Foundations of Cooperation in Young Children

RUNNING HEAD: Foundations of Cooperation

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Abstract

Observations and experiments show that human adults preferentially share resources with close relations, with people who have shared with them (reciprocity), and with people who have shared with others (indirect reciprocity). These tendencies are consistent with evolutionary theory but could also reflect the shaping effects of experience or instruction in complex, cooperative and competitive societies. Here we report evidence for these three tendencies in 3.5 year old children, despite their limited experience with complex cooperative networks. Three pillars of mature cooperative behavior therefore appear to have roots extending deep into human development.

Foundations of cooperation in young children

A central problem for biology and social science concerns the development of cooperation (Darwin, 1871; Fehr & Fischbacher, 2004; Imhof, Fudenberg, & Nowak, 2005; Williams, 1966). Evolutionary models, economic game theory and studies of people in diverse cultures suggest that three propensities favor the emergence of cooperative networks in humans: the tendency to act for the benefit of close relations (Hamilton, 1964), the tendency to reward others whose past actions have benefited the self ("reciprocation"; Trivers, 1971), and the tendency to reward other people who exhibit acts of generosity ("indirect" reciprocation or "third party altruism"; Alexander, 1987; Nowak & Sigmund, 2005; Trivers, 1971). Human adults show all three tendencies (Greiner & Levati, 2005; Gurven, 2006; Patton, 2005; Wedekind & Braithwaite, 2002; Wedekind & Milinski, 2000). Because caring for kin, reciprocating acts of kindness, and honoring the generous are explicit teachings of the major religious and secular traditions, however, studies of adults fail to clarify the sources of these tendencies in genes, ordinary experience, or instruction. Accordingly, we investigate these tendencies in preschool children with limited experience of complex cooperative networks.

Previous research has demonstrated that children begin to engage in pro-social or helping behaviors in their second year of life (Eisenberg & Fabes, 1998; Warneken & Tomasello, 2006), sharing toys with parents and other adults (Hay, 1979; Rheingold, Hay, & West, 1976) and cooperating with adults and peers to perform a goal (Brownell, Ramani, & Zerwas, 2006; Warneken, Chen, & Tomasello, 2006). While young children share more with parents than unknown adults (Rheingold et al., 1976), children also are attentive to friendship relations (e.g., Costin & Jones, 1992), and even chimpanzees treat

non-kin, close-others as kin (Brosnan, Schiff, & de Waal, 2005). Because children observe parents and friends giving to themselves and others, however, these observations do not tease apart the effects of preference for close relations, reciprocity, and indirect reciprocity on children's cooperation.

Prior research provides some evidence for reciprocity effects in children's acts of giving in elementary school (Harris, 1970; Staub & Sherk, 1970) and, more weakly, at younger ages (Levitt, Weber, Clark, & McDonnell, 1985). Because these studies involved first-person giving in which the child was a recipient as well as a potential donor, however, they do not reveal whether children's giving depended on a principle of reciprocity or on positive or negative emotional states caused by receiving, or not receiving, a prior benefit. Moreover, the studies did not tease apart effects of direct vs. indirect reciprocity, because children observed others who gave to them or gave to no one but not others who gave to another person. To our knowledge, no experiments have examined whether children demonstrate the principle of indirect reciprocity and give to people who have shared resources with others, over people who have kept the resources for themselves.

Here we report three experiments that test for each of the principles at the foundation of human cooperation, using a third-person giving task. Children were introduced to a protagonist and helped her to allocate resources to her close relations, to actors who had given to her, and to actors who had given to other people. With this third-person task, we sought to minimize effects of the child's own motivational state and test whether fairness principles serve as general guides to children's reasoning about social exchange. If children's judgments accord with these principles, we cannot conclude that

their behavior would do so as well (indeed, studies of adults suggest frequent gaps between moral reasoning and moral action). Nevertheless, successful performance by children would provide evidence that basic principles of cooperation are accessible to children in novel contexts and guide their intuitions about other people's actions.

Study 1: Preferential Sharing with Close Relations

The first study investigated children's judgments of sharing with family members, friends, and strangers. Children were introduced to a protagonist doll with desirable resources and to six other dolls described either as siblings, as friends, or as strangers. Children were asked to help the protagonist by giving the resources to the other dolls.

Method

Participants. Twenty participants (8 female, *M*=45.5 months, *SD*=2.5 months) completed this study.

Materials. Children were presented with seven dolls over the course of the study: a protagonist and two dolls each described as the protagonist's sisters, friends, or "people she doesn't know" (henceforth, strangers). All of the dolls represented white females from the same collection that differed in appearance (e.g., clothing, hair color); dolls were referred to by the names they were given by the doll company. Children were also shown a set of resources to be distributed by the protagonist on each trial: miniature plastic bananas, stickers, bottles of bubbles, candy bars, paint sets, plastic oranges, seashells, rubber ducks, or hard candies.

Design. Children were given 3 blocks of 3 trials each, contrasting giving to siblings vs. friends, siblings vs. strangers, or friends vs. strangers. On each 3-trial block, children distributed a total of 9 resources: 2, 3, or 4 per trial. A total of six random orders

of trials and blocks were created and children were sequentially assigned to one of these in order to minimize item effects.

Procedure. At the start of the study, the 5 relevant dolls for the first block were presented and named. Then children were read the script of the first trial. An example script follows:

The next weekend, Reese's [the protagonist] parents took her to the beach. Reese's two sisters, O'Ryan and Kenna, came with her. Reese also invited her two friends to the beach, Kylee and Gwen. Reese found some shells on the beach. Reese has 4 extra shells to give out. Can you help Reese give out the extra shells?

Participants helped the protagonist distribute three sets of resources to the recipient dolls (the 2, 3, and 4 resource trials; see Figure 1), then these dolls were removed from the table, and a new block was begun.

Figure 1: Photograph of study set-up. Participant was seated holding the protagonist with four recipient dolls in front of him/her. The relationships between the protagonist and

recipients were described to participants and they were given resources to distribute to these recipient dolls.

Analyses. Trials were eliminated from analysis if a child refused to give out all of the resources; this occurred on 4.4% of trials[1].For each of the three pairwise contrasts (Siblings vs. Friends, Siblings vs. Strangers, Friends vs. Strangers) we created a composite measure across each block, combining the 2, 3, and 4 resource trials and comparing the total number of resources given to one member of the pair to chance using a one-sample t-test. Because a total of 9 resources were distributed over the three trials to each pair of recipient categories (e.g., siblings vs. friends), the maximum score for giving to one of these categories in a pair was 9 and the chance value for each comparison was 4.5. In all cases, the number of items distributed to one pair of recipients was compared to chance using a one-sample t-test.

Results and Discussion

Children guided the protagonist to give preferentially both to siblings and to friends (Figure 2). They directed significantly more resources to siblings than to strangers (M=5.22, chance = 4.5, t(17)=2.34, p=.032), and they directed more resources to friends than to strangers (M=5.63, t (15)=3.09, p =.007). Rates of giving to siblings and friends did not differ significantly, p=.14. Young children therefore guided the protagonist doll to share equally with family and friends, and to share more with individuals in these categories than with strangers.

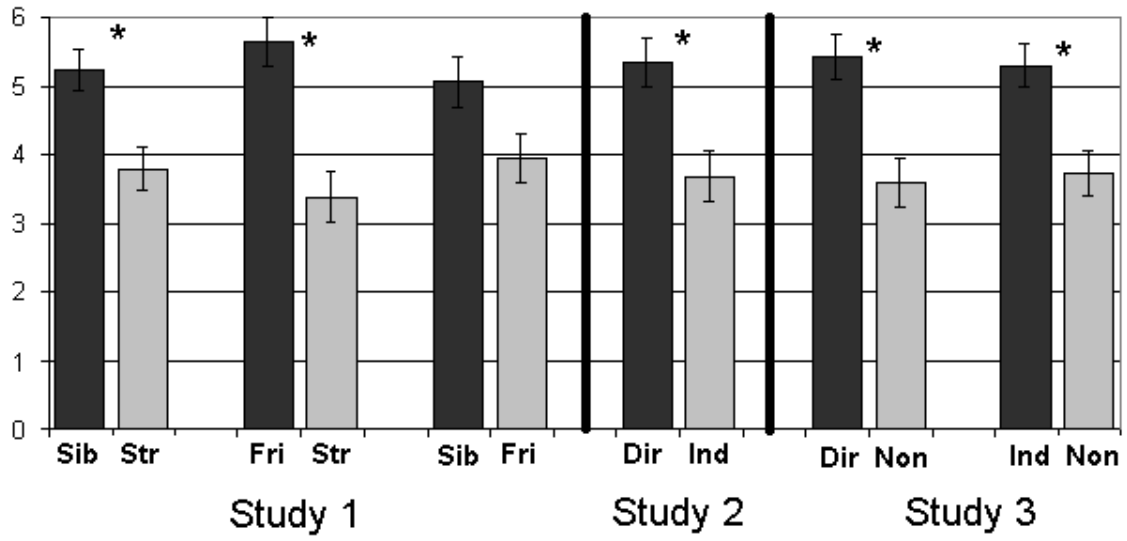

Figure 2: Mean number of resources (out of 9) given to each type of receiver in Studies 1, 2, and 3. Error bars indicate standard error of the mean. Asterisks indicate significance at $p<.05$. Sib=siblings, Str=strangers, Fri=friends, Dir=direct givers, Ind=indirect givers, Non=non-givers.

Study 2: Direct Reciprocity

The second study investigated whether children's resource allocation is influenced by the past sharing behavior of the potential recipients. Using a variation on the method of Study 1, we tested whether 3.5 year old children would guide a protagonist to share more with dolls who had previously shared directly with the protagonist (direct givers). To distinguish direct from indirect reciprocity, we contrasted the direct givers with actors who had shared with a different doll (indirect givers). All potential recipients therefore demonstrated equal acts of generosity, but only some of them had given to the protagonist.

Method

Method. The method was the same as Study 1 except as follows. Twenty-one participants completed Study 2 (11 female, *M*=45.0 months, *SD*=1.6 months). Children were presented with 6 of the dolls from Study 1, with scripts as follows:

Yesterday Reese [the protagonist] was at the park and so was this girl, Gwen. This is Gwen. At the park Reese met some other girls she didn't know. This is Vanessa and this is Britta. This is Angelique and this is Lourdes. Yesterday at the park Vanessa and Britta each gave Reese a penny. Angelique and Lourdes each gave Gwen a penny. Then they all left the park.

During the story, the experimenter acted out the scene using the dolls, by pointing to the dolls as she mentioned them and physically moving the pennies from one doll to the other. At the end Gwen was removed from the table and placed in sight of the participant on a nearby chair or table. Children were then asked if they remembered which girls gave pennies to the protagonist and which girls gave pennies to Gwen. If they answered incorrectly, children were reminded of the correct answer, "remember yesterday Reese got pennies from Vanessa and Britta". They then completed three sharing trials.

An example of the sharing trials is:

Today, Reese was playing at recess when she saw Vanessa and Britta, the two girls who gave her pennies yesterday and Angelique and Lourdes, the girls who gave the pennies to Gwen. Reese has 3 extra stickers to give out. Can you help Reese give out the extra stickers?

Participants also completed two unrelated 3-trial blocks in counterbalanced order. Children's performance on the critical trial block was not influenced by its order of

occurrence, p=.15. Data were analyzed as in Experiment 1; no trials were eliminated from this analysis.

Results and Discussion

Children directed the protagonist to give more to the direct givers than to the indirect givers (M=5.33, chance = 4.5, t(20)=2.27, p=.035; see Fig. 2). Children therefore led the protagonist to share resources more with those who had given to the protagonist compared to those who had given to a different doll, in accord with a principle of direct reciprocity.

Study 3: Indirect Reciprocity

The final study investigated whether young children engage in indirect reciprocity and share more with those who have given to others than with those who have given to no one. Additionally, the comparison of direct givers and non-givers was tested, to confirm that young children will guide a protagonist to give more to direct givers than to non-givers using our method. This latter case provided us with an opportunity to test whether children's responses on our third-person task accorded with previous reports of children's actual behavior when interacting with a peer who either did or did not share with them (Levitt, et al., 1985; Staub & Sherk, 1970).

Method

Participants. Twenty-nine participants[2] completed the study (15 female, M=45.1 months, SD=1.9 months). Three additional children did not meet standard inclusion criteria; they were excluded because of experimenter error (1), parental interference (1) or repeated failure to remember the critical giving events (1).

Method. Participants completed two blocks including one that compared indirect to non-givers and one that compared direct to non-givers. For the indirect vs. non-giver block children were introduced to the dolls with the following script:

Yesterday Reese [the protagonist] was at the park and so was this girl, Gwen. This is Gwen. At the park Reese met some other girls she didn't know. This is Vanessa and this is Britta. This is Angelique and this is Lourdes. Yesterday at the park Vanessa and Britta each gave Gwen a penny. Angelique and Lourdes each had a penny and they kept the pennies for themselves. Then they all left the park.

The script for the direct vs. non-giving condition was creating by combining the scripts from Study 2 and the script above, though the resource was switched to shells rather than pennies. Otherwise the method was identical to that of Study 2.

Results and Discussion

Children led the protagonist to give more resources to indirect givers than to non-givers (M=5.28, chance = 4.5, (t(28)=2.39, p=.024, Fig. 2). They also directed more resources to direct givers than to non-givers, (M=5.41, t(28)=2.70, p=.012). Thus, children guided the protagonist to share resources in accord with a third pillar of mature cooperation, the tendency to share with the generous compared to the non-generous.

Studies 1-3: Equality of Distribution

In all of the above experiments, children were given some trials in which the number of resources equaled the number of potential recipients, and other trials in which the number of resources was smaller than the number of recipients. Comparisons of performance across these different types of trials should reveal whether children tended to distribute resources equally when the number of resources equaled the number of

recipients (i.e., 4 resource trials), or whether children's unequal giving was apparent across all trials.

In all three experiments, children showed a tendency toward equal distribution on trials when there were four resources. In these cases, children's modal response was to divide the resources equally among the four potential recipients, whether they were siblings and friends (18/19 children), siblings and strangers (18/19 children), friends and strangers (15/18 children) direct and indirect givers (17/21 children), direct givers and non-givers (23/29 children), or indirect givers and non-givers (24/29 children). In contrast, the resources were not evenly distributed when there were an even number of resources but not enough for all (2 resources and 4 recipients). On 2 resource trials, few participants distributed equally to members of the two pairs of siblings and friends (5/20), siblings and strangers (6/20), friends and stranger (4/20), direct and indirect givers (6/21), direct givers and non-givers (7/29), or indirect givers and non-givers (3/29).

Children may have distributed resources equally on the 4-resource trials for either of two reasons. First, it is possible that children will resort to equal sharing whenever resources are plentiful and will favor family, friends, reciprocators, and generous others only under conditions of scarcity. Such a possibility is consistent with the finding that social conflicts among older children and adults arise primarily when resources are limited (Jackson, 1993; Sherif, Harvey, White, Hood, & Sherif, 1961). Alternatively, the equality response may be driven by a predisposition to distribute resources in a one-to-one correspondence with recipients whenever such a distribution is possible. That predisposition, in turn, could arise either spontaneously or through the internalization of an explicit rule children are taught by parents and other adults. Future research involving

larger but not equally divisible numbers of resources is needed to distinguish between these possibilities.

General Discussion

Cooperation is essential in all human societies, and it is sustained both by explicit moral teaching and by everyday social experience. The present research provides evidence that three principles at the root of human cooperative behavior are present and functional in young children, and they guide children's judgments about how other people should distribute resources. Children directed a protagonist to share more with family and friends than with strangers, to reciprocate acts of giving by others, and to reward those who give to others. Children also directed the protagonist to share resources equally with all potential recipients, when the number of resources and recipients were equal. These findings add a new dimension to the large body of research concerning children's own patterns of giving. They provide evidence that three specific principles governing complex, mature cooperative networks emerge early in childhood.

Although our studies provide evidence for cooperative principles early in childhood, they do not reveal whether such principles would guide children's reasoning or behavior when they themselves are the protagonists. It is possible that sensitivity to these cooperative principles will emerge in even younger children, if children are given resources to distribute for themselves and need not reason about third-party social relationships. Alternatively, first-person tasks may obscure or impair children's reasoning from cooperative principles by introducing competing motivational factors. Future studies using a variant of the present method could address these questions.

A second limitation of the present studies is that they focus on sharing behavior under situations that bear no cost to the child. In contrast, evolutionary theories of kin selection, reciprocity and indirect reciprocity focus on acts that incur a cost to the giver while providing a benefit to the recipient. It is possible that the present cooperative principles will guide children's giving even more strongly in costly situations: for example, the tendency to give resources equally to all others, even strangers, may diminish in situations in which gifts are costly. Alternatively, motivational factors may diminish children's cooperative reasoning and actions in the face of personal costs. Future research is needed to test these possibilities.

What are the origins of the cooperative principles? Although few three-year-old children have experienced complex social networks outside the home, such children have at least two years of experience engaging in prosocial behavior, mostly within the familial environment (Eisenberg & Fabes, 1998; Rheingold, Hay, & West, 1976). The present studies therefore rule out formal moral instruction and experience in complex social institutions as sources of the cooperative principles, but they cannot tease apart the effects of children's own observational learning, directions from parents and other adults, feedback from other children, and intrinsically guided developmental processes. Further research with infants and young children could serve to test the effects of these factors on the emergence and development of cooperation. Because infants observe the social world before they are capable of any overt acts of giving, the present third-party approach may be especially useful for that effort.

Footnote

1. The findings of this experiment are not changed if these trials are included in the analysis.

2. The number of participants in Studies 1 and 2 was 20 and 21, respectively. In Study 3 we ran more subjects, however, because of concerns that this may have artificially inflated the significance of these findings, we analyzed the data from only the first 20 and the first 21 subjects tested and found that these participants showed the same general results. They gave more to the indirect givers than to the non-givers, $t(19)=2.45$, $p=.024$, and $t(20)=2.16$, $p=.043$, and gave more to the direct givers compared to the non-givers, $t(19)=2.80$, $p=.012$, and $t(20)=2.26$, $p=.035$.

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