

## **Preschoolers distribute scarce resources according to the moral valence of recipients' previous actions**

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## Abstract

Children aged 3 and 4½ years old watched a puppet, struggling to achieve goals, who was helped by a second puppet and violently hindered by a third. The children then distributed wooden biscuits between the helper and hinderer. In Experiment 1, when distributing a small odd number of biscuits, 4½-year-olds ( $N = 16$ ) almost always gave more to the helper. Children verbally justified their unequal distributions by reference to the helper's prosocial behavior or the hinderer's antisocial behavior. In Experiment 2, when biscuits were more plentiful, 4½-year-olds ( $N = 16$ ) usually gave equal numbers to helper and hinderer, indicating that 4½-year-olds usually preferred not to distribute unequally unless forced to by resource scarcity. 3-year-olds ( $N = 16$  in Experiment 1,  $N = 20$  in Experiment 3) gave more biscuits equally often to the helper and to the hinderer. In many cases this was because they were confused as to the identities and actions of the puppets, possibly because they were shocked by the hinderer's actions. Two fundamental moral behaviors are therefore demonstrated in young preschoolers: indirect reciprocity of morally valenced acts; and a preference for equality when distributing resources, although the cognitive bases for these behaviors remain unclear. These results join other recent studies in demonstrating that the seeds of complex moral understanding and behavior are found early in development.

*Keywords:* preschoolers; indirect reciprocity; distributive justice; moral development; reward and punishment;

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The ability to evaluate social acts against third parties by verbally identifying transgressions against norms is present in children as young as three years old (Catron & Masters, 1993; Darley & Shultz, 1990; Ingram & Bering, 2010; Nucci & Turiel, 1978; Sanderson & Siegal, 1988; Tisak, 1993). Importantly for moral judgment, from this age children are also sensitive to the intention behind an action, separate from the outcome (Nelson, 1980; Nunez & Harris, 1998; Piaget, 1932; Siegal & Peterson, 1998; Zelazo, Helwig, & Lau, 1996), and also distinguish between violations of convention and morality (Smetana & Braeges, 1990; Stern & Peterson, 1999). A behavior which possibly represents the seed-corn of these social evaluative abilities is seen in 6-month-olds, who prefer to reach for a puppet they saw helping rather than hindering a second puppet (Hamlin, Wynn, & Bloom, 2007; see also Hamlin, Wynn, & Bloom, 2010).

Although it is therefore established that preschoolers can make moral judgments concerning social acts against third parties, very little is known about how such judgments influence preschoolers' own complex social behavior towards the actors. Here we test the hypothesis that young preschoolers show indirect reciprocation of morally valenced acts, by which we mean acting positively towards those who are prosocial to third parties, and/or negatively towards those who are antisocial to third parties (Nowak & Sigmund, 2005).

There are several reasons why a positive finding would be of importance. Firstly, we note that indirect reciprocity is widespread in adults and crucial in enabling the cooperative networks that characterize human societies (Fehr & Fischbacher, 2004; Henrich et al., 2005; Nowak & Sigmund, 2005; Wedekind & Milinski, 2000). The finding in very young children of indirect reciprocity of morally valenced acts would therefore provide a further example of how moral behaviors which are fundamental in organizing adults' interactions can have early roots. It has been argued that the ability to evaluate pro- and antisocial behavior towards third parties and the tendency to indirectly reciprocate comprise the primary evolutionary and ontogenetic bases of human morality (de Waal, 1996; Fry, 2006; Gintis, Henrich, Bowles, Boyd, & Fehr, 2008; Hauser, 2006). Related to these ideas, it has been argued that the very young age at which children are known to spontaneously help those in need (14 months) reflects an inherited tendency to altruism (Warneken & Tomasello, 2006, 2007, 2009).

A positive finding would also be of importance because the study of early moral judgments and their consequences for behavior is important for understanding the broader picture of early social development (Dunn, 2006; Kagan & Lamb, 1987). For example, moral evaluation abilities in four-year-olds correlate with their popularity amongst their peers (Peterson & Siegal, 2002). The direction of causality is unclear but the observation ties in to the fact that various aspects of preschoolers' social competence affect their peer relations (Hay, Payne, & Chadwick, 2004). A positive finding here will add indirect reciprocity of morally valenced acts to the repertoire of social behaviors which through social interaction are known to influence social development.

It should be noted, however, that studies using the interview method indicate that preschoolers are unlikely to be capable of reasoned application of principles such as indirect reciprocity (Damon, 1977). A positive finding would therefore be in line with observations that very different underlying mechanisms can produce superficially similar behavior at different stages of moral development (Damon, 1977; Kohlberg, Levine, & Hower, 1983), as it would demonstrate that reasoned moral argument need not underlie indirect reciprocity. The

demonstration of a non-reasoned mechanism for indirect reciprocity of moral acts could also be taken to support social intuitionist models, according to which even adults' moral decisions can be directly influenced by intuitive processes which do not require reasoning (Cushman, Young, & Hauser, 2006; Haidt, 2001, 2007; Hauser, 2006; Krebs & Denton, 2005).

There are a number of reasons to believe that young children may show indirect reciprocation of morally valenced acts. From late in the second year, children directly reciprocate both pro- and antisocial behavior – i.e. they tend to treat an individual in the same way the individual treats them (L. L. Birch & Billman, 1986; Dreman & Greenbaum, 1973; Fujisawa, Kutsukake, & Hasegawa, 2008; Hay, Castle, Davies, Demetriou, & Stimson, 1999; Levitt, Weber, Clark, & McDonnell, 1985; Shantz, 1987). Dunfield & Kuhlmeier (2010) further demonstrated that the intentionality of the reciprocated act is taken into account. It should be noted, however, that direct reciprocation differs from indirect reciprocation in that it can be accounted for by much simpler evolutionary and psychological mechanisms (Nowak & Sigmund, 2005). Direct punishment, for example, in contrast to indirect punishment, is widely observed across animal species (Clutton-Brock & Parker, 1995).

More importantly, one study has provided data directly relevant to indirect reciprocity in preschoolers (Olson & Spelke, 2008). At an experimenter's prompting, 3½-year-olds helped a protagonist doll to distribute resources as they saw fit between two pairs of individuals. They had previously been told and shown by movements of resources that one pair had given tokens to a third party, whereas one pair had had tokens but had kept them. The children helped the protagonist to distribute more resources to the generous pair than to the other pair, demonstrating that 3½-year-olds direct a proxy protagonist to behave indirectly reciprocally in a resource distribution paradigm. Although a crucial advance, Olson and Spelke's (2008) study of indirect reciprocity concerned only resource exchange. The actions of giving and not giving which children observed and evaluated were neither morally obliged nor forbidden (at least not in this context, see Fry, 2006), and moral evaluation, which is our focus here, is not required of the children to explain their behavior.

Here, we examine whether young children distribute resources according to the moral valence of the recipients' previously observed social actions. Children observe a protagonist puppet, struggling to achieve a goal, who is helped by a second puppet and hindered by a third. Helping and hindering are achieved by physical contact (with the implication that the latter is violent), because these are the simplest possible types of morally laudable and transgressive behaviors, which even infants are able to evaluate (Hamlin, et al., 2007; Hamlin, et al., 2010; Kuhlmeier, Wynn, & Bloom, 2003; Premack & Premack, 1997). After observing these interactions, children are invited to distribute biscuits between the helper and hinderer puppets. Our hypothesis is that moral evaluations will affect resource distribution, and it predicts that children will distribute more biscuits to the helper, who acted morally laudably, than to the hinderer, who acted morally transgressively in a salient and violent manner.

After biscuit distribution, we put a number of questions to the children in a structured interview. The key questions prompt value judgments, most importantly justifications of any unequal biscuit distributions. Because we hypothesize that children's moral judgments will affect their resource distribution, we predict that children will justify unequal distributions with respect to the helper's prosociality and/or the hinderer's antisociality.

Experiment 1 comprises our primary test of these two predictions, and Experiments 2 and 3 investigate issues arising from the results: an unpredicted preference for equal distributions (Experiment 2) and poor understanding and/or recollection of the puppet's interactions by the

youngest children (Experiment 3). We test 3-year-olds because this is the age at which children first make verbal moral judgments and 4½-year-olds in order to test a sample with an improved quality of verbal response. We use puppets because pilot experiments showed that even non-violent antisocial interactions (e.g. Vaish, Carpenter, & Tomasello, 2009) between adult strangers shocked many children into inactivity. The puppetry is of a professional dramatic standard. Drama can elicit emotional responses comparable to those elicited by similar real-life events in children and adults, irrespective of whether or not the events are perceived as real (Huston et al., 1995; Pouliot & Cowen, 2007; Schiller, 2005). Of note is that the form of dramatic characters is not salient to preschoolers, who are, for example, very poor at categorizing them into people and puppets (Quarfoth, 1979).

Our study is intended to extend Olson and Spelke's (2008) study in a number of areas besides the focus on moral evaluation. Firstly, we intend to examine children's own behavior, not what they recommend as appropriate behavior for a third party. It is plausible that children themselves do not discriminate between recipients when distributing directly rather than through a proxy, because of the cost of antagonizing the penalized individual (Petersen, Sell, Tooby, & Cosmides, 2010). From three years of age children have an aversion to inequality, sometimes even when it is in their favor (LoBue, Nishida, Chiong, Deloache, & Haidt, in press).

Secondly, rather than explicitly informing children about the status of the potential recipients, as is the norm in distributive justice studies (see Gummerum, Hanoch, & Keller, 2008 for a recent review), we take a show not tell approach in which children witness the behavior of potential recipients and draw their own conclusions. By being more realistic this method is intended to be more informative about how children may behave real-life situations. Furthermore, this method is potentially extendable to infants, who have little verbal understanding but who can make evaluations of social behavior.

Thirdly, as a side effect of the fact that the behavior which the children observe is not resource distribution, we avoid a confound present in Olson and Spelke's (2008) design. Children as young as four years old are sometimes more inclined to share with poor recipients than with rich ones (Zinser, Perry, & Edgar, 1975). This implies that a potential explanation of Olson and Spelke's (2008) observations is that children perceived the pair which gave away their tokens as resultantly more needy than the pair which kept their tokens, and directed the protagonist to give on that basis, rather than as a reward for the pair's generosity.

## Experiment 1

### Methods

#### Participants

Participants were a self-selected sample who responded to an invitation letter sent to all families with children of appropriate age living in Uppsala, a medium-size Swedish city; therefore, participants were mostly ethnically Swedish and had mixed socioeconomic backgrounds. The final sample consisted of 16 4½-year-olds (six girls, mean age 54.6 months,  $SD = 0.8$  months) and 16 3-year-olds (eight girls, mean age 37.2 months,  $SD = 0.7$  months). Additionally, 10 4½-year-olds and six 3-year-olds were tested but excluded because of experimenter error (six and two children respectively), parental interference (two and one), or lack of interest (two and three, defined as either not watching the puppet interactions for more than one scene, or refusing to distribute biscuits).

## Materials

The puppet interactions were shown above a flat vertical painted set representing a playground with a sandpit and a slide with steps up to it, and containing a tea room, positioned low and centrally, within easy reach of the children. The tea room was initially covered by a board (Figure 1a). Just below the sandpit was a small basket into which a spade could be dropped and retrieved by puppets. Also in the room was a mat on which the child sat to watch the puppet interactions and a table and chair for the parent.

The puppet interactions were shown by an experimenter standing hidden behind the set. Three custom-made human-like hand puppets were used, one of which was always the *protagonist* and the other two of which were either the *helper* or *hinderer*. The protagonist puppet was dressed primarily in plain green and was slightly smaller than the helper/hinderer puppets, one of which was dressed in stripy red and one spotted blue. The helper/hinderer puppets were further distinguished by skin tone, head shape, and presence/absence of eyeglasses (Figure 1b).

The tea room was revealed by removing the covering board. In the tea room was a table with a plate for each puppet, behind which the helper/hinderer puppets were seated during biscuit distribution. Three biscuits (unpainted wooden disks) were initially placed on the tea room floor in a symmetrical row (Figure 1b).

## Design and procedure

The experiment took the form of an initial *puppet interaction* phase, in which the child passively watched interactions between the puppets in the playground; a *distribution* phase, in which the child distributed biscuits to the helper and hinderer in the tea room; and a final *question* phase, in which children's understanding of what they had seen and done was tested in a structured interview. The only between subject variables were counterbalanced and of no interest (see below).

One experimenter, always the same individual, carried out the experiment. After welcoming the child and the parent to the study room, she engaged the child in informal play intended to familiarize the child to the surroundings and to herself. She then explained the procedure to the parent and the child, and the parent signed an informed consent form. The procedure explanation was informal. However, one important phrase was always repeated until it was clear that the child had listened: "you will decide how many biscuits the puppets should get". No further instruction was given to the child about how to distribute biscuits. The parent was instructed not to intervene in any way during the distribution and question phases; sitting with the child during the puppet interaction was allowed however.

### *Puppet interaction phase*

The puppet interaction phase consisted of four scenes in the order *helping helping hindering hindering*, or the reverse (counterbalanced). One scene of each type (helping or hindering) occurred at the slide and the sandpit, with the first always at the sandpit. Which puppet (blue or red) was the helper was also counterbalanced.

We use one social interaction display similar to that which has been previously used successfully (helping or hindering a climbing attempt; Hamlin, et al., 2007; Kuhlmeier, et al., 2003), and one new. The reason for using two was to keep the interest of children who are substantially older than those previously tested in the climber paradigm, and to maximize the perceived differences between the helper and hinderer.

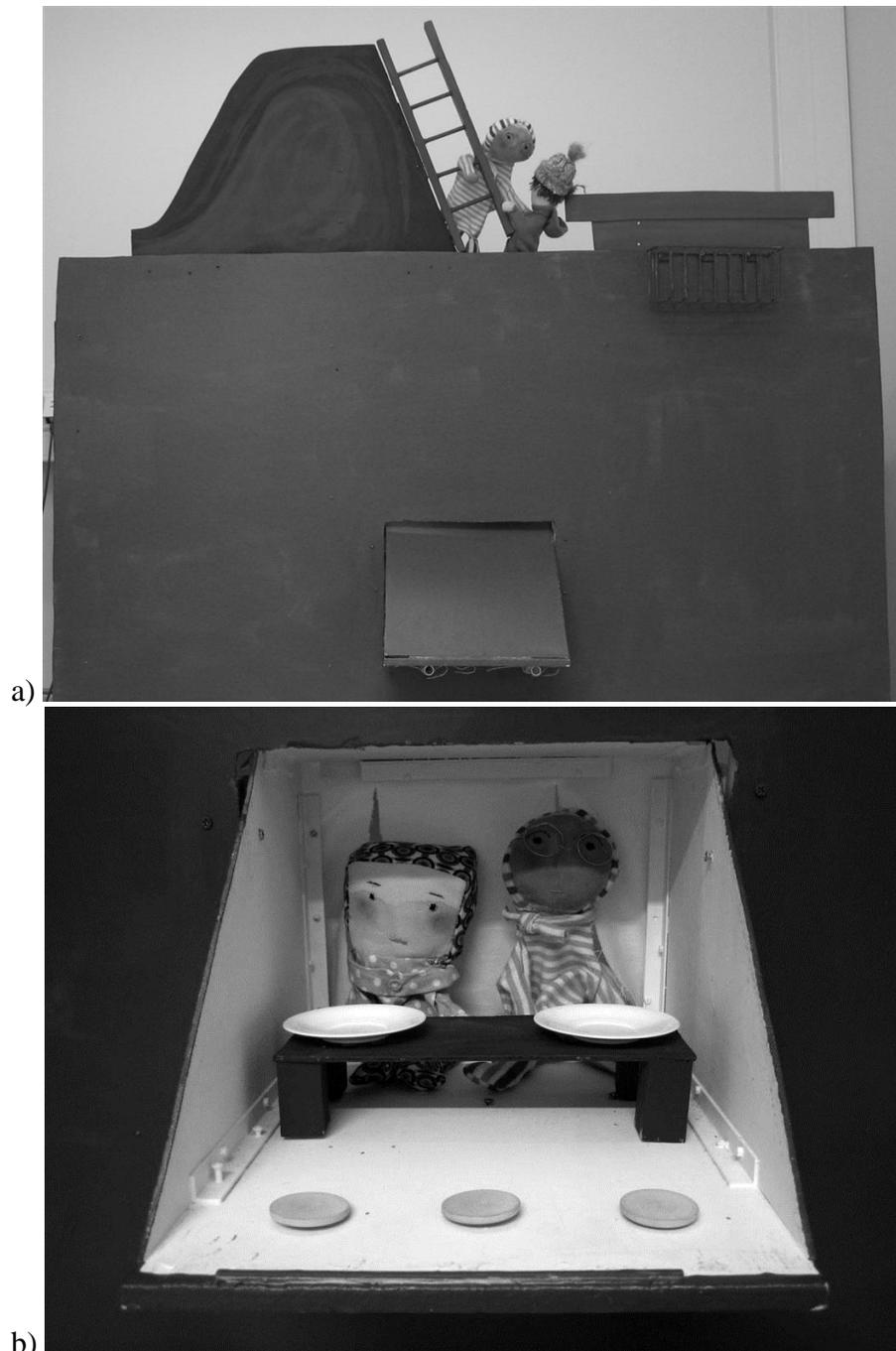


Figure 1. (a) Still from the interaction phase, showing the hinderer having pushed the protagonist down the slide steps. To the right is the sandpit; below is the covered tea room. (b) Tea room as seen at the start of distribution phase. The left puppet is clothed in blue, the right in red.

Each scene began with the protagonist entering and beginning either to climb the slide steps, or to dig in the sandpit with a spade. The helper/hinderer entered as the protagonist began to experience difficulties in its activity. On the helper/hinderer's entrance, the protagonist paused its activity and made eye-contact with the helper/hinderer. The protagonist's difficulty in the sandpit scenes was that it dropped the spade, which was caught by the basket below (Figure 1a), just out of reach. The helper took up the spade and returned it to the protagonist; the hinderer took it up and hit the protagonist with it. The protagonist's difficulty in the slide scenes was that it could not climb further than halfway up the slide steps. The helper pushed the protagonist up from below; the hinderer pushed it down from above. After being helped or hindered, the protagonist expressed satisfaction or distress as appropriate. After the helping or hindering incident, all puppets exited.

During the scenes the experimenter vocalized on behalf of the puppets one or two word sentences describing their activities. A high voice was used for the protagonist and a low voice for the helper/hinderer. Video of an example puppet interaction phase is available as Supplementary Video 1, with English subtitles. The mean phase length was 246 s ( $SD = 19.1$ ).

### *Distribution phase*

Immediately after the puppet interaction phase the experimenter emerged from behind the set and again used the phrase "now you can decide how many biscuits the puppets should get". The experimenter guided the child to the tea room and explained that puppets were inside. After knocking on the covering board, and encouraging the child to do the same, she hid behind the set again and removed the board to reveal the tea room containing the helper and the hinderer (side counterbalanced), their table, plates, and three biscuits on the floor. At this point timing of the distribution phase began. After four seconds, and again after 24 and 44 s, the helper/hinderer puppets rocked back and forth together, and the experimenter said, in the helper/hinderer voice, "We want biscuits".

After 64 s, the experimenter emerged from behind the set. If all biscuits had not been placed on the plates or puppets, the experimenter asked the child, "Will no one get that/those biscuit(s)?" If the child indicated no, the phase was over. If the child did not indicate no, the phase was over after 40 additional seconds (with the question repeated once after 20 s), or when the last biscuit was distributed. When the phase was over, the experimenter went behind the set and covered the tea room and puppets with the board.

### *Question phase*

Immediately after the distribution phase, the experimenter placed the helper and hinderer on her hands (on the same sides as in the tea room), emerged from behind the set, and reminded the child that she would now ask some questions. Both puppets were displayed prominently unless otherwise stated below. The questions were asked in the following order, with the order of Questions 1a and 1b counterbalanced, and the first puppet in Questions 3 and 4 the same as the first puppet to appear in the puppet interaction phase:

1. Was there a puppet who was (a) mean / (b) kind? [Both questions asked in turn.]  
Which one? [If the child answered "yes" without specifying a puppet.]
2. (a) Which puppet do you like best? (b) Why?
3. Should anyone be angry with this puppet? [Asked twice showing each puppet in turn.]
4. (a) What did this puppet do in the park? (b) What did you think about that? [Asked twice showing each puppet in turn.]
5. Why did this puppet get more biscuits? [Asked if one puppet did get more; showing only the one that did.]

Questions 1 and 4a are manipulation checks testing children's memory of factual events and results are reported below. Question 5 comprises an important hypothesis test and results are also reported below. Questions 2a, 2b, 3, and 4b are additional manipulation checks testing children's value judgments, which because of their redundancy and lesser importance are reported in the Supplementary Data.

### ***Coding and analysis***

Children's behavior during the distribution phase and question phase was coded afterwards from video and sound recordings. Biscuits were coded as allocated to a puppet if they had been left on the puppet's plate or lap at the end of the distribution phase (across all experiments only 3 children moved biscuits from one puppet to another during distribution).

Questions 1a, 1b, and 2a elicited puppet identifications and answers were coded as either identifying a particular puppet or as no clear answer. Questions 2b, 4b, and 5 elicited value judgments about the puppets and/or their actions. Any such judgments were coded as falling in one of the following value categories: *prosocial* (e.g. "kind"<sup>1</sup>), *antisocial* (e.g. "mean"), *good* (anything positive and possibly but not explicitly prosocial, e.g. "good"), *bad* (likewise but opposite<sup>2</sup>), *non-social* (anything clearly neither pro- nor antisocial, e.g. "pretty"). The specific puppet referred to was also coded. Question 5 responses could also be coded as explicitly justifying uneven distribution on the basis of the odd number of biscuits (e.g. "There were no more"). Question 3 was not coded for reasons discussed in the Supplementary Data.

Question 4a was intended to elicit action descriptions. Any action descriptions were coded on a five-point bipolar scale, with 1 indicating that the child clearly ascribed to the puppet in question an action performed only by the helper, 5 indicating an action performed only by the hinderer, and 3 indicating an action performed by both or neither. The intermediate values of 2 and 4 were assigned in ambiguous but suggestive cases. For example, "took the spade" was coded as 4 because although both helper and hinderer did pick up the spade, only the hinderer took it in the sense of taking it from the protagonist.

All question responses for all participants were coded by the experimenter and by a second coder, an undergraduate student blind to our hypotheses and blind to puppet identities, trained on pilot and excluded data. In a correction process intended to catch accidental mistakes, coders were informed which of their codes differed, but not how, and asked to double check. Inter-rater reliability reported as Cohen's  $\kappa$  for Questions 1, 2a, 2b, 4a, 4b, and 5 respectively were: pre-correction 0.93, 0.89, 0.98, 0.81, 0.93, and 0.89; post-correction 1.00, 1.00, 1.00, 0.93, 0.98, and 1.00. For Question 4a we report linear weighted  $\kappa$  as the data are ordinal. The blind coder's corrected codes were used for analysis. All statistical tests were two-tailed. All confidence intervals are 95%.

## **Results and discussion**

The manipulation checks indicated that most 4½-year-olds could identify the helper and hinderer and could give correct reports of what the puppets did in the park, but 3-year-old's answers could not be distinguished from chance responding (Table 1). Three-year-olds' biscuit distributions should therefore be considered in light of the probability that many did not accurately remember the puppet's interactions.

Table 1

*Children’s Understanding of the Puppet Interactions, Assessed by Control Questions*

Exp.	Age (years)	N	N making mean/kind identifications (Question 1)		Reported action score (Question 4a) <sup>c</sup>					
			Correct <sup>a</sup>	Incorrect <sup>b</sup>	Helper			Hinderer		
					N	M	SD	N	M	SD
1	4½	16	14 <sup>**</sup>	2 <sup>**</sup>	14	1.8 <sup>**</sup>	1.1	14	4.4 <sup>**</sup>	1.0
1	3	16	10	4	9	2.6	1.7	13	3.8	0.9
2	4½	16	16 <sup>***</sup>	0 <sup>***</sup>	13	1.7 <sup>**</sup>	1.2	15	4.5 <sup>**</sup>	1.1
3	3	20	10	6	9	2.1 <sup>*</sup>	1.7	9	4.3 <sup>*</sup>	1.0

*Note.* Significance tests are sign tests for identifications, and Wilcoxon matched-pair sign-rank tests for action score comparisons.

<sup>a</sup> At least one puppet correctly identified, and none incorrectly. <sup>b</sup> Any incorrect identifications.

<sup>c</sup> A value of 1 represents actions performed by the helper, 5 represents actions performed by the hinderer.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 2

*Children’s Justifications for Giving More Biscuits to the Helper or Hinderer (Question 5)*

Exp.	Age (years)	N	Justification after giving more biscuits to						
			Recipient prosocial	Helper			Hinderer		
				Non-recipient antisocial	Odd number biscuits	No clear answer	Recipient antisocial	No clear answer	
1	4½	12	3	2	2	5	2	1	1
1	3	5	1	0	0	4	6	2	4
2	4½	4	3	0	0	1	0	0	0
3	3	6	2	0	0	4	9	1	8

*Note.* Columns are not shown for justifications which were never given. *Good* and *bad* were never coded as all of the children’s references to puppets were in terms of social valence. See methods for list of and explanations of categories.

Most 4½-year-olds, 87%, CI [64%, 96%], gave more biscuits to one puppet than the other, and of these, 86%, CI [60%, 96%] gave more biscuits to the helper than to the hinderer,  $p = .013$ , sign test. Three-year-olds showed no such trends (Figure 2). Only two 4½-year-olds gave biscuits after the emergence of the experimenter, so this effect still holds when children were distributing in the absence of the experimenter,  $p = .039$ , sign test. The proportion of children who gave more biscuits to the helper was greater in the 4½-year-olds than in the 3-year-olds,  $p = .032$ , Fisher's exact test.

Most 4½-year-olds justified their unequal distributions, with justifications including that the helper as recipient was prosocial, that the hinderer as non-recipient was antisocial, and that there were an odd number of biscuits (Table 2). As the sample size of justifications is nonetheless small, we postpone analysis and discussion till further data are collected in Experiment 2. Most 3-year-olds were not able to justify their unequal distributions.

The results indicate that 4½-year-olds in this situation are very prone to discriminate in favor of the helper. However, a further observation is that no child distributed no biscuits to the hinderer – it always got at least one. This means the distributions were as equal as possible given the distribution of all three biscuits, which usually occurred. This is in line with previous observations that young preschoolers are sometimes averse to inequality (LoBue, et al., in press; Olson & Spelke, 2008). In Olson and Spelke's (2008) study, children very rarely distributed unequally when distributing a number of tokens matching the recipient number. The authors offered two hypotheses to explain their observation. Possibly children are predisposed to make a one-to-one correspondence between recipients and resources if the quantities are equal. Alternatively, children may opt for equality given sufficient resources, discriminating only if limited resources force an unequal distribution.

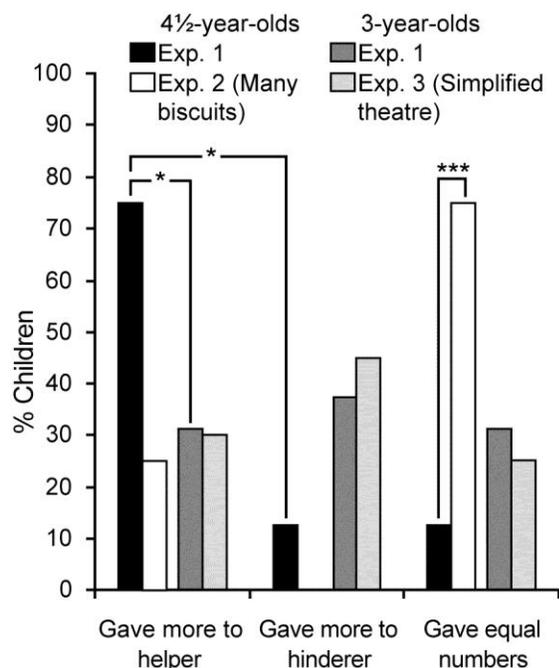


Figure 2. Biscuit distribution by children to helper and hinderer puppets.  $N = 16$  for all groups except Exp. 3 where  $N = 20$ . See text for details of significance tests. \*  $p < 0.05$ , \*\*\*  $p < 0.001$ .

## Experiment 2

### Introduction

Our results prompt us to favor the latter of the two above mentioned hypotheses: children prefer equality given sufficient resources. This is because children distributed as equally as possible although one-to-one correspondence was not possible, given distribution of all three biscuits. It seems likely that an important factor promoting unequal distribution in Experiment 1 is the small odd number of biscuits. In this experiment we therefore test this hypothesis further by examining the effects of making available plentiful biscuits and even numbers of biscuits. We predict that under these conditions, biscuits will be distributed equally between the recipients more often.

### Method

#### Participants

Participants were recruited as in Experiment 1. The final sample consisted of 16 4½-year-olds (nine girls, mean age 56.2 months,  $SD = 1.5$  months). Additionally, three children were tested but excluded, one each because of experimenter error, technical problems, and lack of interest.

#### Design and procedure

Experiment 2 was performed exactly as Experiment 1, with the following three variations. Firstly, instead of three biscuits, eight were available for half the children and nine for the other half (counterbalanced), arranged in rows on the tea room floor as in Experiment 1. In order to maintain orthogonality given the unchanged sample size and the additional variable, it was necessary to merge two unimportant variables, so that the puppet who appeared first in the puppet interaction phase always sat on the same side of the tea room.

Secondly, a statement was added to the procedure explanation to the child that there would be many biscuits present and that they did not all need to be distributed. Thirdly, when the experimenter emerged after 64 s in the distribution phase, instead of asking whether any remaining biscuits would be distributed, she simply asked “are you finished?”. Children never wanted to distribute more biscuits after this point.

### Results and discussion

The children had a very good recall of the puppet interactions (Table 1). As a check that biscuits were indeed experienced by the children as more plentiful in this experiment, we note that 50% of children, CI [28%, 72%], did not distribute all the biscuits, which was marginally significantly more often than in Experiment 1, 12% of 4½-year-olds, CI [3%, 36%],  $p = 0.054$ , Fisher’s exact test.

Most children, 75%, CI [50%, 90%], distributed equal numbers of biscuits to each puppet (Figure 2). This means that these 4½-year-olds distributed equally more often than 4½-year-olds did in Experiment 1, 12% of children, CI [3%, 36%],  $p = .001$ , Fisher’s exact test. This effect cannot be solely accounted for by the fact that half of the children in this experiment had an even number of biscuits available (eight biscuits), whereas all children in Experiment 1 had an odd number available (three biscuits). This is because even amongst the half of the children in this experiment with an odd number available (nine biscuits), an equal distribution was made in 62% of children, CI [31%, 86%], still more often than in Experiment 1,  $p = .021$ , Fisher’s exact test. This demonstrates that even when the number of biscuits was not equally divisible between the recipients; children achieved an equal distribution anyway, by means of not distributing all the biscuits. Note that the high frequency of equal distribution observed is very unlikely to be a product of random distribution. We determined by Monte Carlo simulation that if children had

distributed the same numbers of biscuits as they were observed to, but at random, the probability of obtaining the observed frequency of equality would be less than .001.

Finally we summarize across Experiments 1 & 2 data on 4½-year-old's justifications for giving more biscuits to one of the puppets (Table 2). Of 18 individuals who did so, 11 gave a clear answer, of which nine, 81%, CI [52%, 95%], referred to the helper's prosociality or the hinderer's antisociality.

## Experiment 3

### Introduction

Because it is plausible that the reason for the lack of systematic discrimination in the 3-year-olds in Experiment 1 is simply that many did not accurately evaluate or remember the actions of the individual puppets, in this experiment we attempt to simplify the experience for 3-year-olds by three changes to the procedure. To minimize confusion over identity, all puppets are visible during all scenes; to simplify, the sandpit scene is replaced by slide scene repetitions; and to minimize fatigue effects, the question order is altered to ask the most important questions first.

### Method

#### Participants

Participants were recruited as in Experiment 1. The final sample consisted of 20 3-year-olds (14 girls, mean age 37.6 months,  $SD = 1.1$  months). Additionally, two children were tested but excluded, one because of experimenter error and one because of lack of interest.

#### Design and procedure

Experiment 3 was performed exactly as Experiment 1, with the following variations. Firstly, the sandpit scenes were replaced by repetitions of the slide scenes. Secondly, the tea room was open throughout the puppet interaction phase, with the helper/hinderer initially present (but no table, plates, or biscuits). When a puppet was to interact with the protagonist, it climbed out of the back of the tea room and emerged by the slide. After interacting, the puppet climbed back into the tea room. This necessitated a change in how the distribution phase began, because the biscuits and plates could not be revealed by the tea-room opening. Instead, when the experimenter guided the child to the tea room, she also placed the table, plates, and the biscuits in their standard positions, before going behind the flat and continuing the distribution phase as in Experiment 1. Finally, the questions were asked in the following order: 1, 5, 4, 2, 3.

Because sample size was determined by the maximum number of subjects available, and was therefore not a multiple of 16, orthogonality was lost with respect to the uninteresting variables. We therefore examined statistically whether any of the uninteresting independent variables puppet identity, puppet side, first puppet in puppet interaction, and first puppet in Question 1, predicted any of the dependent variables puppet receiving most biscuits, puppet identified as mean or kind (Question 1), and puppets' reported actions in park (Question 4a). There were no significant effects.

#### Results and discussion

Although puppet identification and puppet preference trends remained non-significant, this time there was a significant tendency for 3-year-olds to correctly report the actions they had seen the puppets perform (Table 1). A salient observation is that, across Experiments 1 and 3, the actions of the helper were never attributed to the hinderer. The only source of error was that the actions of the hinderer were frequently attributed to the helper.

Yet again, however, there was no tendency for those who distributed unequally to favor the helper (Figure 2). Manipulation checks had indicated that some children did correctly detect and remember the puppet's actions, but some were confused. We therefore examined the

subsample ( $n = 11$  of 20) who evidenced accurate recollection by making at least one correct and no incorrect puppet identifications (Question 1) or action descriptions (Question 4a). Five children gave more biscuits to the helper, five gave more to the hinderer, and one gave one each.

Unequal distributions were seldom justified (Table 2), but those justifications which were given were all in terms of the helper's prosociality or the hinderer's antisociality. A final salient observation is that across Experiment 1 and 3, in 35 of 36 cases, 3-year-olds gave at least one biscuit to each puppet.

## General discussion

Children watched interactions in which a protagonist puppet was assisted by a helper puppet and violently prevented from attaining its goals by a hinderer puppet. When distributing a scarce supply of biscuits between the helper and the hinderer, 4½-year-olds, but not 3-year-olds, were much more likely to give more to the helper. When biscuits were plentiful, however, most 4½-year-olds distributed biscuits equally between the helper and hinderer, although a minority of children still favored the helper. When plentiful biscuits were of an odd number, children achieved equality by not distributing all the biscuits.

Indirect reciprocity of morally valenced acts, and unequal distribution avoidance, are therefore demonstrated in 4½-year-olds. Caution is required in interpreting these behaviors, however, because very different modes of thought can produce similar behavioral outcomes from moral judgment (Damon, 1977; Kohlberg, et al., 1983). One should not therefore expect that the mechanisms motivating the observed behaviors are the same as those underlying adults' performance of them. In interview situations regarding resource allocation, children of this age have not been shown to be capable of explicit reasoning on a level consistent with the understanding of principles of fairness or reciprocity (Damon, 1977). Arguments for why one individual should receive more than another which are not self-interested or arbitrary have seldom previously been seen before six years of age; nor are arguments for equal distribution based on moral principles rather than practical concerns such as conflict avoidance (Damon, 1977; Sigelman & Waitzman, 1991). Furthermore, before six years of age children do not appear capable of coordinating understandings of multiple emotions in a manner presumably necessary for arriving at a reasoned principle of indirect reciprocity (Arsenio & Kramer, 1992). It is therefore highly unlikely that that our participants distributed on the basis of explicit reasoning concerning moral principles of indirect reciprocity or fairness.

With respect to the observed indirect reciprocation, one simple potential explanation is that children came to like the helper better as a result of its actions, and then gave more to the individual they liked best. On the other hand, the judgment's effects on distribution might have been mediated through a more specific process than liking – the children may have been applying a rule that morally valenced acts should be indirectly reciprocated, in other words punished or rewarded. Although it is unlikely that the children hold such a rule as a reasoned moral principle, such a rule could potentially guide behavior without being accessible to explicit reasoning (Cushman, et al., 2006; Haidt, 2001; Hauser, 2006).

Most 4½-year-olds and a small minority of 3-year-olds justified their unequal distributions, and the majority of these justifications referred to the helper's prosociality or the hinderer's antisociality. Although post-hoc justifications for moral judgments cannot always be trusted to accurately reflect the judgment process (Haidt, 2001; Hauser, 2006; Hauser, Cushman, Young, Jin, & Mikhail, 2007), these observations demonstrate at the least that from three years of age some children account for unequal distributions they have made by reference to the recipients' moral valence. As 3-year-olds did not show clear evidence that they did actually

distribute on this basis, it is possible that the few justifications they gave were not representative of their true motivations. In 4½-year-olds, however, justifications matched distributive behavior. This observation, together with observations that children of this age state that moral transgressions are deserving of punishment (Smetana, 1981; Smetana, Schlagman, & Adams, 1993), increases the plausibility of the hypothesis that 4½-year-olds applied a rule that morally valenced acts should be indirectly reciprocated. At the least we can conclude that although 4½-year-olds are not typically capable of reasoning utilizing this rule as a principle (Damon, 1977), they are sufficiently aware of it in order to use it post-hoc to justify their own behavior that is in line with it.

Three-year-olds showed no group-level tendency to discriminate against the hinderer in their biscuit distributions. A major factor, discussed below, is the fact that many of them did not remember the identities of the puppets. In Experiment 3, however, despite a significant tendency for 3-year-olds to remember the puppets' actions, there was nevertheless no trend to favor the helper, even when excluding children who did not evidence accurate recollection of the puppet interactions. Because of the small sample size of 3-year-olds evidencing accurate recollection, we avoid speculation as to why, beyond to note one possibility of interest for future research: one 3-year-old justified giving more biscuits to the hinderer by saying "if you don't get [biscuits] ..., then you get angry". This suggests that some three-year-olds may have given more biscuits to the hinderer for the purposes of placation.

We now turn to the second key finding: the tendency to avoid unequal distributions. This behavior was shown by most 4½-year-olds distributing plentiful biscuits, and although 3-year-olds were not tested with plentiful biscuits, the observation that in 98% of cases they gave at least one biscuit to each puppet suggests they also prefer to distribute as equally as possible. A relevant anecdote is that one 3-year-old, after giving each puppet one biscuit, pretended to distribute the last one equally by breaking it in half. The observation of inequality avoidance given plentiful resources is in line with theoretical and common sense predictions of how children are likely to act in real situations (Green & Rechis, 2006; Jackson, 1993). In adult economic interactions, third party punishment occurs, with important effects on interaction dynamics, but rarely (Ule, Schram, Riedl, & Cason, 2009). Discriminating against an individual is costly because the discriminated individual's attitude towards the discriminator is likely to be negatively influenced (Petersen, et al., 2010).

It is nevertheless the case that although equal distribution has been observed in significant minorities of older preschoolers in a number of studies (McGillicuddy-De Lisi, Watkins, & Vinchur, 1994; Sigelman & Waitzman, 1991; Thomson & Jones, 2005), a strong tendency to distribute equally has not previously been observed in children at the ages of this study. Rather, a number of studies have concluded that children at these ages have no preference for equality (Damon, 1975; Fehr, Bernhard, & Rockenbach, 2008; Lane & Coon, 1972). Our first response to this disparity is to note that when 3-year-olds are recipients rather than distributors, they have in fact been shown to be averse to inequality, even on occasion when the inequality is in their favor (LoBue, et al., in press). Secondly we note that, in contrast to here, previous distribution studies have typically included the distributing child themselves as a potential recipient. Because egocentricity is strong in children of this age (S. A. J. Birch & Bloom, 2004; Flavell, Miller, & Miller, 2002), we suggest that when the self can be a recipient, self-concern normally overrides the incipient tendency towards equal distribution which young preschoolers otherwise show.

This interpretation harmonizes with our finding that the tendency towards equality can itself override the tendency towards indirect reciprocation of morally valenced acts when resources are plentiful. The idea that at any one developmental stage, different motivations exist but override each other, with development being to some extent a question of changes in the relative strengths of the different motivations, is consistent with a variety of existing theories on moral development (Gummerum, et al., 2008; Krebs & Denton, 2005; Piaget, 1932).

The content-rich puppet theatre approach we used for demonstrating third party interactions is unusual and deserves evaluation. Most studies of preschoolers' moral development use an approach in which children are explicitly told about individuals' behavior, presumably because the approach is straightforward and because it lessens children's interpretative cognitive burden (though see Smetana, et al., 1993). Displays of interacting agents unaccompanied by adult narration have nevertheless been used successfully with infants in the hill climber paradigm (Hamlin, et al., 2007; Hamlin, et al., 2010).

We used a live display of interactions because we wanted to assess children's abilities to interpret what they saw without support from adults. The display was content rich because we wanted it to be in some senses realistic, and to maintain the attention of the older children. For all ages, the method successfully held the interest of the vast majority of children – the relatively high level of participant attrition in Experiment 1 was mainly a result of experimenter error due to the complexity of the procedure. Almost all 4½-year-olds were able to detect, remember, and appropriately evaluate what they saw. In contrast, a substantial minority of 3-year-olds attributed actions to the puppet which had not performed them. This was surprising, given even infants' reliable abilities to remember the helper's and hinderer's identities in the similar hill climber paradigm.

One possible explanation is simply that our displays were richer, in that expressive hand puppets were used instead of wooden block puppets, and therefore more confusing. We do not favor this explanation because a richer social context has been found to improve, not diminish, young children's memories for socially relevant details (e.g. Moses, Baldwin, Rosicky, & Tidball, 2001). Another explanation, however, has some support. Poor recall of the puppet's actions was never manifest as the attribution of the helper's actions to the hinderer – it was always the other way around. This shows that the hinderer's actions were very salient to the 3-year-olds. This is to be expected as negative events are more salient to young children than positive ones of similar intensity (Vaish, Grossmann, & Woodward, 2008). In studies of eye-witness reliability, more perpetrator misidentifications are made in violent than similar but non-violent crimes (e.g. Clifford & Hollin, 1981), because high arousal and stress can interfere with certain aspects of memory (Deffenbacher, Bornstein, Penrod, & McGorty, 2004). We observed anecdotally that some 3-year-olds were frightened of the hinderer. We therefore suggest that the hinderer's actions themselves were so arousing that memory of the identity of the actor was degraded. We note that if this problem is solved, possibly by diminishing the intensity of the antisocial actions, then this method is potentially extensible to much younger children.

We conclude by assessing the wider issues raised by our results. The demonstration that 4½-year-olds alter their behavior towards individuals according to the moral valence of the individuals' behavior towards third parties suggests that similar behavior may be observed in preschoolers' everyday social groups. That such indirect reciprocity was only observed when resources were scarce is unlikely to preclude a role for such behavior – the fact that preschoolers frequently encounter limited resources is testified to by the large body of research on preschoolers' behavior in limited resource situations (Green & Rechis, 2006). Indirect

reciprocity has been demonstrated theoretically and empirically to be important in promoting cooperative social interactions (Nowak & Sigmund, 2005), and the effect observed here may therefore play a role in promoting cooperation and reducing moral transgressions in preschooler social groups. Further research would be needed to establish this, and the picture would no doubt be complex, for example due to the possibly counteracting effect of the tendency for preschoolers to like dominant individuals (Hawley, 1999).

Finally we place our results within the broader context of moral development in preschoolers and infants. It has become clear that indirect reciprocation of moral behavior, and a tendency towards equality in resource distribution, are behaviors originating earlier than previously thought (see also LoBue, et al., in press; Olson & Spelke, 2008). This is in line with recent results from other areas within developmental moral psychology such as action evaluation (Hamlin, et al., 2007), cooperation (Warneken & Tomasello, 2007), and helping (Warneken & Tomasello, 2009). In general, these results demonstrate that behaviors related to morality are displayed in children before they are capable of the kind of rational argument which can underpin the same behaviors in older children and adults. The results of this study provide a salient example of this effect because children's developing arguments concerning distributive justice have been explored in particular depth (Damon, 1977; Gummerum, et al., 2008). In this area the point is therefore underlined that similar behavior at different developmental stages can be produced by quite different mechanisms. Further, a possibility which is compatible with the current data, and which merits future examination, relates to social intuitionist models for moral cognition. According to such models, even adults' moral decisions are directly influenced by intuitive processes outside the control of reason (Cushman, et al., 2006; Haidt, 2001, 2007; Hauser, 2006; Krebs & Denton, 2005). Our results raise the possibility that preschoolers' mechanisms for equal distribution and indirect reciprocity might be developmentally continuous with similar intuitive processes in adults. Discovering more about the nature of these early mechanisms, and investigating how they scaffold, develop into, or are replaced by later moral understanding, are some of the most important priorities for future investigation.

### Footnotes

<sup>1</sup> The Swedish word *snäll* is active in young children's vocabulary long before the corresponding English *kind*, possibly because there is no direct Swedish equivalent to the common but ambiguous *nice*. This means coding *prosocial* rather than *good* is likely to be possible more often in Swedish.

<sup>2</sup> The Swedish word *dum*, commonly used by young children, is ambiguous. Literally meaning *stupid*, sometimes used by small children to mean *mean* and sometimes to mean *bad*, it was usually coded as *bad*, depending on context. This means coding *antisocial* rather than *bad* is likely to be possible less often in Swedish.

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