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Brief Report

Allocation of resources to collaborators and free-riders in 3-year-olds

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ABSTRACT

Recent studies have shown that in situations where resources have been acquired collaboratively, children at around 3 years of age share mostly equally. We investigated 3-year-olds' sharing behavior with a collaborating partner and a free-riding partner who explicitly expressed her preference not to collaborate. Children shared more equally with the collaborating partner than with the free rider. These results suggest that young children are sensitive to the contributions made by others to a collaborative effort (and possibly their reasons for not collaborating) and distribute resources accordingly.

Introduction

One feature of human cooperation is the egalitarian sharing of resources. Despite selfish motives to maximize personal gains, the distribution of resources in humans is often governed by rules of equality, where all individuals obtain an equal share, and rules of equity, where individuals obtain outcomes proportional to their investment.

Developmental research has shown that in windfall situations children's allocation of resources starts off rather selfish, and it is only at around 6 or 7 years of age that children tend to divide resources equally. Some of these studies have used the dictator game, in which children are given the totality of the rewards by a third party and are asked to allocate the rewards between themselves and a partner (Benenson, Pascoe, & Radmore, 2007; Blake & Rand, 2010; Gummerum, Hanoch, Keller, Parsons, & Hummel, 2010; Gummerum, Keller, Takezawa, & Mata, 2008; Rochat et al., 2009). Some other studies have presented children with two or more predetermined options resulting in equal or unequal (advantageous and disadvantageous) allocations and have also found that, in general,

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young children behave selfishly and choose the prosocial option that benefits the partner only when it is not costly for them to do so (Brownell, Svetlova, & Nichols, 2009; Fehr, Bernhard, & Rockenbach, 2008; Moore, 2009; Thompson, Barresi, & Moore, 1997). In the majority of these studies, the partner was a fictitious one to rule out the possibility that children's behavior might be motivated by the expectation of future favors by the partner. But even in studies conducted among peers, children under 6 years of age do not share equally in windfall situations. In a study conducted by Birch and Billman (1986), where each target child received 10 pieces of food and the potential recipient received only 1, children shared on average only 1.5 pieces and the majority of sharing events were the result of active elicitation by the recipients (see also Brownell et al., 2009).

Interestingly, recent studies have shown that in situations where the resources have been acquired collaboratively, children at around 3 years of age already share mostly equally (Hamann, Warneken, Greenberg, & Tomasello, 2011; Warneken, Lohse, Melis, & Tomasello, 2011). Warneken et al. (2011) presented pairs of 3-year-olds with a collaborative task in which they needed to simultaneously pull on a rope in order to move a baited board within reach. In one condition, the rewards were clumped in one location, making it easier for one child to monopolize them. However, children shared equally in 75% of trials and did so independently of the type of rewards (edible and nonedible rewards). In another study, Hamann et al. (2011) compared 2- and 3-year-olds' tendency to correct inequality following collaboration, parallel individual work, and windfall. Peer dyads were presented with a task similar to the one used by Warneken et al. (2011) that required them to work together pulling simultaneously to move the rewards within reach (collaboration), pull independently from each other (parallel work), or not pull at all given that the rewards were already reachable from the trial's start (windfall). The critical manipulation was that in all three conditions one child got three rewards and the second child got only one reward. The 3-year-olds, but not the 2-year-olds, significantly more often shared one reward piece, restoring equality, in the collaboration condition than in either of the other two conditions. This study suggests that 3-year-olds are sensitive to outcomes produced in collaborative interactions and that this influences their sharing behavior.

From an evolutionary perspective, the equitable sharing of resources is fundamental for the stability of collaborative interactions. That is, recognition of partners' contributions to the collaborative task followed by both rewarding contributing partners and punishing free riders is fundamental to promote and stabilize collaboration. Research on the development of equity has shown that it is not before 7 years of age that children start making allocations proportional to the amount of work done by different parties (e.g., Almås, Cappelen, Sørensen, & Tungodden, 2010; Damon, 1977; Hook & Cook, 1979; Kienbaum & Wilkening, 2009; Lerner, 1974; Peterson, Peterson, & McDonald, 1975). However, it is possible that at a more simple level, children at a younger age are sensitive to noncontributing partners in collaborative tasks and this also affects their sharing behavior, especially when partners intentionally choose not to collaborate.

In the current study, we were interested in investigating children's sharing behavior when one child did all the work while the partner did nothing, as opposed to Hamann and colleagues' (2011) study, where in the individual work condition children worked on parallel tasks. Therefore, we compared 3-year-olds' sharing behavior with a partner (puppet) who had contributed to the acquisition of rewards (collaborative condition) and with a partner who had intentionally expressed a preference for doing something else while the child acquired the rewards alone (individual acquisition condition). Having a puppet as the partner allowed us to focus on active sharing (i.e., children actively give rewards to the partner) as opposed to Warneken and colleagues' (2011) study, which also included cases of passive sharing (i.e., children take only their share). This new manipulation gives further insight into the exact contexts in which children share or do not share equally.

Method

Participants

The participants were 63 3-year-olds (age range = 34–38 months, 31 girls and 32 boys). Children were recruited from a database of parents who volunteered to participate in child development stud-

ies and were invited to a child laboratory, where testing took place. All participants were native German speakers and came from mostly middle-class backgrounds. An additional 19 children participated in the experiment but could not be included in the final sample due to the following reasons: unwillingness to pull alone in the introduction or test (n = 10), wanted to stay with the mother (n = 2), did not follow instructions with the gummy bears (n = 3), and did not want to continue playing (n = 4).

Apparatus

The collaboration apparatus consisted of a transparent box (250 × 50 × 11 cm) in which rewards were placed on a little plate fixed on the right side of the board (based on Hirata & Fuwa, 2007; Warneken et al., 2011). In the *collaboration* condition, a rope (450 cm long) was looped around wheels on the corners of the board, with the ends of the rope sticking through holes at the front of the apparatus. Children were required to pull from the rope simultaneously with the partner in order to move the board toward the front of the box, where they could access the rewards by reaching through the window in front of the dish (see Fig. 1). In the *individual acquisition* condition, the children were required to pull both ends of the long rope by themselves. The gummy bears were placed in a transparent little container on the dish.

Design and procedure

We employed a between-participants design (collaboration: n = 32; individual acquisition: n = 31). Each child participated in one session of three trials of the collaboration or individual acquisition condition, with an equal number of boys and girls per condition. Using a puppet was important to guarantee that the partner behaved in a controlled way and according to condition. The puppet was manipulated by a second experimenter (E2), who never gave instructions to the children or talked as an adult/experimenter at any time.

Fig. 1. Cooperation apparatus. Children were required to pull from the two ends of the rope simultaneously in order to reach the rewards. In the collaboration condition, the hand puppet helped by pulling from one end of the rope, whereas in the individual acquisition condition, only children pulled.

Introduction

Children of both conditions received the same introduction. The first experimenter (E1) first explained to the child and the hand puppet ("Max" for boys or "Lola" for girls) how to collaborate to obtain the gummy bears in the apparatus ("gummy bear box"). E1 pointed to the empty dish in the rear of the box, saying that later there would be gummy bears there. She tried to reach through the opening on the side of the box, showing that it was impossible to reach the dish. Then she tried to pull one end of the rope, emphasizing that nothing happened. She asked the hand puppet to do the same with the other end of the rope, and the puppet said nothing was happening either. Then E1 said it was necessary to pull at the same time and asked the hand puppet and the child to pull at the same time. Once the board had been pulled to the front side of the box, E1 encouraged the child to take the little transparent container out of the box. E1 said the gummy bears obtained should be kept in a bowl (the child and puppet were each given a transparent color-marked bowl) and then later could be taken home. E1 prepared the box one more time, and the child and hand puppet were encouraged to try again. Afterward, E1 said one person alone could also obtain the gummy bears. She encouraged the hand puppet to grab both ends of the rope and pull while she and the child were looking. The hand puppet followed the instructions, pulling the board within reach twice. Then E1 encouraged the child to try by himself or herself while E1 and the hand puppet watched. When the child was about to start pulling, the hand puppet said he or she wanted to do something else in the meantime and started drawing on a piece of paper that was lying close to the apparatus. The same procedure was repeated one more time. Once the child had successfully pulled twice, E1 repeated that later the child should put the gummy bears in his or her bowl. E1 checked whether the child remembered which bowl belonged to the child and which bowl belonged to the hand puppet. E1 encouraged the child and the hand puppet to wait briefly outside of the room while she was baiting the box.

Test phase

After baiting the box with 4 gummy bears per trial, E1 came out from the room and said, "Now there are gummy bears in the box! Do you want to get them?" In the collaboration condition, the hand puppet said excitedly, "Oh, yes!" and entered the room together with the child to pull together. The hand puppet always positioned himself or herself on the side of the box without the dish, leaving the child in the pulling position closer to the gummy bears. In the individual acquisition condition, the hand puppet said, "Oh, I'd rather stay here [outside the testing room] drawing something," to which E1 answered while looking at the child, "You know . . .? You know how to get the gummy bears alone, so why don't you get them?" The hand puppet (together with E2) and E1 stayed outside while the child entered the room to obtain the gummy bears. Once the child had pulled the gummy bears within reach, the hand puppet (together with E2) entered the room, whereas E1 stayed outside. E1 always treated the hand puppet as a child, ignoring E2, who never behaved as an adult and only played the role of the hand puppet (producing the puppet's voice and moving the puppet).

In both conditions, as soon as the child had the container holding the gummy bears in her hands, the hand puppet approached the child and said, "I would also like some gummy bears." Trials were recorded with two cameras: one filming the whole apparatus and interaction between the child and the puppet and one close to the bowls where the child shared the gummy bears with the puppet. After each trial, E1 entered the room and counted the gummy bears in each bowl. If the child entered the room but did not pull, instructions were repeated a maximum of two times, after which the child was dropped from the data sample.

Results

We first analyzed the mean percentage of trials in which children split the gummy bears equally (2:2). On average, children shared equally in 68% ($SD = 40$) of the collaboration trials and 46% ($SD = 50$) of the individual acquisition trials. The difference between the two conditions was marginally significant, $t(57.19) = -1.977$, $p = .053$. We also compared both conditions separating gender but found no significant differences (boys: $t(28.9) = -1.027$, $p = .313$; girls: $t(26.4) = -1.755$, $p = .091$). We then conducted a trial-by-trial detailed analysis of how children split the gummy bears. We catego-

rized three possible types of splits—*selfish* (child: 4 or 3; hand puppet: 0 or 1), *equal* (2:2), and *generous* (child: 1 or 0; hand puppet: 3 or 4) and looked at the frequencies of the different splits across trials (see Table 1). We found that in Trial 1, children shared more equally (and less selfishly) in the collaboration condition than in the individual acquisition condition ($\chi = 6.25$, $p = .03$). Although the same pattern was observed in Trials 2 and 3, the effect was not statistically significant (Trial 2: $\chi = 1.94$, $p = .36$; Trial 3: $\chi = 4.66$, $p = .097$). Occasionally, children gave all 4 rewards to the puppet (see Fig. 2).

Discussion

In this experiment, children shared equally in the majority of the collaboration trials. There were also significantly less equal splits in the individual acquisition condition than in the collaboration condition. The difference between the two conditions became less apparent in Trials 2 and 3 due to a slight decrease in the number of equal splits in the collaboration condition. It is possible that this was due to the passive role and neutral reaction of the puppet during and after the sharing process of Trial 1. Children may have initiated the experiment with a natural tendency to share equally after collaboration with the partner and later realized the passive nature of their partner and that he or she would probably not react to, or care about, less equal splits. This difference in results across trials contrasts with the results of Warneken et al. (2011), who found similar levels of sharing across all three trials. Because Warneken and colleagues tested peers, one possible interpretation is that children are sensitive to whom they are sharing with and how their actions influence their partner and/or their partner's welfare. The use of a puppet (manipulated by an adult experimenter) as the recipient could have influenced the results toward children always sharing equally to conform to adults' egalitarian sharing expectations. However, children shared equally after collaboration (as in Warneken et al., 2011, and Hamann et al., 2011, Experiment 1) and more selfishly in the individual acquisition condition.

The results of this experiment replicate and extend previous findings by Warneken et al. (2011) and Hamann et al. (2011). Children at 3 years of age have a strong tendency to share rewards equally with a partner who has collaborated to acquire the rewards. This is the case when rewards are clumped in one position and children need to actively decide how to allocate them (Warneken et al., 2011, and current study) and when children encounter an unequal distribution of rewards and can choose to restore equality by giving up one of their pieces (Hamann et al., 2011). Children also shared equally with the puppet in the collaboration condition of the current experiment, suggesting that sharing with the puppet is subject to the same (or very similar) rules as sharing with a peer (see also Olson & Spelke, 2008, who also used dolls and showed evidence of reciprocal interactions at this young age). However, in a situation where the partner (i.e., hand puppet) explicitly stated his or her decision not to collaborate in the acquisition task and left children alone to retrieve the rewards, children shared less equally than after collaboration. It is unlikely that children interpreted the puppet's behavior in the individual acquisition condition as a lack of interest for the rewards given that the puppet always ex-

Table 1
Numbers of children sharing selfishly, equally, and generously with the hand puppet as a function of condition.

Trial		Collaboration	Individual acquisition
1	Selfish	6	15
	Equal	24	15
	Generous	2	1
2	Selfish	9	13
	Equal	20	14
	Generous	3	4
3	Selfish	9	12
	Equal	22	14
	Generous	1	5

Note. Fisher's exact tests revealed that only Trial 1 was significant.

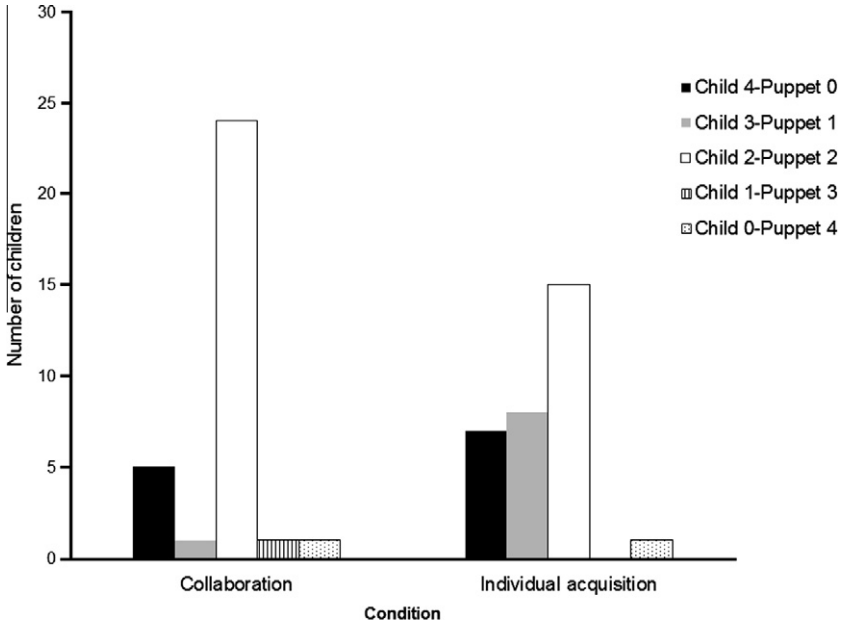

Fig. 2. Number of children in Trial 1 sharing in each of five possible ways.

pressed his or her desire for the rewards and asked for some in the exact same way as in the collaboration condition. Therefore, children may have felt entitled to keep more rewards and/or even motivated to punish the free-riding partner by sharing less.

Together with previous findings, this study suggests that 3-year-olds have a strong tendency to divide equally collaboratively earned resources. Furthermore, they are sensitive to others' lack of participation in a collaborative task and share less equally with a partner who chooses not to participate (i.e., a free rider). In the future, it would be interesting to examine whether or not children also take into account whether lack of collaboration is intentional or unintentional. For example, would children still share less with a partner who was forced to leave during the task? These findings add to a growing body of research suggesting that collaborative contexts represent a more natural situation for equality and even equity considerations to emerge (Hamann et al., 2011; Ng, Heyman, & Barner, 2011; Warneken et al., 2011).

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