparatus and proceeded to the next phase. Unless otherwise noted, all subsequent treatment and test trials were performed in E1's absence. For trials employing the apparatus, this involved E1 sending child and puppet out of the room in order to bait the apparatus with new marbles. E1 then sent them back to play with the apparatus while she waited outside until the end of the trial.

Treatment. The treatment phase consisted of three trials in which the apparatus was manipulated such that marbles were "accidentally" allocated unequally, with the child receiving three and the puppet receiving just one marble (Figure 1b). It was assured that children attended to the unequal outcome by the puppet alternating her gaze between the two access holes. The puppet's subsequent behavior varied between conditions.

In the *baseline condition*, the puppet communicated her desire for children's items with a series of progressively more explicit cues in fixed time intervals, starting with state description ("I only got one marble."), followed by begging ("I want to have as many marbles as you."), and finally, direct request ("Will you give me one?"). The puppet stopped addressing the child as soon as the child shared a marble.

In the *praise condition*, the puppet's behavior was exactly the same as in the baseline condition, only that when the child had shared a marble, the puppet reacted enthusiastically and praised the child for doing so ("Oh, thank you for sharing a marble with me. That was really nice of you."). In both conditions 50% of children shared either spontaneously or after the puppet's state description in the very first trial, rising up to 95% in the two subsequent trials.

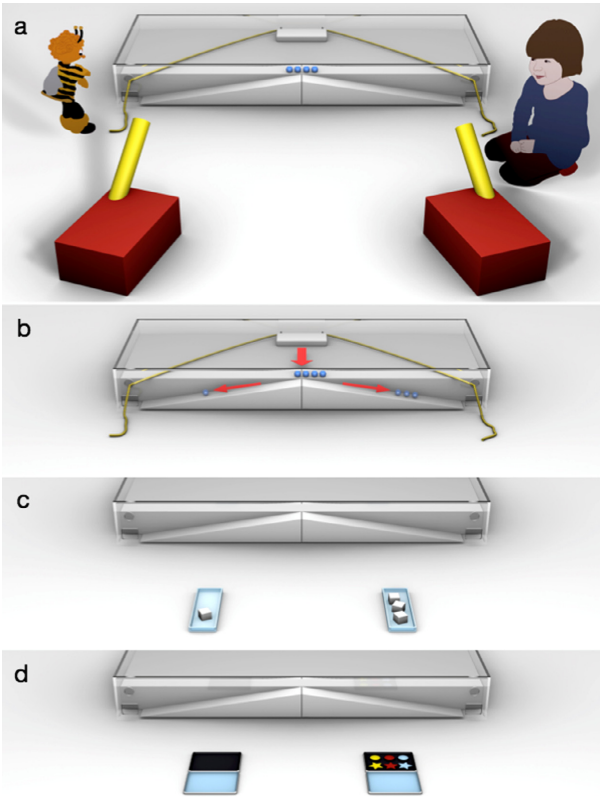

Figure 1. Study setup and material. (a) Experimental setup and apparatus with relocation mechanism used for demonstration. Child and puppet sat opposite to each other with the apparatus in between. "monster boxes" to collect marbles were placed on the ground next to them. The apparatus was adapted from studies with chimpanzees (e.g., Hirata & Fuwa, 2006) and children (Hamann et al., 2011; Warneken et al., 2011), and consisted of a transparent box (120 × 50 × 15 cm) in which four marbles were placed on a little plate in the middle. Child and puppet had to pull both ends of a rope simultaneously to move a block closer to move the marbles such that they would roll down to the access holes. Two marbles rolled to either side. (b) Apparatus with relocation mechanism used in the treatment phase and collaboration test. One marble rolled to the side of the puppet, and three marbles rolled to the child's side. (c) Setup of the windfall test. Child and puppet received an unequal number of dice. (d) Setup of the dictator game test. E1 assigned one sticker box containing six stickers to the child, and an empty box to the puppet.

In the *reward condition*, the puppet started out the same way as in the other conditions, that is, with gaze alternation and the state description verbalization. Importantly, according to the overjustification effect, the reward has to be expected and

therefore offered *before* children engage in the activity (Lepper et al., 1973). Accordingly, the puppet now presented a transparent box full of gifts. She offered one to the child while she outstretched her other hand palm up ("If you share a marble, I will give you this gift."). Gifts were a colored balloon (Trial 1), a rubber bracelet (Trial 2), and an animal shaped eraser (Trial 3). Children collected their gifts in a little transparent bucket, where they remained visible until the very end of testing.

In order to enter the test phase, children were required to share one marble in all three trials. This criterion was established to assure that children where naturally motivated to share in the first place. Four subjects refused to give up a marble in at least one trial and were thus excluded from further testing.

Interlude. One interlude trial was conducted between treatment and test phase to illustrate that refusing the share would not have any negative consequences. This time, E1 and the puppet operated the apparatus together, whereas the child was watching, pretending that the apparatus had a malfunction that needed to be fixed. E1 received three, whereas the puppet received only one marble. E1 then took all three marbles and threw them directly in the child's monster box, happily stating "Oh look! Great! I got three marbles. I am feeding your monster with them." Meanwhile, the puppet remained quiet but alternated her gaze between her and E1's marbles. In the following, the apparatus was handled by child and puppet as usual.

Test 1 (collaboration). In the first test, child and puppet continued to operate the apparatus employing unequal marble allocations over three trials (Figure 1b). This time the puppet showed no verbal reaction but still alternated her gaze between the two access holes; only in the reward condition the puppet stated that she was not going to give another gift, although there were obviously plenty of gifts left in the box. This was to make sure that children were fully aware of the fact that the puppet was unwilling rather than unable to make any more presents. Furthermore, pilot testing had shown that if children were uncertain as to whether they would get a gift, they simply waited and showed no reaction at all, even if there has not been a gift over several trials. The trial ended once all marbles were inside the boxes or after 20 s had elapsed.

Demonstration 2. E1 showed the child and puppet two dice that were lying behind each monster box. Next, E1 declared that marble monsters would also eat dice and thus that they could continue to feed the monsters.

Test 2 (windfall). The second test phase consisted of three trials in which E1 allocated dice unequally to child and puppet (see Figure 1c). E1 handed three dice to the child ("Here are one–two–three dice for you."), but only one to the puppet ("And here is one die for you."). Whether child or puppet received their dice first was counterbalanced across subjects and between trials. E1 left the room as soon as she had allocated the dice. Puppet reaction and trial length was the same as in Test 1. Finally, E1 declared that both child and puppet won the "feeding-the-monster" competition.

Test 3 (dictator game). As an acknowledgment for participation, E1 handed out postcards and stickers. Unfortunately, E1 brought only one set of stickers (see Figure 1d). She handed a box containing six stickers to the child ("I'll give you the stickers. You can decide whether you want to keep them, or whether you want to share them with the puppet.") and an empty box to the puppet. She then turned around and pretended to be busy with doing paperwork. The puppet progressively communicated her desire for children's stickers, matching the cues used during treatment phase. The test ended when the child shared some stickers with the puppet or after 30 s.

Coding and Reliability

We measured whether and how fast children in Tests 1 and 2 would share a marble or a die with the puppet and thus equalize the outcome. For Test 3, we measured the number of stickers children gave to the puppet and how many cues they needed to do so. All data were coded by the first author. Twenty-five percent of the sample ($n = 12$ children) was randomly selected and coded for reliability by a second coder who was unaware of the study hypotheses. Interrater agreement was excellent for share and stage of sharing (all κ's = 1), as well as sharing latency ($r = .99$).

Preliminary Analyses

There was no effect of gender, age, or side, therefore we did not include those variables in further analyses. In order to evaluate whether children's sharing patterns changed across trials statistically, we used generalized linear mixed models testing for an interaction between the predictors trial number, test, and condition (including subject as additional random factor and with sharing as the binary response variable). Neither a main effect for trial number nor any interactions were significant

(n = 288 observations, all ps > .62), thus children's sharing response was averaged across trials in further analyses.

Results and Discussion

Children shared in the majority of trials during the collaboration test (M = 0.80 of trials, SD = 0.38) but rarely in the windfall test (M = 0.17, SD = 0.36). A one-way analysis of variance (ANOVA) showed that children's sharing rates in the collaborative test differed significantly between conditions, $F(2, 45) = 6.97$, $p = .002$, $\eta^2 = .24$, see Figure 2. Post hoc tests (Tukey's HSD) revealed that this effect was mainly due to lower sharing rates in the reward condition, which were significantly lower than both in the baseline ($p = .01$) as well as the praise condition ($p < .001$). There was also a significant effect of condition for the windfall test, $F(2, 45) = 4.53$, $p = .02$, $\eta^2 = .17$, see Figure 3, driven by the low sharing rate of the reward condition compared to the praise condition (Tukey's HSD; $p = .01$). Thus, children continued to equalize an unfair outcome after having experienced praise or a neutral response from the favored play partner but shared less often after they had received material rewards.

On average, children shared marbles after 9.30 (SD = 3.54) s and dice after 9.65 (3.76) s. Children tended to give away marbles later in the reward as compared to the baseline condition (11.50 s vs. 8.18 s); one-way ANOVA, $F(2, 45) = 2.74$, $p = .08$, $\eta^2 = 0.13$; post hoc $p_{\text{reward/baseline}} = .07$. There was no latency difference between conditions in the windfall test (two-sample t test, $p_{\text{baseline/praise}} = .51$; no shares in reward condition).

Figure 4 illustrates the results of the dictator game test. One average, children were willing to give 2.02 stickers to the puppet. However, the exact number of stickers that children shared differed between conditions, one-way ANOVA, $F(2, 45) = 4.40$, $p = .02$, $\eta^2 = .16$. Post hoc testing (Tukey's HSD) showed that this effect was mainly driven by the low number of stickers given away in the reward condition, as compared to praise ($p = .02$) or baseline condition ($p = .07$). Five children in the reward condition refused to share their stickers, but only one child in the praise and no child in the baseline condition did so. We additionally analyzed whether the number of stickers that children were willing to give away differed from an equal split (i.e., three of the six stickers). Children who had received a reward beforehand shared significantly less than three stickers, one-sample t test: t

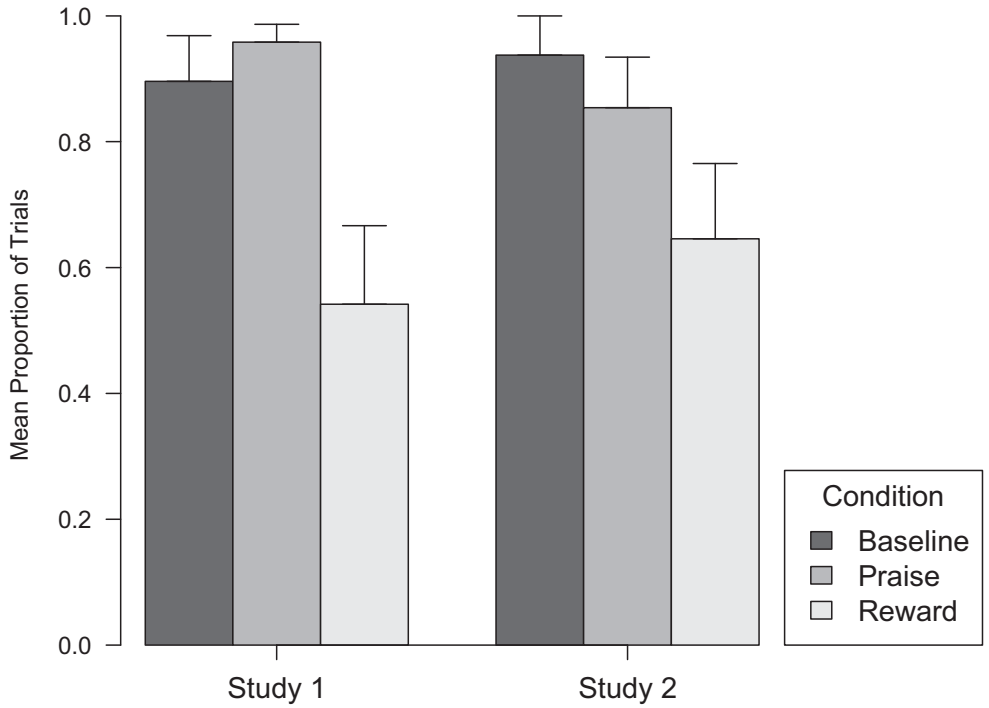

Figure 2. Rates of equal shares in the collaboration test (Test 1) as a function of previous treatment condition. Error bars represent standard error of the mean.

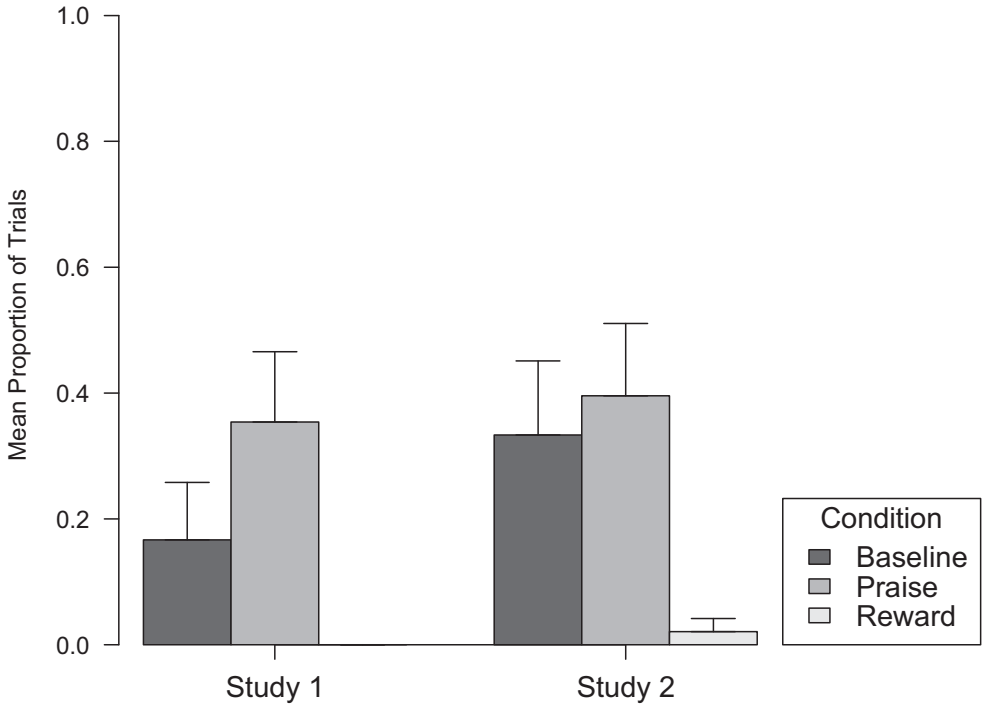

Figure 3. Rates of equal shares in the windfall test (Test 2) as a function of previous treatment condition. Error bars represent standard error of the mean.

(15) = −6.54, $p_{\text{two-sided}} < .001$, $d = 1.64$. However, the number of stickers children donated in both the baseline as well as praise condition did not differ significantly from an equal share, baseline: $t(15) = -1.90$, $p_{\text{two-sided}} = .08$, $d = .48$; praise: $t(15) = -1.10$, $p_{\text{two-sided}} = .29$, $d = .28$. There was no significant difference between conditions with regard to the number of cues children needed prior to sharing (Kruskal–Wallis H test, $p = .09$): 7 children shared spontaneously, 19 children shared between Stages 1–3, and 16 children were only willing to give up some of their stickers after they had been directly requested by the puppet.

Taken together, the current results show that 3-year-old's sharing behavior was sensitive to external rewards: Children who had been rewarded for sharing earlier were the least likely to continue sharing as compared to children who had been praised or received a neutral response for giving up one of their own items. There are two possible interpretations for the diminishing effect of rewarding on children's subsequent sharing behavior. First, results can be interpreted consistent with the overjustification effect. The fact that the loss of the material incentive reduced children's motivation to share provides further evidence for the intrinsic motivation to behave prosocially (e.g., Warneken & Tomasello, 2008).

However, it was the social partner (and thus beneficiary of a potential prosocial act) who directly caused this loss by refusing to give out more rewards, and so there is the possibility that reciprocity was having an effect in the reward condition. That is to say, although the manipulation in the reward condition changed the child's expectation of a future reward, it might have also changed their perception of the puppet's social intent. There is evidence that children's prosocial behavior is selective (e.g., Dunfield & Kuhlmeier, 2010; Kuhlmeier, Dunfield, & O'Neill, 2014). For instance, 3-year-old children avoid helping people with harmful intentions (Vaish, Carpenter, & Tomasello, 2010) but share more with a partner who has shared with them before (Warneken & Tomasello, 2013b). Hence, in the reward condition, children might have simply avoided continuously sharing with a partner who had become unwilling to share in a kind of tit-for-tat strategy (Axelrod, 1984). To rule out this alternative interpretation, a second study was conducted.

Study 2

As proposed, it is possible that children's reduced sharing behavior in the reward condition was

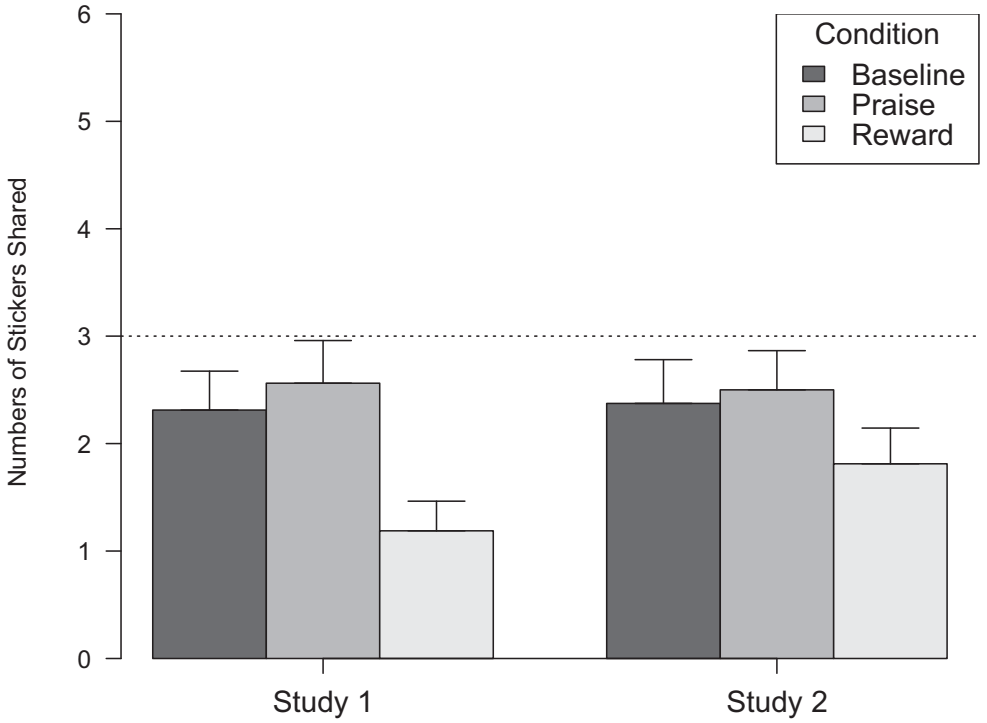

Figure 4. Average number of shared stickers in the dictator game test as a function of previous treatment condition. The dashed line represents an equal share, error bars represent standard error of the mean.

context specific and affected by the willingness and kindness of their social partner in the game rather than by the material reinforcement. In a second study, we therefore modified the procedure of Study 1: Importantly, this time it was not the direct play partner but a neutral person who provided the rewards or praised the child.

Method

Participants

We tested forty-eight 3-year-old children (24 girls, 24 boys; M = 41 months and 26 days) from the same population. One child had to be excluded due to camera malfunction. Five additional children were tested but excluded from final analysis because they did not pass the criterion to proceed to the test phase (i.e., subjects did not share a marble with the puppet in at least one treatment trial). Data were collected in the spring and summer of 2015.

Procedure

The procedure was almost identical to the previous experiment but with the following modifications addressing the three trials of the treatment phase: This time, it was not the puppet's behavior that varied between conditions but that of the main experimenter (E1).

In the *praise condition*, E1 re-entered the room after puppet and child had successfully shared a marble, following the puppet's more or less explicit cues (see Experiment 1 for details), and enthusiastically praised the child for doing so ("Did you just share a marble with the puppet? That was really nice of you. You are really kind."). E1's reaction in the *baseline condition* was modeled similarly, but this time E1 addressed the child in a neutral manner ("Did you just share a marble with the puppet? Ok."). In the *reward condition*, E1 did not leave the room but turned around as soon as child and puppet had received their marbles. E1 then approached the child, saying "Oh look, [name of the puppet] only received one marble. If you share a marble with her, I will give you this gift." Meanwhile the puppet alternated her gaze between her and the child's tray and eventually outstretched her hand toward the child. As soon as children handed over the marble, E1 gave out the reward and left the room, such that child and puppet were on their own again to feed their marble monsters.

The subsequent test phase consisted of three tests identical to Study 1 (collaboration, windfall, dictator game). This time, E1 did not react or comment on the child's behavior. Crucially, now, because E1 always left the room when child and puppet operated the apparatus, no more rewards were provided.

Coding followed the rules introduced in Study 1 and reliability was excellent for share and stage of sharing (all κ's = 1), as well as sharing latency (r = .99).

Analyses

Analyses were conducted as described in Study 1. There was no effect of gender, age, side, or trial number, hence those variables were excluded from further analyses and children's sharing response was averaged across trials.

Results and Discussion

Pairwise comparisons of conditions revealed no differences in their sharing rates between Studies 1 and 2 (two-sample t test; all ps > .24 for collaboration test; ps > .27 for windfall test). Children in Study 2 shared in the majority of trials during the collaboration test (M = 0.81, SD = 0.38), see Figure 2. A one-way ANOVA revealed a marginally significant effect of condition, $F(2,45) = 2.74$, $p = .075$, $\eta^2 = .11$, mainly due to the reward condition that tended to elicit lower sharing rates than the baseline condition (Tukey's HSD post hoc tests, $p = .069$). An overall ANOVA combining results of Studies 1 and 2 revealed a highly significant main effect of condition, $F(2, 90) = 8.71$, $p < .001$, $\eta^2 = .16$, but no main effect of ($p = .85$) or interaction with study ($p = .48$). Post hoc testing revealed that children across both studies were generally less likely to share marbles when they had been rewarded beforehand than when they had been praised ($p = .002$) or had received no reinforcement of any kind ($p = .001$).

Children shared in only one quarter of trials in the windfall test (M = 0.25, SD = 0.41), with sharing rates significantly differing between conditions, $F(2, 45) = 4.41$, $p = .018$, $\eta^2 = .16$ (see Figure 3). Post hoc tests revealed that this effect was mainly due to the reward condition, which produced lower sharing rates than both the praise ($p = .02$) and the baseline condition ($p = .06$). An overall ANOVA showed that there was no main effect or interaction of study (ps > .30), but a highly significant difference between the three conditions, $F(2, 90) = 8.53$, $p < .001$, $\eta^2 = .16$. Children shared less dice in the reward condition in comparison to both the baseline ($p = .02$) as well as the praise condition ($p < .001$).

There was no difference between conditions with regard to the latency of sharing in the first two tests (one-way ANOVA, $p_{\text{collaboration}} = .93$, $p_{\text{windfall}} = .50$). On average, children shared marbles after 10.16 (SD = 5.45) s and dice after 9.31 (6.67) s. We observed only one case in which a child handed over a die in the reward condition (latency = 9.08 s).

Analysis of the dictator game test revealed different results than the first study (see Figure 4): Although, on average, children were willing to share 2.23 stickers with the puppet, they shared more or less the same number of stickers regardless of condition (one-way ANOVA, $p = .38$). However, there was a main effect of condition with regard to the number of cues children needed until they shared (Kruskal–Wallis H test, $\chi^2(2) = 11.97$, $p = .003$). That is, children in the praise (M = 0.88, SD = 1.50) and baseline condition (M = 1.29, SD = 1.59) shared at an earlier stage and thus more spontaneously than in the reward condition (M = 2.88, SD = 1.45; post hoc tests $p_{\text{reward/praise}} = .002$, $p_{\text{reward/baseline}} = .019$). Comparing the number of shared stickers to an equal split showed that children who had received a reward beforehand shared significantly less than three of their six stickers, one-sample t test: $t(15) = -3.58$, $p_{\text{two-sided}} = .003$, $d = .89$. On the other hand, children's sharing in the baseline and praise condition did not differ significantly from an equal split, baseline: $t(15) = -1.54$, $p_{\text{less}} = .14$, $d = .38$; praise: $t(15) = -1.37$, $p_{\text{less}} = .19$, $d = .34$.

Study 2 was conducted to clarify whether the results of the main study were generated by a general diminishing effect of rewarding on children's sharing or, alternatively, by the emergence of selective prosocial behavior. Therefore, we modified the circumstances under which the rewarding happened. Unlike in the original conditions of Study 1, in Study 2 a neutral person who was never involved as the child's play partner distributed the rewards or praised the child. The direct social partner (the puppet), although beneficiary of a possible share, was never involved in providing or refusing rewards and hence never changed her intent toward the child. Therefore, the puppet's behavior was entirely identical during the test phase for all conditions, thus there was no personal or strategic reason for the child to stop behaving prosocially toward the puppet partner. Nevertheless, the findings of Study 2 mirror to a great extent the initial

results of the first study. The overall analyses support the finding of a general diminishing effect of rewarding on subsequent sharing in comparison to both receiving praise or no reinforcement, although for the collaboration test, this effect was less powerful than in Study 1. Results of the dictator game differ slightly from Study 1: The original finding that children shared fewer stickers after they had been rewarded beforehand could not be replicated. However, we found that children in the reward condition shared at a later time point and thus after receiving more and more explicit requests, whereas children in the other two conditions were more likely to share their stickers spontaneously. Hence, although in Study 2 condition had no effect on the quantity of their willingness to share in a dictator game scenario, it had an effect on the quality of sharing.

Taken together, Study 2 replicated the finding that children's willingness to engage in costly sharing was negatively influenced when they had been rewarded for the same behavior beforehand. Therefore, it seems most likely that the reduction in sharing is due to a general change in the child's prosocial motivation consistent with the overjustification effect rather than selectivity in early prosocial behavior.

General Discussion

The current two studies replicate the surprising finding that children as young as 3 years of age engage in costly sharing aimed at equalizing resources when they receive more than a partner (Hamann et al., 2011). Moreover, this study is the first to demonstrate that fairness concerns, here in the form of advantageous inequity aversion, are intrinsically motivated.

To begin with, the current study shows that young children reliably equalize unfair resource distributions at their own expense, over repeated trials and even in the absence of any reinforcement or authority. Our findings complement similar results addressing early helping behavior (Warneken & Tomasello, 2006, 2013a). Taken together, this speaks against the hypothesis that prosocial behavior needs to be reinforced in order to emerge (Bar-Tal, 1982; Cialdini, Baumann, & Douglas, 1981). Most importantly, in the current study the expectation of a material reward undermined children's initial motivation to share. These results are consistent with the overjustification hypothesis, proposing that the motivation to receive an external reward might have replaced children's inherent fairness inclination (e.g., Lepper et al., 1973). This furthermore supports the claim that children appear to be genuinely intrinsically motivated to share resources with others. Whether this motivation in itself is fully intrinsic from the beginning or whether it was at least partly socialized in the course of children's first 3 years of development to then be internalized cannot be answered with the current study. At present, we are unable to distinguish between these alternative trajectories but view them as necessary areas for future research. Our results for the praise condition leave room for both possibilities: In accordance with research on the influence of social reinforcement on intrinsically motivated behavior (e.g., Henderlong & Lepper, 2002), receiving praise did not diminish but maintained children's tendency to share equally. Due to the fact that these sharing rates were already relatively high providing a ceiling effect, a possible encouraging influence of praise on intrinsic motivations could not be proved.

Interestingly, our results were not restricted to children's distributive behavior in the same collaborative sharing situation, as other sharing situations, like windfall and dictator game scenarios, were likewise affected. Crucially, receiving a reward initially in the collaborative sharing context diminished children's motivation to share in new situations in which they had never been reinforced before, whereas their motivation remained stable over test situations in praise and baseline conditions. Taking into account that the absolute sharing rates differed between tests, for example, higher sharing rates in collaborative than in windfall situations, it seems unlikely that the influence of treatment is due to a mere carryover effect. If that were the case, we would have expected higher sharing rates in general, given that all subjects started with equalizing the marble allocation in the treatment phase. We rather interpret this finding as a strong indicator of a generalization effect, in the sense that the negative consequences of previous rewarding hold true throughout different sharing scenarios. That is, children who had been provided with a material incentive for sharing did refuse to share when rewarding stopped, not only in the same type of situation but also in further sharing scenarios. Thus, we conclude that rewarding had a comprehensive influence on all sharing scenarios in the current studies. This *general* diminishing effect of rewarding on costly sharing behavior provides strong evidence for a common underlying intrinsic motivation of fairness.

Addressing the results of the different tests in general, children were more likely to engage in costly sharing after collaboration than if resources had been provided by an adult as a windfall. Given the way that humans generate the majority of their resources, it seems plausible that children are more prone to equalize an unfair outcome if they had to work together to produce it (Hamann et al., 2011; Ulber, Hamann, & Tomasello, 2015; Warneken et al., 2011). This collaborative sharing behavior sets in very early and is differentiated a few years later in life, when children also tend to share a windfall of resources equally most of the time (e.g., Rochat et al., 2009). Our data provide a snapshot of this developmental trajectory, as 3-year-olds are highly motivated to equalize unfair outcomes with a collaborative partner but are not (yet) willing to share to the same amount in windfall situations.

However, because it was not part of our primary research question to compare different sharing contexts but rather to evaluate generalization effects, we did not counterbalance test order. Therefore, even though findings are consistent with previous results (e.g., Hamann et al., 2011), order effects cannot be entirely excluded. Nevertheless, we found no effect of trial number. In addition, we consider this effect to be not due to a loss of motivation because we took effort to assure a constant motivation over tests, for example, by providing an apparently entertaining cover story and changing item type across tests.

Of further interest are the results for the dictator game. Although many studies have documented that children under the age of 4 distribute rewards self-interestedly (e.g., Blake & Rand, 2010; Lane & Coon, 1972; Smith, Blake, & Harris, 2013), children in our study shared on average two of their six stickers and hardly ever refused to share at all. A reason for this selfless behavior might be that—in contrast to other findings—the current study generated a collaborative relation between distributor (child) and recipient (puppet). Moreover, one third of the sample only shared after they had been begged to do so. When being explicitly requested, children have been shown to share as young as 2 years of age (Brownell, Svetlova, & Nichols, 2009). These specifics of the current study design might also explain why a large number of children were even willing to share half of their resources, keeping in mind that sharing their own resources in an equal manner is extremely rare among children at that young age (e.g., Blake & Rand, 2010).

Notably, despite the reported negative findings regarding external rewards, extrinsic contingencies may be essential for producing involvement in cases where children are very shy or inhibited, or when the intrinsic interest in the activity is very low (Cameron, Banko, & Pierce, 2001; Lepper et al., 1973). Regarding the latter, it is important to point out that the overjustification effect, by definition only occurs when the motivation for an activity is already high, which was the case for children in our sample, as well as in previous studies regarding equal sharing (e.g., Hamann et al., 2011; Warneken et al., 2011). Furthermore, in the current studies, we violated children's expectation to receive an external reward by either refusing to give further gifts in later trials (Study 1) or make the rewarding person leave the room (Study 2). Accordingly, rewarding children does not necessarily have negative implications if it happens unexpectedly (Lepper et al., 1973). This might also explain why, whereas in Study 1 rewarding still influenced sharing later on in the dictator game test, we could not replicate this effect in Study 2. In the original reward condition, the expectation to be rewarded was clearly broken, both verbally and gesturally. In the reward condition of Study 2, however, the person who had distributed the rewards earlier was potentially available to handout more rewards. In turn, children might have donated more stickers here because they saw the chance to be rewarded again if they behaved nicely. An alternative explanation why only children in the reward condition of Study 1, but not of Study 2, were so reluctant to share with the puppet could be that they indeed used the dictator game as a way to punish the selfish partner in that case. However, that does not explain why they also shared less in the collaborative as well as the windfall sharing task when this interpretation was ruled out. We rather think that due to the fact that the dictator game task is conceptually very different from the other two sharing tasks (i.e., deciding whether or not to share up to six valuable stickers that one can keep versus whether to equalize an uneven share of fewer, and less precious resources), the diminishing effect of previous external rewarding was overwritten by selfish tendencies to keep the majority of stickers or even a spiteful motivation to punish the other (i.e., the puppet). In light of that interpretation, it is even more astonishing that children who had received no incentive were able to overcome these desires and shared half of their stickers most of the times. On the other hand, one has to keep in mind that children in Study 2 still behaved differently after being rewarded beforehand—although they did not actually share less stickers, they were

less willing to do so and needed stronger encouragement than in the other two conditions.

Taken together, all the characteristics of sharing behavior found here—originating in early childhood, occurring even when there is no benefit at all, being undermined by external rewards, remaining stable under the influence of praise, as well as applying to different sharing related tasks—provide strong evidence for the intrinsic origin of fairness-related behavior.

These findings do have important implications not only with respect to the use of material and social rewards to facilitate fairness behavior in early development but also for (educational) attempts to enhance prosocial behavior in general. Considering schooling, classical findings indicate that, rather than relying on rewards for motivation purposes, it is important to focus more on how to facilitate and preserve the intrinsic interest in learning and exploration that young children naturally bring along (e.g., Deci, Koestner, & Ryan, 2001; Lepper et al., 1973). Hence, parents and educators should be encouraged to rely on intrinsic motivation and reinforce feelings of autonomy and competence as much as possible rather than to provide superfluous material incentives, which can even have detrimental effects.

Certainly, there are also other forms of reinforcements aside from material rewards or praise, for instance the quality of parents' talking about emotions, that have been shown to positively influence toddler's helping and sharing (Brownell, Svetlova, Anderson, Nichols, & Drummond, 2013). Thus, despite its internalized motivation, socialization plays a crucial role in the further development of early prosocial behavior, too.

References

Anderson, R., Manoogian, S. T., & Reznick, J. S. (1976). Undermining and enhancing of intrinsic motivation in preschool-children. *Journal of Personality and Social Psychology*, *34*, 915–922. doi:10.1037//0022-3514.34.5.915

Axelrod, R. (1984). *The evolution of cooperation*. New York, NY: Basic Books.

Bar-Tal, D. (1982). Sequential development of helping behavior: A cognitive-learning approach. *Developmental Review*, *2*, 101–124 doi: 10.1016/0273-2297(82)90006-5.

Bem, D. J. (1972). Self-perception theory. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 6, pp. 2–62). New York, NY: Academic Press.

Blake, P. R., & Rand, D. G. (2010). Currency value moderates equity preference among young children. *Evolution and Human Behavior*, *31*, 210–218. doi:10.1016/J.Evolhumbehav.2009.06.012

Boggiano, A. K., & Ruble, D. N. (1979). Competence and the overjustification effect—Developmental study. *Journal of Personality and Social Psychology*, *37*, 1462–1468. doi:10.1037//0022-3514.37.9.1462

Brownell, C., Svetlova, M., Anderson, R., Nichols, S., & Drummond, J. (2013). Socialization of early prosocial behavior: Parents' talk about emotions is associated with sharing and helping in toddlers. *Infancy*, *18*, 91–119. doi:10.1111/j.1532-7078.2012.00125.x

Brownell, C. A., Svetlova, M., & Nichols, S. (2009). To share or not to share: When do toddlers respond to another's needs? *Infancy*, *14*, 117–130. doi:10.1080/15250000802569868

Cameron, J., Banko, K. M., & Pierce, W. D. (2001). Pervasive negative effects of rewards on intrinsic motivation: The myth continues. *Behavior Analyst*, *24*, 1–44.

Cialdini, R. B., Baumann, D. J., & Douglas, T. K. (1981). Insights from sadness: A three-step model of the development of altruism as hedonism. *Developmental Review*, *1*, 207–223. doi:10.1016/0273-2297(81)90018-6

Danner, F. W., & Lonky, E. (1981). A cognitive-developmental approach to the effects of rewards on intrinsic motivation. *Child Development*, *52*, 1043–1052. doi:10.1111/j.1467-8624.1981.tb03147.x

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*, *18*, 105–115. doi:10.1037/h0030644

Deci, E. L. (1975). *Intrinsic motivation*. New York, NY: Plenum Press.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*, 627–668. doi:10.1037/0033-2909.125.6.627

Deci, E. L., Koestner, R., & Ryan, R. M. (2001). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. *Review of Educational Research*, *71*, 1–27. doi:10.3102/00346543071001001

Dollinger, S. J., & Thelen, M. H. (1978). Overjustification and children's intrinsic motivation—Comparative effects of 4 rewards. *Journal of Personality and Social Psychology*, *36*, 1259–1269. doi:10.1037/0022-3514.36.11.1259

Dunfield, K. A., & Kuhlmeier, V. A. (2010). Intention-mediated selective helping in infancy. *Psychological Science*, *21*, 523–527. doi:10.1177/0956797610364119

Dunfield, K. A., Kuhlmeier, V. A., O'Connell, L. J., & Kelley, E. A. (2011). Examining the diversity of prosocial behaviour: Helping, sharing, and comforting in infancy. *Infancy*, *16*, 227–247. doi:10.1111/j.1532-7078.2010.00041.x

Eisenberg, N., Fabes, R. A., & Spinrad, T. (2006). Prosocial development. In N. Eisenberg (Ed.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, 6th ed., pp. 646–718). Hoboken, NJ: Wiley.

Fabes, R. A., Eisenberg, N., Fultz, J., & Miller, P. (1988). Reward, affect, and young children's motivational orientation. *Motivation and Emotion*, *12*, 155–169. doi:10.1007/bf00992171

Fabes, R. A., Fultz, J., Eisenberg, N., May-Plumlee, T., & Christopher, F. S. (1989). Effects of rewards on children's prosocial motivation: A socialization study. *Developmental Psychology*, *25*, 509–515. doi:10.1037/0012-1649.25.4.509

Greene, D., & Lepper, M. R. (1974). Effects of extrinsic rewards on children's subsequent intrinsic interest. *Child Development*, *45*, 1141–1145. doi:10.1111/j.1467-8624.1974.tb00720.x

Grusec, J. E., & Redler, E. (1980). Attribution, reinforcement, and altruism: A developmental analysis. *Developmental Psychology*, *16*, 525–534. doi:10.1037//0012-1649.16.5.525

Hamann, K., Warneken, F., Greenberg, J. R., & Tomasello, M. (2011). Collaboration encourages equal sharing in children but not in chimpanzees. *Nature*, *476*, 328–331. doi:10.1038/Nature10278

Henderlong, J., & Lepper, M. R. (2002). The effects of praise on children's intrinsic motivation: A review and synthesis. *Psychological Bulletin*, *128*, 774–795. doi:10.1037//0033-2909.128.5.774

Hirata, S., & Fuwa, K. (2006). Chimpanzees (Pan troglodytes) learn to act with other individuals in a cooperative task. *Primates*, *48*, 13–21. doi:10.1007/s10329-006-0022-1

Kuhlmeier, V. A., Dunfield, K. A., & O'Neill, A. C. (2014). Selectivity in early prosocial behavior. *Frontiers in Psychology*, *5*, doi:10.3389/fpsyg.2014.00836

Lane, I. M., & Coon, R. C. (1972). Reward allocation in preschool children. *Child Development*, *43*, 1382–1389. doi:10.1111/1467-8624.ep12114931

Lepper, M. R. (1981). Intrinsic and extrinsic motivation in children: Detrimental effects of superfluous social controls. In W. A. Collins (Ed.), *Minnesota symposium on child psychology* (Vol. 4, pp. 15–214). Hillsdale, NJ: Erlbaum.

Lepper, M. R., Greene, D., & Nisbett, R. E. (1973). Undermining children's intrinsic interest with extrinsic reward: A test of the "overjustification" hypothesis. *Journal of Personality and Social Psychology*, *28*, 129–137. doi:10.1037/h0035519

Liszkowski, U., Carpenter, M., Striano, T., & Tomasello, M. (2006). 12-and 18-month-olds point to provide information for others. *Journal of Cognition and Development*, *7*, 173–187. doi:10.1207/s15327647jcd0702_2

Rochat, P., Dias, M. D. G., Guo, L. P., Broesch, T., Passos-Ferreira, C., Winning, A., & Berg, B. (2009). Fairness in distributive justice by 3-and 5-year-olds across seven cultures. *Journal of Cross-Cultural Psychology*, *40*, 416–442. doi:10.1177/0022022109332844

Smith, C. E., Blake, P. R., & Harris, P. L. (2013). I should but I won't: Why young children endorse norms of fair sharing but do not follow them. *PLoS ONE*, *8*, e59510. doi:10.1371/journal.pone.0059510

Ulber, J., Hamann, K., & Tomasello, M. (2015). How 18-and 24-month-old peers divide resources among themselves. *Journal of Experimental Child Psychology*, *140*, 228–244. doi:10.1016/j.jecp.2015.07.009

Vaish, A., Carpenter, M., & Tomasello, M. (2010). Young children selectively avoid helping people with harmful intentions. *Child Development*, *81*, 1661–1669. doi:10.1111/j.1467-8624.2010.01500.x

Warneken, F., Lohse, K., Melis, A. P., & Tomasello, M. (2011). Young children share the spoils after collaboration. *Psychological Science*, *22*, 267–273. doi:10.1177/0956797610395392

Warneken, F., & Tomasello, M. (2006). Altruistic helping in human infants and young chimpanzees. *Science*, *311*, 1301–1303. doi:10.1126/Science.1121448

Warneken, F., & Tomasello, M. (2008). Extrinsic rewards undermine altruistic tendencies in 20-month-olds. *Developmental Psychology*, *44*, 1785–1788. doi:10.1037/a0013860.supp

Warneken, F., & Tomasello, M. (2009). The roots of human altruism. *British Journal of Psychology*, *100*, 455–471. doi:10.1348/000712608X379061

Warneken, F., & Tomasello, M. (2013a). The emergence of contingent reciprocity in young children. *Journal of Experimental Child Psychology*, *116*, 338–350. doi:10.1016/j.jecp.2013.06.002

Warneken, F., & Tomasello, M. (2013b). Parental presence and encouragement do not influence helping in young children. *Infancy*, *18*, 345–368. doi:10.1111/j.1532-7078.2012.00120.x