

BRIEF REPORT

Meritocratic Sharing Is Based on Collaboration in 3-Year-Olds

Katharina Hamann, Johanna Bender, and Michael Tomasello
Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

The present study investigated young preschoolers' proportional allocation of rewards in 2 different work contexts. We presented 32 pairs of 3.5-year-old peers with a collaborative task to obtain rewards by pulling ropes. In order to establish differences in work input, 1 child's rope was not immediately accessible but had to be retrieved from the apparatus by means of a specific tool, while the other child had no such additional work to do. The result of the game was that 1 individual received 1 toy and the other received 3 toys. In the Deserving condition, the working child received the 3 toys (thus work and reward matched), whereas in the Undeserving condition, the other child received the 3 toys (he or she was overpaid, and the working child was underpaid). Another 32 dyads participated in a noncollaborative, parallel work task, again in a Deserving condition and an Undeserving condition. On average, children with 3 toys shared with their partner more in the Undeserving condition than in the Deserving condition after collaboration but not in a parallel work setup. These results suggest that young children take merit into account in distributing resources at a much younger age than previously believed and that peer collaboration is an especially facilitative context for children's attention to norms of fairness.

Keywords: collaboration, social cognition, moral development, fairness

Distributions and redistributions of the goods within a given group can be of crucial importance to its members, especially if the goods are of high value. Human social life is deeply affected by ideas about the appropriate distributions of, for example, money, opportunities, rights, and obligations. Philosophical discourse focusing on fairness in distribution exposes the great degree of complexity of this topic (e.g., Marx, 1922; Nozick, 1974; Rawls, 1971). Different distributional rules exist and sometimes compete: The rule of parity, with everyone receiving equal dues, or the rule of need, with providing someone who is in greater need with a greater share. Meritocratic distribution models relate a person's work input, that is, productivity and effort, to his or her outcome (Adams, 1965). Other rules factor in ownership and legality considerations (see Leventhal, 1976, for an overview).

Classically, young children are thought to pass through three broad phases in the way they distribute resources among them-

selves and others (Damon, 1977): selfish (early preschool), equality-based (later preschool), and equity-based (school-age). Early research supporting this developmental view was based on children's judgments as external observers, often in commenting on verbal scenarios (see Hook & Cook, 1979, for an overview.) More recent evidence for this pattern is provided by studies relying on children's spontaneous sharing of resources they had just received by an adult experimenter; for example, by playing economic games like the dictator game. In such a situation, children will behave selfishly before they equalize the outcome among themselves and another agent by about 4 to 6 years of age (Benenson, Pascoe, & Radmore, 2007; Blake & Rand, 2010; Gummerum, Hanoch, Keller, Parsons, & Hummel, 2010; Rochat et al., 2009; Thompson, Barresi, & Moore, 1997). If given the chance to choose between several distribution options (e.g., Fehr, Bernhard, & Rockenbach, 2008) they will reject unequal distributions that put them into advantage by 8 years of age but not before (Blake & McAuliffe, 2011). In particular, in Blake and McAuliffe's (2011) study, two children sat face-to-face when represented with rewards, which were distributed by the experimenter. One child was able to decide whether to accept or reject the distribution. The experimenter allocated the items in three different ways: equal; unequal and advantageous for the deciding child; or unequal and disadvantageous for the deciding child. Four- to 7-year-old children rejected disadvantageous offers more often than equal offers, but only 8-year-olds rejected offers that were advantageous for them.

However, recent research has shown one particular exception to this pattern, a way in which this classic scenario does not hold: if children are actually participating to produce their resources. As just one example, when children collaborate to produce some

This article was published Online First May 20, 2013.

Katharina Hamann, Johanna Bender, and Michael Tomasello, Department of Developmental and Comparative Psychology, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany.

We would like to thank Kristin Altrichter, Jutta Boehm, Katja Buschmann, Nadine Fietkau, Sandra Griebel, Solveig Jurkat, Esther Klonowski, Elena Rossi, Anne Schrimpf, and Svea Taubert for their help in recruiting children, collecting data, and coding. Thank you to Sylvio Tüpke for creating the figures and to all the children and daycare centers for their friendly cooperation.

Correspondence concerning this article should be addressed to Katharina Hamann, Department of Developmental and Comparative Psychology, Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, 04103 Leipzig, Germany. E-mail: khamann@eva.mpg.de

rewards, even 3-year-old children tend to divide the spoils equally (Hamann, Warneken, Greenberg, & Tomasello, 2011; Warneken, Lohse, Melis, & Tomasello, 2011)—and they do this more often after collaboration than in parallel work situations, where they still sit next to each other but work independently of one another, or in windfall situations, where they receive rewards without contributing any work (Hamann et al., 2011). Importantly, sharing in those studies means correcting an *advantageous* distribution.

Again classically, it is at about six years of age that children begin to consider relative work contribution of agents in earning their goods by giving more rewards to someone who worked more and less to someone who worked less (Hook, 1978; Hook & Cook, 1979; see also Lerner, 1974; Leventhal, Popp, & Sawyer, 1973), thereby navigating toward a more adult notion of meritocratic fairness norms (Adams, 1965; Almås, Cappelen, Sørensen, & Tungodden, 2010; Damon, 1977). It is at about the same time that children develop a notion of deservingness. In situations in which they are “overpaid,” that is, when given more reward items than they would have “deserved” in terms of work input, they are willing to share more with others than when appropriately paid or underpaid (Long & Lerner, 1974; Olejnik, 1976). For example, in Olejnik (1976), 5- to 8-year-old children cut out either 20 or 4 shapes and were rewarded with 19 candies (which previously had been established to be the “right” pay for cutting out 20 shapes, with 1 candy being the appropriate pay for 4 shapes). In this situation, 5- to 6-year-old children gave more of their candies to another, non-present child when overpaid than when appropriately paid. Conversely, children are also able to recognize the deservedness of other children, giving more to under-rewarded than to over-rewarded children (Krantz & Andrews, 1979; Miller & Smith, 1977).

This school-age understanding of the correspondence between contribution and outcome implies at least some rudimentary understanding of proportion (e.g., Hook & Cook, 1979; Tompkins & Olejnik, 1978). Not surprisingly, it is at 5 years of age that children begin to acknowledge the proportion of items given (relative to the amount available for the giver in total) in judging how nice one of two givers is. For instance, when a both a “poor” and a “rich” puppet gave the child the same amount of tokens, 5-year-olds thought the poor puppet—who gave a bigger proportion of her possession—to be nicer than the rich puppet. Four-year-olds did not make this distinction (McCrink, Bloom, & Santos, 2010). Again, however, the specific context of collaboration seems to elicit an understanding of proportion already in younger, 3- to 5-year-old children (Ng, Heyman, & Barner, 2011).

In sum, recent studies have shown that collaboration facilitates the equalizing of outcomes and the acknowledgment of the proportion of items shared to some degree. Those findings suggest that collaboration enhances children’s tendency to share proportionally according to the work input they have undertaken in comparison to a coworker. Therefore, one hypothesis is that at least in preschool years, collaboration functions as a framework for focusing children’s attention to work contributions in favor of a joint goal and therefore facilitates proportional sharing.

An alternative view has been formulated by Lerner (1974). He argued that the unifying character of collaborations promotes most and foremost parity, while some forms of parallel, noncollaborative activities may rather enhance proportional sharing. The rationale behind this hypothesis is that participa-

tion in collaborations blurs the dividing line between individual agents. Individuals may understand themselves more like a “unity” putting aside the importance of individual contributions. In favor of this line of reasoning is the finding that children sometimes tend to forget about their actual contributions and rather show an “I did it” bias in joint activities with adults (Sommerville & Hammond, 2007). According to Lerner (1974), noncollaborative, non-team parallel work, on the other hand, would rather allow for a clear and unbiased view on proportional contributions. Early research in this area asked school-aged children to paste stickers either in a team or non-team mode. Children were led to believe that while they pasted 5 stickers, the other child managed to achieve 15 (or the reverse). Afterwards, they could distribute 20 prize stickers among themselves and the other participant as they liked. In the team mode, children chose to distribute rewards evenly; in the non-team mode, on the contrary, when children were just told that they were working in parallel without any reference to collaborative efforts, they tended to divide the rewards more equitably, providing the child who worked more with more stickers (Lerner, 1974). Therefore, it may also be true for preschoolers that collaborative efforts by two agents providing different amounts of work may actually result in equalizing the gain, whereas different efforts in parallel work contexts may result in splitting the gain rather equitably (merit-based).

In sum, in typical experimental scenarios children begin to develop tendencies to distribute goods in meritocratic terms when they enter school age. Recent research, however, leads to the hypothesis that collaboration, where agents jointly produce the goods to be distributed, may have a considerate facilitative effect on children’s preschool development of fairness including proportional giving. An alternative view suggests that collaboration has a unifying character and therefore promotes only egalitarian sharing, with merit-based equity being rather encouraged by parallel work. The present study pioneers in testing the two contradicting hypotheses against each other by investigating 3-year-olds’ sharing behavior in response to contribution-based collaborative and parallel work tasks.

In order to test the current hypotheses, we investigated the sharing patterns of pairs of 3.5-year-old peers ($N = 64$ dyads) in response to tasks with experimentally manipulated work contributions. Children had to retrieve rewards out of an apparatus by pulling ropes. In order to establish differences in work input, one child’s rope was not immediately accessible but had to be retrieved from the apparatus by means of a special tool, while the other child had no such additional work to do. The final state of the apparatus was that one individual had 1 toy and the other had 3. We compared two conditions in a between-subjects design. In the Deserving condition, the working child received *more* toys than her peer, that is, work input and payoff corresponded. In the Undeserving condition, on the contrary, the working child received *fewer* toys than her peer. Thus, the Deserving condition created a “fair” situation, whereas the Undeserving condition was “unfair” in that the working child was under-rewarded, while the other child was overpaid. We hypothesized that if children possess a notion of fairness regarding the relation of work contribution to the task and the respective outcome, they should share more items when over-rewarded than when appropriately rewarded. A critical question

was whether they would be sensitive to work contribution in either of two tasks: the collaboration task or the parallel work task.

Method

Participants

Participants were 64 three-year-old same-sex dyads (15 male, mean age = 44 months, range = 42 to 46 months). Seven additional dyads had to be excluded from final analysis due to experimenter or technical error ($n = 2$), shyness ($n = 3$), or because they failed criterion ($n = 2$). All children were native German speakers, recruited in urban day care centers, and came from mixed socioeconomic backgrounds.

Design

We tested two conditions, Deserving and Undeserving, across two different tasks, Collaboration and Parallel work, in a between-subjects design (see Table 1 for an overview). Please note that in the following, we will use the term “condition” whenever we refer to the Deserving and Undeserving treatments. The term “task” is reserved for Collaboration versus Parallel work setups.

In our *Condition manipulation*, we controlled for (1) how much each child worked in order to (2) gain a specific number of toys. In the Deserving condition, the child who worked more than her peer received also more rewards (3 toys) than her peer (1 toy), that is, work input and payoff corresponded. In the Undeserving condition, on the contrary, the child who worked more received fewer rewards (1 toy) than her peer (3 toys).

In our *Task manipulation*, we varied whether children would work together in order to gain the rewards (Collaboration task) or independently of one another (Parallel work task).

Throughout the Demonstration phase of each task and condition, rewards were allocated equally (2 for each child). In the subsequent six test trials, rewards were allocated unevenly (1 vs. 3). Side of work and gender were counterbalanced across subjects. The main dependent measure was the number of rewards children would share with their peer. The child in focus of the analysis was the one with the three rewards, that is, one child per dyad. We hypothesized that children would keep more toys in the Deserving condition (i.e., when the outcome was “fair” with respect to the work input) than in the Undeserving condition.

Table 1
Relation Between Work and Marble Distribution

Task: Between subjects	Condition: Between subjects	
	Deserving	Undeserving
Collaboration	+work = 3 marbles & -work = 1 marble	+work = 1 marble & -work = 3 marbles
Parallel work	+work = 3 marbles & -work = 1 marble	+work = 1 marble & -work = 3 marbles

Note. In both the collaboration and the parallel work task, children participated in either the undeserving or the deserving condition. In the undeserving conditions, less work led to more marbles. The reverse was true for the deserving conditions.

Materials

General experimental setup. At first, we will describe the global setup that was constant across conditions and tasks. For the specific manipulations necessary to test our hypotheses, please see below. The toy rewards were colored glass marbles children could use to play a rewarding game, the “jingle machine game” (a colorful box with a xylophone inside; Warneken, Hare, Melis, Hanus, & Tomasello, 2007). In order to gain the marbles, children had to work on the test apparatus, which contained four marbles per trial, either two for each child (Demonstration phase) or three for one child and one for the other (Test phase). The basic test apparatus was a transparent box ($180 \times 60 \times 15$ cm; adapted from Hamann et al., 2011). Each child had to pull a rope in order to activate a specific mechanism releasing the marbles. The mechanism was clearly visible to the children and consisted of the following elements. Pulling the ropes caused (1) the movement of one or two blocks (depending on the task: Collaboration or Parallel work; see below) to the front of the apparatus. (2) The block(s) knocked over the marbles, which had been sitting on a little platform. (3) The marbles then rolled along two tracks down to two small holes in the front corners of the box (one for each child). Children then could access the toys for playing (see Figure 1).

Differences in work input (condition manipulation). In order to establish differences in work input, one child’s rope was not immediately accessible but had to be retrieved from inside the apparatus by means of a specific tool, while the other child had no such additional work to do (see Figure 1). In particular, the rope was stuck in the back corner of the apparatus. The tool was such that if moved, it “fished” the rope out of the apparatus by means of a magnet (both the rope and the tool were magnetized.) The tool had to be moved along a zigzag-shaped track toward the front of the apparatus. This “fishing” exercise required hand-eye coordination skills and continuous attention. It was designed to be well manageable by 3-year-olds while still eliciting the exertion of some effort. Once this was accomplished, the child could retrieve the rope and start either the joint pulling together with her partner (Collaboration task) or pulling by herself (Parallel work task). Pulling activated the mechanism described above and released the marbles. In the Deserving condition, the child who had to effortfully “fish” the rope off the apparatus prior to pulling was rewarded three marbles, while the partner received just one marble. In the Undeserving condition, the child who did not do this kind of work but rather watched her partner working undeservingly gained the three. This uneven distribution was achieved by moving the marble platform 1.5 cm away from the center so that the marbles landed on different positions on the tracks.

Differences in cowork (task manipulation). In case of Collaboration (see Figure 1, upper picture), there was one long rope (320×0.5 cm). When both ends protruded the apparatus, they were at least 130 cm apart and therefore not within reach for a single child. Inside the box, the rope was looped around a $14 \times 7 \times 2.5$ cm plastic block, which was located at the rear end of the apparatus. Ultimately, children had to move this block closer by pulling both ends of the rope simultaneously. Once this was done, the block knocked over the marbles, causing them to fall off the platform and roll to the access holes. In the Parallel work task (see Figure 1, lower picture), children did not pull the two ends of a single rope in order to bring a single block to the front, but rather

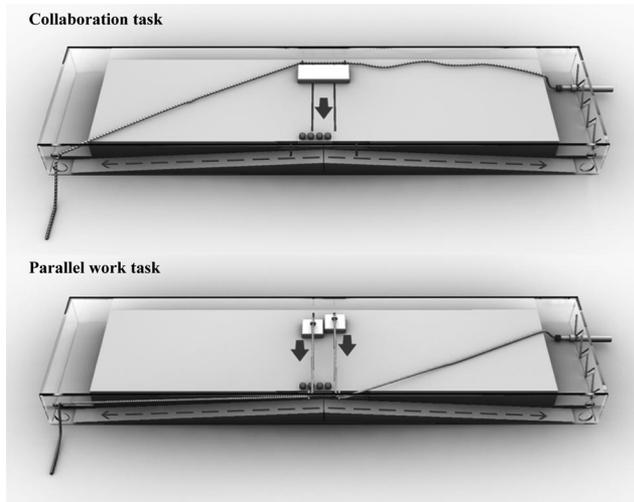


Figure 1. Setup in the two task situations.

they pulled two individual ropes tied to two individual plastic blocks (each $7 \times 7 \times 2.5$ cm) such that their movements were independent of each other. Please note that in the Collaboration task, individual pulling would yield no success since rope and tool would detach easily, causing the rope to be pulled out rather than the block to be moved to the front, whereas in the Parallel work task, individual pulling led to immediate success.

Procedure

Pairs of familiar children were tested in a quiet room in their daycare centers. All testing was done by two female experimenters. After a short familiarization period in their playgroup, children were brought to the testing room. Each session was videotaped and lasted approximately 30 minutes.

Demonstration phase. The demonstration phase introduced the study procedure employing equal reward distributions (2 marbles for each child) and identical work input for the two children. In the *Collaboration task*, after introducing the task devices, the experimenters demonstrated the collaborative action of simultaneously pulling the two ends of the rope in order to make the block move (trial 1). During the following three trials, both ends of the ropes were placed in the back corners of the apparatus and consequently had to be retrieved by using the additional work tools. Children were invited to retrieve and pull the ropes with gradually less and less assistance, finally conducting the fourth trial in the absence of the experimenters (criterion trial). In an additional fifth trial, children were asked to retrieve the rewards by just pulling the ropes as a reminder of the basic situation without the necessity of additional work. In the *Parallel work task*, the demonstration phase was carried out for the two children individually. Children took turns in being introduced to the task by Experimenter 1. The reason for this procedure was that children were to be moved away from the impression of a joint activity and rather to follow their individual goals. Importantly, they were still rewarded two marbles each. Everything else was kept identical to the Collaboration task.

Experimental phase. Test trials started when the children were sitting in front of the apparatus, ready to operate the mechanism or pulling the rope, and ended as soon as all rewards were inside the jingle machines. During trials, the experimenters monitored the children from outside the room via a video screen that was connected to a camera inside. In case the apparatus did not work or children failed to operate it, trials were repeated. Role switches were generally discouraged in order to keep the amount of work by each child constant both within and across trials.

Coding and Reliability

All sessions were videotaped and coded by a single observer. Twenty percent of sessions were randomly selected and coded for reliability by a second observer who was unaware of the hypotheses of the study.

Of interest was whether children would share different amounts of marbles in the two conditions and/or tasks. Sharing was defined as providing the peer with marbles, with the “lucky” child (the child with three) as the focus of analysis. Thus, there was one focus child per dyad with respect to the sharing measure. Specifically, children *actively* provided marbles either directly by handing them to the other child or indirectly by throwing them into the peer’s jingle machine for the sake of sharing. To be categorized as active sharers in the latter way, children had to explicitly verbalize their intention to share by saying, for example, “I’ll give you two.” Moreover, children could let the other child take marbles *passively*. The following mutual exclusive categories arose: no sharing, active sharing, passive sharing. In the Collaboration task, the inter-rater agreement for the occurrence of sharing events and number of marbles given was $\kappa = .96$, and for type of sharing, weighted $\kappa = .94$. In the Parallel work task, inter-rater agreement was $\kappa = 1$ for the occurrence of sharing events, $\kappa = .95$ for the number of items shared, and $\kappa = .88$ for types of shares.

The measures just reported focus on the lucky child who was able to decide whether to share or not. In addition, we further assessed the “unlucky” child’s communication in order to evaluate her/his understanding of the situation. Thus, again, there was only one focus child per dyad with regard to this communication measure. We coded utterances describing the situation (state descriptions: “I have only one marble,” “There is my marble”), direct requests clearly addressing the partner (e.g., “Can you give me one marble?”), and requests containing a normative element (“You should give me one”). Whenever they displayed more than one of these behaviors, the higher code was assigned (normative statements > requests > state descriptions). The inter-rater agreement across all tasks and conditions (weighted kappa) was $\kappa = .76$.

Results

Preliminary data analyses revealed no effect of gender (t tests: $M(\text{girls}) = .52$ marbles ($SD = .53$), $M(\text{boys}) = .55$ ($SD = .55$), ns) or side of work ($M(\text{left}) = .49$ ($SD = .47$), $M(\text{right}) = .58$ ($SD = .60$), ns) Therefore, those variables were not included in further analyses.

Main Analysis

A mature understanding of merit-based sharing ensures that rewards are allocated more or less exactly according to the effort

invested by each agent. However, since previous work showed that three-year-old children display a selfish bias (e.g., Rochat et al., 2009) and an equalizing tendency within collaborations (Hamann et al., 2011; Warneken et al., 2011), we would not expect such a mature approach from children this young. Our study was designed such that children would be allowed to display a potential understanding of merit *despite* those biases. That is, if children do possess an early understanding of merit, the lucky agents should simply keep their three items in the Deserving condition. Yet they should show a different pattern of behavior in the Undeserving condition, although not necessarily giving away 2 of their 3 marbles (this would reflect the “mature” split, with more rewards for more work, and requires overcoming both types of biases). Instead, it would be sufficient if they would equalize the outcome by giving away just one marble. The crucial component is that they should share, on average, more items when they do not deserve their greater gain than when they do deserve it. It was an open question whether they would show this condition difference in both the Collaboration task and the Parallel task. According to our hypothesis, we would expect children to display differences between Deserving and Undeserving conditions in the Collaboration task but not in the Parallel work task. According to Lerner’s (1974) view, children should rather equalize the outcome across conditions in the Collaboration task but not in the Parallel task. Therefore, the dependent measure of primary interest was the number of marbles children shared in the two conditions and tasks.

Figure 2 shows a clear pattern of results. In the Parallel work task, children shared only a little ($M = 0.39$ marbles in the Deserving and $M = 0.33$ marbles in the Undeserving condition). In the Collaboration task, sharing rates in the Deserving condition were higher ($M = 0.48$). In the Undeserving condition, when children were overpaid for doing only little work but their peer was underpaid, they shared much more often than in the other 3 conditions: on average 0.95 marbles. A 2 (task) \times 2 (condition)

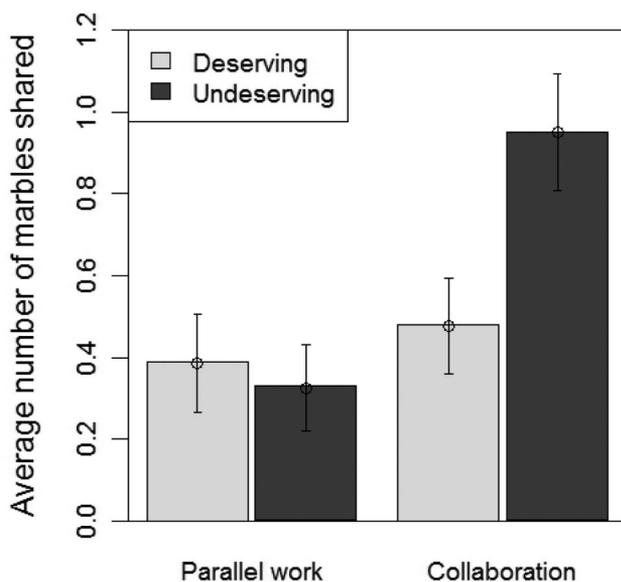


Figure 2. Average number of marbles shared in the two tasks and conditions. Error bars represent standard errors of the mean.

analysis of variance (ANOVA) revealed a main effect of task, $F(1, 60) = 8.60$, $MSE = 2.05$, $p < .01$, $\eta^2 = .13$; children shared more rewards in the Collaboration task than in the Parallel work task. Moreover, the analysis yielded a significant task \times condition interaction, $F(1, 60) = 4.76$, $MSE = 1.14$, $p = .03$, $\eta^2 = .07$. A look at the data and post hoc t tests confirmed that in the Collaboration task, children shared significantly more rewards when in the Undeserving condition when they were over-rewarded, as compared to the Deserving condition when they were appropriately rewarded, $t(30) = 2.56$, $p = .016$; Cohen’s $d = .9$. There was no difference between conditions in the Parallel task, Cohen’s $d = .13$. Taken together, the three-year-old children in our study showed that they are able to share according to relative deservingness within a collaboration, but not within a parallel work context.

Next, we analyzed the maximum number of marbles individual children shared in a trial. Giving away one item equalizes the outcome; giving away either 2 or 3 items would reflect the more mature allocation (more rewards for more work). In the collaborative Undeserving condition, 9/16 children gave away one item at least once, and 5/16 gave *more* than one (i.e., four children gave two items, and one child gave even three). In the collaborative Deserving condition, 10/16 children gave one at least once, but no-one gave more than one. We ran a Mann-Whitney U test in order to compare the number of marbles maximally shared by each child in the different conditions. We found a significant effect of condition in the collaborative setup: The mean ranks of the collaborative Undeserving and Deserving conditions were 12.6 and 20.4, respectively; $U = 190.5$, $z = 2.64$, $p = .01$; $r = 0.47$. In the parallel Undeserving condition, 9/16 children gave away one item at least once, but no child gave more; in the parallel Deserving condition, 6/16 children gave one and 3 additional children gave two (with mean ranks of 17.3 and 15.7). The Parallel test conditions did not differ significantly, $U = 114.5$, $z = .56$, $p = .47$; $r = .1$. So, again, children shared more in the Undeserving than in the Deserving condition in the cooperative task set up, but not in the parallel work set up.

Change Over Trials

Figure 3 suggests that the distribution of sharing over trials did not change systematically. In order to determine statistically whether children changed their behavior over time, we performed generalized linear mixed models (Baayen, Davidson, & Bates, 2008; Bolker, 2007) with the number of marbles shared as the dependent measure and the four treatments (Cooperation: Deserving, Undeserving, Parallel work: Deserving, Undeserving) and trial number as predictor variables. Dyad was included as a random factor. The model confirmed the main impact of the collaborative Undeserving condition on children’s sharing rates, $Estimate = .85$; $z = 2.14$; $p = .03$, but yielded no other significant results. Moreover, this model did not differ significantly from a similar model *not* containing trial as predictor ($p = .96$). Therefore, we conclude that trial number had no influence on children’s sharing.

Communication by the “Unlucky” Children

In order to investigate the “unlucky” children’s reaction to the distribution, we analyzed their communicative attempts to

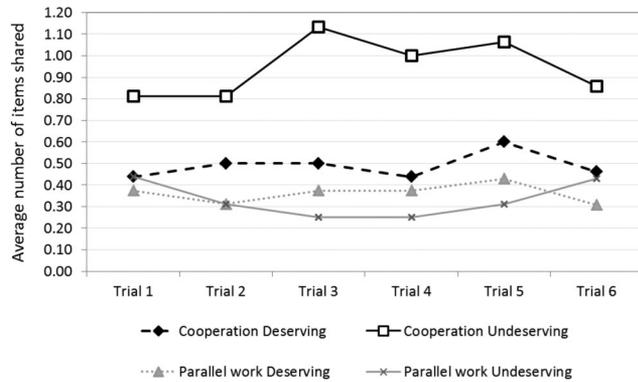


Figure 3. Children's sharing responses per trial and condition.

gain more marbles from the peer. In 32.97% of trials, children noted the outcome, that is, that they got only 1 and/or the other got 3 marbles, or that they got fewer than the peer, and so on. In 22.97% of trials, children directly requested the partner to share ("Can you give me one?"). In 1.62% of trials children even used normative language ("You must give me marbles.") Figure 4 depicts the average proportion of trials in which children used these communication types in a particular condition and task.

A 2 (task) \times 2 (condition) ANOVA (with the mean percentage of trials children communicated as the dependent variable) yielded a main effect of task, $F(1, 60) = 12.32$, $MSE = 1.21$, $p = .001$, $\eta^2 = .17$. Children highlighted their plight more often in the Collaboration task than in the Parallel work task. No other effects were found. That is, the unlucky children did communicate about their situation and even requested marbles fairly often from their peer, and they did so more often after collaboration than in a parallel work context. Investigating the influence of trial number on children's communication by running a generalized linear mixed model with communication as the response variable and task and condition and trial as predictors (and dyad as random variable) showed that children's communication declined over trials, $Estimate = -.4$, $z = -4.8$, $p < .001$. The significant effect of task remained, $Estimate = -1.9$, $z = -3.6$, $p < .001$. No other effects or interactions were found.

Finally, in order to determine whether the lucky child's sharing was encouraged by the peer's requests, we computed the frequency of co-occurrence of sharing events and previous communication per dyad and compared the resulting scores with the probability of co-occurrence based on chance. The observed pattern did not differ significantly from chance (Wilcoxon test, $p = .34$). Therefore, sharing and requesting occurred relatively independently, including children who shared without previous reminders and children who requested unsuccessfully.

Discussion

The current study investigated three-year-old children's sharing patterns when they and a peer collaborator invested different amounts of work effort. In particular, the study was motivated by two contradictory hypotheses, stating that either

(1) collaboration or (2) parallel work would be most facilitative for a sharing pattern reflecting the different work contributions by the two children.

First of all, the present results suggest that 3-year-old children are able to factor in work input given the right circumstances. This apparently contrasts previous research locating the emergence of the acknowledgment of the work contribution of agents in their allocation of resources typically at about age 6 (e.g., Hook & Cook, 1979). Importantly, it was the collaborative situation showing this understanding: Here, the child who "deserved" the majority of toys by having worked more (Deserving condition) shared significantly fewer toys with an under-rewarded partner than did a child who did not deserve the toys (Undeserving condition). A very similar working situation without collaborative elements, the Parallel work task, did not elicit such a differentiation between conditions. This finding is in line with recent studies suggesting that collaboration strongly facilitates young children's egalitarian sharing in cases in which work input is equal (Hamann et al., 2011; Warneken et al., 2011), and it adds new evidence to the claim that peer collaboration provides a specifically encouraging framework for children's developing understanding of norms of fairness and equity (Piaget, 1932; Tomasello, 2009). Notably, in the present study children demonstrated an appreciation of equity when they had to give up some of their own toys, that is, when they were in an advantageous situation. There are also other studies demonstrating an early understanding of equitable distributions; in those studies, however, children were usually not recipients of the goods but rather allocators distributing toys among several puppets, which does not require overcoming any egocentric or selfish tendencies (e.g., Baumard, Mascaró, & Chevallier, 2012; Olson & Spelke, 2008).

Contrary to the present findings, it has been suggested earlier (Lerner, 1974) that an emphasis on *membership in a team* generally promotes egalitarian behavior, whereas non-team or

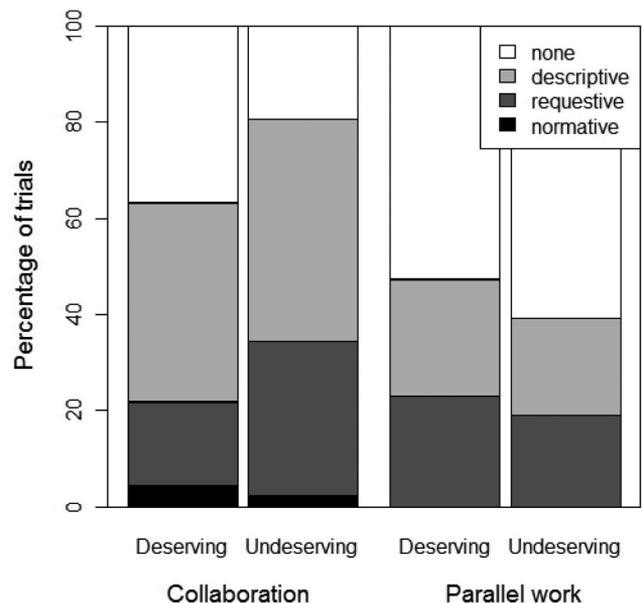


Figure 4. Communicative attempts (state descriptions, requests, and normative statements) by the child receiving one marble only.

competitive situations rather facilitate equity (this was our alternative hypothesis; Lerner, 1974; see also Sommerville & Hammond, 2007, suggesting that collaboration between adults and children decreases the awareness of who did how much work). Interestingly, we also found that most (but not all) children in the collaboration test actually equalized the outcome; speaking at least partly in favor of this idea. Yet we believe that the difference between the Deserving and Undeserving conditions is most telling. In particular, even though it is possible that the collaborative team-like setup indeed encouraged egalitarian sharing for many children, it obviously also helped in going beyond such a potential bias for parity since (1) children kept their three toys more often when they deserved it, and (2) some individuals who undeservingly earned more than their share actually restored equity by giving away more than one toy, thereby creating an unequal, but fair, split. The fact that the data show no sign of any appreciation of merit in the current non-team, that is, Parallel work test, suggests that by three years of age, collaboration is a crucial component of the development of equitable sharing.

The joint examination of the present findings and the results by Lerner (1974) that in school-aged children, parallel non-team work leads to equitable sharing whereas team membership elicits egalitarianism, suggests a specific developmental pattern of fairness concerns. The emergence of the motivation to follow norms of fairness by age 3 seems to require concrete and close collaboration between agents. The interdependence of actions in collaborations with a shared goal and close shared attention on both the work the agents are carrying out and the final gain may be the primary context motivating children to share rewards based on this very work. Later in development, once sharing norms within collaborations are established and children are more able to use rather abstract concepts of both cooperation and fairness, cooperation may be just one among many other contexts used to determine which type of distribution might be most appropriate (see also Lerner, 1974, 1977).

Apart from that, the present findings corroborate recent research on the influence of collaboration on young children's understanding of an important prerequisite of allocating goods in a merit-based way, namely, the understanding of proportion (Ng et al., 2011). Yet it still seems unclear how exactly proportional and collaborative skills interact developmentally in order to finally initiate reasoning about fairness and justice. For instance, as just noted, collaboration may enhance the awareness of the social relation between self and other (Brownell & Carriger, 1990) and therefore make corresponding features like individual contributions and possessions most prominent.

Traditionally, the development of fairness in resource distribution has been described as following a steady path from early self-centered motives over egalitarianism to more complex conceptualizations like merit and need feeding into justice judgments and allocation decisions (Damon, 1977). Recent research has identified facilitative contexts that might motivate, or contribute to, this development. Future studies are needed in order to better understand the relation between the context-dependence of children's representations of fairness norms and the corresponding developmental sequences and should investigate other components of decisions about justice, like, for example, ownership and legality. There is still much room for

further developments in children's full understanding and application of principles of distributive justice.

References

- Adams, J. S. (1965). Inequity in social exchange. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 2, pp. 267–299). New York, NY: Academic Press. doi:10.1016/S0065-2601(08)60108-2
- Almås, I., Cappelen, A. W., Sørensen, E. Ø., & Tungodden, B. (2010). Fairness and the development of inequality acceptance. *Science*, 328, 1176–1178. doi:10.1126/science.1187300
- Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, 59, 390–412. doi:10.1016/j.jml.2007.12.005
- Baumard, N., Mascaro, O., & Chevallier, C. (2012). Preschoolers are able to take merit into account when distributing goods. *Developmental Psychology*, 48, 492–498. doi:10.1037/a0026598
- Benenson, J. F., Pascoe, J., & Radmore, N. (2007). Children's altruistic behavior in the dictator game. *Evolution and Human Behavior*, 28, 168–175. doi:10.1016/j.evolhumbehav.2006.10.003
- Blake, P. R., & McAuliffe, K. (2011). "I had so much it didn't seem fair": Eight-year-olds reject two forms of inequity. *Cognition*, 2, 215–224. doi:10.1016/j.cognition.2011.04.006
- 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
- Bolker, B. (2007). *Ecological models and data in R*. Princeton, NJ: Princeton University Press.
- Brownell, C. A., & Carriger, M. (1990). Changes in cooperation and self–other differentiation during the second year. *Child Development*, 61, 1164–1174. doi:10.2307/1130884
- Damon, W. (1977). *The social world of the child*. San Francisco, CA: Jossey-Bass.
- Fehr, E., Bernhard, H., & Rockenbach, B. (2008). Egalitarianism in young children. *Nature*, 454, 1079–1083. doi:10.1038/nature07155
- Gummerum, M., Hanoch, Y., Keller, M., Parsons, K., & Hummel, A. (2010). Preschoolers' allocations in the dictator game: The role of moral emotions. *Journal of Economic Psychology*, 31, 25–34. doi:10.1016/j.joep.2009.09.002
- Hamann, K., Warneken, F., Greenberg, J. R., & Tomasello, M. (2011). Collaboration encourages equal sharing in children but not chimpanzees. *Nature*, 476, 328–331. doi:10.1038/nature10278
- Hook, J. G. (1978). The development of equity and logico-mathematical thinking. *Child Development*, 49, 1035–1044. doi:10.2307/1128743
- Hook, J. G., & Cook, T. D. (1979). Equity theory and the cognitive ability of children. *Psychological Bulletin*, 86, 429–445. doi:10.1037/0033-2909.86.3.429
- Krantz, M., & Andrews, D. (1979). Reward deservedness and children's sharing behavior. *The Journal of Psychology*, 103, 241–247.
- Lerner, M. J. (1974). The justice motive: "Equity" and "parity" among children. *Journal of Personality and Social Psychology*, 29, 539–550. doi:10.1037/h0036206
- Lerner, M. J. (1977). The justice motive: Some hypotheses as to its origins and forms. *Journal of Personality*, 45, 1–52. doi:10.1111/j.1467-6494.1977.tb00591.x
- Leventhal, G. S. (1976). *Fairness in social relationships*. Morristown, NJ: General Learning Press.
- Leventhal, G. S., Popp, A. L., & Saywer, L. (1973). Equity or equality in children's allocation of reward to other persons? *Child Development*, 44, 753–763. doi:10.2307/1127720
- Long, G. T., & Lerner, M. J. (1974). Deserving, the "personal contract," and altruistic behavior by children. *Journal of Personality and Social Psychology*, 29, 551–556. doi:10.1037/h0036207

- Marx, K. (1922). *Randglossen zum Programm der deutschen Arbeiterpartei* [Critique of the Gotha Program, Part I]. Leipzig, Germany: Vereinigung Internationaler Verlags-Anstalten.
- McCrink, K., Bloom, P., & Santos, L. (2010). Children's and adults' judgments of equitable resource distributions. *Developmental Science, 13*, 37–45. doi:10.1111/j.1467-7687.2009.00859.x
- Miller, D. T., & Smith, J. (1977). The effect of own deservingness and deservingness of others on children's helping behavior. *Child Development, 48*, 617–620. doi:10.2307/1128661
- Ng, R., Heyman, G., & Barner, D. (2011). Collaboration promotes proportional reasoning about resource distribution in young children. *Developmental Psychology, 47*, 1230–1238. doi:10.1037/a0024923
- Nozick, R. (1974). *Anarchy, state, and utopia*. New York, NY: Basic Books.
- Olejnik, A. B. (1976). The effects of reward-deservedness on children's sharing. *Child Development, 47*, 380–385. doi:10.2307/1128792
- Olson, K. R., & Spelke, E. S. (2008). Foundations of cooperation in young children. *Cognition, 108*, 222–231. doi:10.1016/j.cognition.2007.12.003
- Piaget, J. (1932). *The moral judgement of the child*. London, England: Kegan Paul, Trench, Trubner and Co.
- Rawls, J. B. (1971). *A theory of justice*. Cambridge, MA: Belknap Press of Harvard University Press.
- Rochat, P., Dias, M. D., Liping, G., 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
- Sommerville, J. A., & Hammond, A. J. (2007). Treating another's actions as one's own: Children's memory of and learning from joint activity. *Developmental Psychology, 43*, 1003–1018. doi:10.1037/0012-1649.43.4.1003
- Thompson, C., Barresi, J., & Moore, C. (1997). The development of future-oriented prudence and altruism in preschoolers. *Cognitive Development, 12*, 199–212. doi:10.1016/S0885-2014(97)90013-7
- Tomasello, M. (2009). *Why we cooperate*. Cambridge, MA: MIT Press.
- Tompkins, B. M., & Olejnik, A. B. (1978). Children's reward allocations: The impact of situational and cognitive factors. *Child Development, 49*, 526–529. doi:10.2307/1128723
- Warneken, F., Hare, B., Melis, A. P., Hanus, D., & Tomasello, M. (2007). Spontaneous altruism by chimpanzees and young children. *PLoS Biology, 5*, 1414–1420.
- 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

Received December 6, 2011

Revision received February 5, 2013

Accepted February 11, 2013 ■