

Original Article

The Influence of Social Category and Reciprocity on Adults' and Children's Altruistic Behavior

Michaela Gummerum, Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development, Berlin, Germany. Email: michaela.gummerum@plymouth.ac.uk (Corresponding author).

Masanori Takezawa, Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development, Berlin, Germany.

Monika Keller, Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development, Berlin, Germany.

Abstract: Evolutionary theories of altruism have suggested that reciprocal exchanges and ingroup favoritism have been important strategies leading to the evolution of altruistic behavior among strangers. This study investigates whether minimal information about an interaction partner's membership in a trivial social group affects the allocations of adults and children in dictator game, reciprocity in a sequential prisoner's dilemma, and altruistic punishment in a third-party punishment game. In all, 155 adults and 157 students from second and sixth grade played these three economic games in either an ingroup, outgroup, or neutral condition. Adults and sixth-grade children allocated more to ingroup than to outgroup receivers in the dictator game, and adults punished ingroup non-cooperators more in the third-party punishment game than outgroup non-cooperators. When additional information about the other player's past behavior was presented, adults reciprocated equally with ingroup, outgroup, and neutral players, whereas children from sixth grade reciprocated more with ingroup and neutral than with outgroup players. Overall, the results of this study support the importance of group membership and reciprocity for adults' and older elementary school children's altruistic behavior. For younger elementary school children, however, reciprocity and group membership do not serve as salient social information that influence their altruistic behavior.

Keywords: Altruism, social category, reciprocity, children

Introduction

Altruism, that is, behavior that benefits others at a cost to oneself, has attracted interest in disciplines as diverse as philosophy, psychology, economics, and the biological sciences. Over the last decades social and evolutionary scientists have investigated the proximate and ultimate causes of altruism in humans. Concerning the former, research has suggested that altruistic behavior is influenced by a variety of variables, for example, personality dispositions (e.g., Eisenberg et al., 1999), empathy, guilt, and other emotions (e.g., Batson, 1991), and social norms (e.g., Gouldner, 1960). Concerning ultimate causes, evolutionary theories have focused on three major models for explaining the evolution of altruism (see Hammerstein, 2003; Henrich, 2004; for overviews): Hamilton's (1964) theory of kin selection or inclusive fitness predicts that altruistic actions are most likely to occur between closely related kin, thus helping to increase the proportion of shared genes in the population; Trivers (1971) in his theory of reciprocal altruism showed that altruistic behavior between non-kin can be favored by natural selection if it follows the principle of reciprocity and if the costs for the performer of the altruistic act are less than the benefits of that act for the recipient; and theories of (cultural) group selection propose that the evolution of human altruism can be driven by individuals selectively cooperating with members of their (symbolically marked) ingroup (Henrich, 2004; Richerson and Boyd, 2005).

All three of these evolutionary approaches suggest that people bestow altruistic actions selectively depending on their information about the recipients of the behavior. Thus, humans have to distinguish kin from non-kin, and they must understand cues that signal reciprocal exchanges and group membership. Here, we are interested in whether cues about an interaction partner's group membership and cues indicating direct reciprocity affect the altruistic behavior of adults and children in three economic games. We investigate altruistic sharing in the dictator game, reciprocity in a sequential prisoner's dilemma, and altruistic punishment in a third-party punishment game.

There have been numerous studies that have employed these games to examine altruistic behavior in adults (see Camerer, 2003) but relatively few with children (e.g., Benenson, Pascoe, and Radmore, 2007; Fan, 2000; Gummerum, Keller, Takezawa, and Mata, 2008; Harbaugh and Krause, 2000; Sally and Hill, 2006). Furthermore, no study so far has explored how children's altruistic behavior in these games is influenced by the social information available about the other player. The strength of using a game theoretical approach to investigate altruistic behavior lies in the fact that children's behavior can be systematically compared to previous research with adults, which allows us to draw meaningful conclusions about the development of altruistic behavior across the lifespan. Studying children's altruistic behavior in relation to group membership and reciprocity permits us to investigate ontogenetic differences in reciprocal altruism and group selection and helps to clarify the nature of human altruism more generally.

Reciprocity, Group Membership, and Altruism in Adults

Research in social psychology and experimental economics has shown that both reciprocity and information about an interaction partner's group membership play an important role in adults' altruistic behavior. Reciprocity has been defined as the provision of equivalent benefits over a period of time between functional equals (Montada, 2003).

Immediate reciprocity seems to be most important for cooperation to arise in social dilemmas, such as the prisoner's dilemma; players reciprocate the past behavior of their partners and also expect this kind of reciprocity from others (e.g., Berg, Dickhaut, and McCabe, 1995; Fehr and Gächter, 2000; Komorita, Parks, and Hulbert, 1992).

Cosmides (1989) and Cosmides and Tooby (1992) investigated the hypothesis that the human mind is designed to keep track of the reciprocal provision of benefits in social interactions and to detect violations of these implicit social contracts. A cheating detection module helps humans pay attention to whether the exchange partner has paid her costs when she collects her benefits and to cooperate selectively only with non-cheaters. Cosmides and colleagues (Cosmides, 1989; Cosmides and Tooby, 1992; Cosmides, Tooby, Fiddick, and Bryant, 2005) demonstrated that if the classical selection task by Wason and Johnson-Laird is framed as a social contract, up to 75% of adults are indeed sensitive to information that might indicate cheating in social exchanges.

There is also ample evidence that people treat and judge members of their ingroup more positively than outgroup members, and this ingroup bias is found cross-culturally (see Hewstone, Rubin, and Willis, 2002). Tajfel (1970, 1982) showed that the random classification of people into trivial social categories (e.g., "a green group," "a yellow group") can lead them to allocate more money to an ingroup than an outgroup member. Yamagishi, Jin, and Kiyonari (1999) demonstrated that players in a one-shot prisoner's dilemma game cooperated more with an ingroup than an outgroup member, even when group membership was based on trivial social categories.

Shinada, Yamagishi, and Ohmura (2004) conducted a third-party punishment game in an intergroup situation and found that adults punished ingroup cheaters more often and more severely than outgroup cheaters. In this game, punishment is altruistic because punishers spend some of their own endowment in order to punish non-cooperators, and punishers' returns are less than if they had not punished. Even though there might not be one person directly benefitting from the punishers' actions, punishment leads to the enforcement of cooperative and other social norms in a population (Fehr and Fischbacher, 2003; Fehr and Gächter, 2002). Shinada and colleagues' findings indicate that people are more willing to punish ingroup members who have violated the group norm of sharing with other ingroup members than to punish outgroup members (see also Bernhard, Fischbacher, and Fehr, 2006). Similarly, in a hypothetical punishment experiment Lieberman and Linke (2007) found that perpetrators were punished significantly more severely when the victim of a crime was either a relative or an ingroup member. According to Yamagishi (2003), ingroup members are more strongly punished than outgroup members because they violate the norm of generalized or indirect reciprocity in the group. In keeping with this norm, members of a group are expected to reciprocate and behave altruistically not only to the one who directly bestowed benefits on them, but to every group member.

However, Yamagishi and colleagues (Kiyonari, Tanida, and Yamagishi, 2000; Yamagishi et al., 1999; Yamagishi and Kiyonari, 2000) showed that altruistic behavior favoring ingroup members disappears if people are presented with information that suggests direct reciprocity from their interaction partner. If adult participants had reason to expect reciprocity from their interaction partner in a sequential prisoner's dilemma game, there was no difference in their sharing behavior with ingroup versus outgroup members. Thus, these studies suggest that if information about direct and indirect reciprocity (group membership) is presented simultaneously, information about direct reciprocity seems to be

more relevant for altruistic decisions than information about indirect reciprocity. In the present study, we were interested in whether similar findings could be obtained with elementary school children of different ages.

Reciprocity, Group Membership, and Altruism in Children

As pointed out by Hirschfeld (2001), understanding and acting according to the affordances of social relationships is a major developmental task for young children. It is important for children to know “who’s who” in a social environment, what different individuals are likely to do, and how to react to others’ behavior. Here, we investigate whether group membership and reciprocity serve as salient social information for elementary school children for regulating altruistic behavior, when presented both separately and simultaneously.

Research on the development of attitudes toward ethnic and gender in- and outgroups has found that from 3 years of age, children ascribe more positive attributes to their own groups, like their own groups more, feel more similar to members of their ingroup, and are less willing to join a team of outgroup members (e.g., Aboud, 1988; Martin, Ruble, and Szkrybalo, 2002; Nesselrode, Maass, Griffiths, and Durkin, 2003). However, Bigler and colleagues (Bigler, Brown, and Markell, 2001; Bigler, Jones, and Lobliner, 1997; Patterson and Bigler, 2006) found that ingroup bias toward trivial social groups seems to appear in young children only when they are able to perceive group membership visually and when others, particularly authority figures, use these novel group categories in a functional way during routine interactions.

Studies investigating differences in children’s actual behavior toward ingroup and outgroup members seem to support Bigler and colleagues’ findings. There was no ingroup bias in the helping behavior of 6- to 9-year-old children grouped into novel social categories in Bigler and colleagues’ (1997) study. Vaughan, Tajfel, and Williams (1981) reported that 8- and 11-year-old children allocated more coins to an ingroup member than to an outgroup member. In contrast, kindergarteners in a study with trivial social categories only rewarded more play chips to an ingroup member than to an outgroup member when they were competitively primed. In a no-prime or neutral-prime condition, no differences in the allocation of resources occurred (Spielman, 2000). Thus, young elementary school children only treat their ingroup members more positively than outgroup members when group membership is made salient to them by adults in their environment. In older children, in contrast, ingroup bias is a pervasive phenomenon, even when group membership is based on trivial social categories.

To our knowledge, no study has investigated altruistic punishment in children in relation to the other players’ group membership. However, studies by Abrams and colleagues (Abrams, Rutland, Cameron, and Ferrell, 2007; Abrams, Rutland, Ferrell, and Pelletier, 2008) indicate that children exclude peers who violate or deviate from important ingroup norms. In experiments with both real and trivial groups they found that the more children are biased toward their ingroup, the more negatively they evaluate and treat an ingroup member who disregards the norm of being loyal to his or her group. Young elementary school children did not show ingroup bias when trivial social categories were used. Based on this research, we might expect that when group membership is based on trivial social categories older but not younger elementary school children punish an ingroup member who violates the group norm of indirect reciprocity.

Children typically understand the norm of (direct) reciprocity by 5 to 6 years of age (Berndt, 1977; Youniss, 1980). Elementary and preschool children rate reciprocity as a good strategy for determining whether to help someone (Suls, Witenberg, and Gutkin, 1981) or whether to share with a classmate (Dreman and Greenbaum, 1973). Keller, Gummerum, Wang, and Lindsey (2004) found that even preschool children recognize the violation of social contracts with bilateral cheating options when they are given all the relevant information. However, elementary school children have difficulties checking for the relevant information that might indicate a violation of reciprocity in the Wason selection task. Thus, although even young children implicitly understand the violation of reciprocity, in the course of development they might become better able to explicitly comprehend what kinds of acts constitute reciprocal exchanges, and the feelings related to the fulfillments and violations of such social contracts.

To our knowledge, no study to date has investigated developmental differences in children's reactions to social information about direct or indirect reciprocity as investigated by Yamagishi and colleagues (e.g., Yamagishi et al., 1999). Will children reciprocate equally to ingroup and outgroup members when they additionally receive information about their interaction partner's past behavior? In this study we try to answer this question.

Questions and Hypotheses

The first main goal of the present study was to investigate the influence of direct and indirect reciprocity on altruistic behavior in three economic games, and how this influence might change over the course of development. As suggested by Yamagishi (2003), indirect reciprocity was manipulated through group membership in trivial social categories. In the first economic game, the dictator game, participants allocated resources to a receiver from the ingroup or outgroup or to one who had no group membership indicated (neutral condition). We expected that adults and older elementary school children would share more with the ingroup member than with the outgroup member, but that no ingroup bias would occur for younger elementary school children.

In the second game, a sequential prisoner's dilemma, participants received information about both the past behavior and group membership of their partner. We expected that all participants would reciprocate equally independent of group membership. The third game, a third-party punishment game, examined participants' punishment of ingroup, outgroup, and neutral players. We expected that adults and older elementary school children would punish non-cooperators more in the ingroup than in the outgroup or neutral condition. We included gender in the analyses of altruistic behavior, because research has found that females tend to act more altruistically than males (Fabes and Eisenberg, 1998).

Materials and Methods

Participants

The adult sample consisted of 155 participants (90 females and 65 males; $M = 25.3$ years, $SD = 3.8$), mostly students, who were recruited from a participant register at the authors' research institution. The child sample included 92 students from second grade (50 girls, 42 boys; $M = 7.1$ years, $SD = 0.7$) and 81 students from sixth grade (46 girls, 32 boys; $M = 11.4$ years, $SD = 0.5$). They were recruited from two primary schools in the

southwestern part of Berlin. About 85% of the students had German parents; the remaining 15% had at least one parent of a different nationality, mostly Middle Eastern or Eastern European. Most students came from middle-class families.

Of the original students 92 students from second grade and 81 students from sixth grade, 11 second graders (6 girls, 5 boys) and 6 sixth graders (4 girls, 2 boys) were excluded because they failed to answer the quiz questions correctly (see below). The final child sample thus consisted of 81 students from second grade (44 girls, 37 boys; $M = 7.1$ years, $SD = 0.6$) and 75 students from sixth grade (42 girls, 33 boys; $M = 11.6$ years, $SD = 0.5$).

Materials

Dot estimation task. To establish membership in a trivial social category, a dot estimation task was conducted. Participants were presented with three pictures for 2s, respectively. Each picture contained 70–80 yellow dots on a blue background. Participants were asked to estimate the total number of yellow dots and to write this number on an answer sheet. Numbers were rank ordered. The six people with the highest numbers were in the “blue” group, and the six participants with the lowest numbers were in the “yellow” group. In the neutral condition, the dot-estimation task was omitted.

Dictator game. The dictator game is an altruistic sharing situation in which one player, the proposer, can allocate money to another, anonymous player, the responder. The responder can only accept an offer from the proposer, meaning that the proposer decides unilaterally. All participants played the dictator game as a proposer. In the adult sample, participants could allocate 20 euros between themselves and an anonymous responder. Allocations could be made in steps of 1 euro. The smallest allocation could be 0, the largest 20 euros.

In the two child samples, participants allocated 10 coins between themselves and an anonymous responder. In second grade, each coin was worth 20 eurocents; in sixth grade each coin was worth 50 eurocents. Allocations could be made in steps of 1 coin. The smallest allocation could be 0, the largest 10 coins.

Both adult and child participants were asked quiz questions after they made their allocation decision to test their understanding of the dictator game. In the child sample, quiz questions were accompanied by cartoon pictures of the players and the coins. First, participants were asked how many euros/coins they could allocate to the other player. Second, participants were asked to calculate the payoffs for a proposer and responder in an example dictator game. Adults were given the situation, in which a proposer decided to give 17 euros to the responder; adult participants had to indicate how many euros the responder and proposer would receive. Children were told to calculate the payoffs for a proposer and responder in a situation where the proposer decided to give 1 coin to the responder.

Sequential prisoner's dilemma. In the sequential prisoner's dilemma, two anonymous players have an initial monetary endowment, which they can sequentially exchange between each other. The money they give to the other player from their endowment is doubled and added to the other's endowment. For example, if one player gives 3 euros to the other, this money is subtracted from his initial endowment, but 6 euros are added to the other's account.

In this experiment, all participants played the second player. In the adult sample,

both players initially had an endowment of 5 euros each. Participants, as second players, were given all 5 euros from the first player, doubled. Thus, according to the rules of the game, they possessed 15 euros altogether (5 euros initial endowment + 2 x 5 euros from the other player) before they made the decision of how much to give back to the first player. They could give back any sum between 0 and 15 euros in steps of 1 euro. The sum they gave back to the other player would be deducted from their 15 euros. Whatever amount participants gave to the first player would be doubled and added to the first player's account.

In the two child samples, both players initially had an endowment of three coins each. Each coin was worth 20 eurocents in second grade and 50 eurocents in sixth grade. Participants were given all three coins from the first player, which was doubled according to the rules of the game. Thus, they possessed nine coins altogether before they made the decision of how much to give back to the first player. They could give back any sum between zero and nine coins in steps of one coin.

All participants were asked quiz question to test their understanding of the game after they made their decision. They were presented with an example scenario of a sequential prisoner's dilemma for which they had to calculate the payoff for the first and second player. Adults shown a scenario, in which the first player gave 2 euros to the second player, and the second player sent 4 euros to the first player. Adult participants were asked how many euros each player had in their initial endowment, how many euros both players had after the first player's decision and the final payoff for each player. Children were presented with a scenario, in which the first player gave all 3 coins to the second player and the second player decided to send 1 coin to the first player. Participants were asked about the initial endowment of each player, the number of coins each player has after the first player's decision, and the final payoff of each player. In the child sample, the quiz questions were accompanied by cartoon pictures of the players and the coins.

Third-party punishment game. In the third-party punishment game, players can pay money from their own initial endowment to punish another anonymous (unfair) player. In the adult sample, all participants were presented with a scenario in which Player A (proposer) had given only 2 of 20 euros to Player B (responder) and had kept 18 euros for himself in a dictator game. Participants played Player C with an initial endowment of 10 euros. Participants could pay any amount between 0 and 10 euros in steps of 1 euro, and this sum would be subtracted from their endowment. However, twice that amount would be subtracted from the payoff of Player A. For example, if participants paid 2 euros, 2 euros would be deducted from their initial endowment leaving them with 8 euros. However, 4 euros would be subtracted from Player A's account, leaving him with 12 euros.

In the two child samples, participants were initially endowed with 5 coins. Each coin was worth 20 eurocents in second grade and 50 eurocents in sixth grade. The participants' task was to decide how many of these 5 coins they were willing to pay to reduce the payoff of Player A. All participants were presented with a scenario in which Player A gave only 1 of 10 coins to Player B and kept 9 coins for herself. Participants could pay any amount between 0 and 5 coins in steps of 1 coin, and this sum would be subtracted from their endowment. However, twice that amount would be subtracted from the payoff of Player A.

Participants were presented with an example scenario after their decision to test their understanding of the game. In the adult sample, participants were told that Player A

had allocated 5 euros to Player B. Player C decided to pay 2 euros. In the child sample, Player A decided to give Player B 3 coins, and player C decided to pay 1 coin. All participants were asked about the endowments of Players A, B, and C after Player A made his decision and the final payoff of Players A, B, and C after Player C made his decision. The sample scenario was accompanied with cartoon pictures of the players and coins in the child sample.

Procedure

Adult Sample. Three experimenters were involved in the experiment: The first experimenter was in the lab and interacted with the participants. The second experimenter sat outside the lab, received the decision sheets of the participants, and was responsible for matching the decisions and determining the payoff for each participant. If one of the participants did not appear for the experiment, a third experimenter filled in for this missing participant and acted as a participant.

Twelve participants were invited to the lab at one time. Upon arrival, they were welcomed by the first experimenter and led to their seats. The seats were arranged such that participants could not communicate with each other. Participants were told that they would be making decisions in three consecutive tasks with different anonymous interaction partners in each game. Payment would be determined by randomly picking one of the three tasks after the experiment was finished. All participants would then be paid according to their decision in this one task. This procedure was used to make sure that participants would regard the decisions in the three games as independent. Each participant received an identification number (ID) that consisted of a random arrangement of three or four digits. It was pointed out that the second experimenter could only identify participants by their IDs and would be blind to their real identities. The first experimenter in the room would not know their decisions.

To establish membership in a trivial social category, the dot estimation task was conducted in the ingroup and the outgroup condition. Participants were asked to keep the information of their group membership private. It was also pointed out that the first experimenter was not aware of their group membership. In the neutral condition, the dot-estimation task was omitted.

The three games were run in counterbalanced order. The rules of explained to the dictator participants with the help of a PowerPoint presentation. Participants were given one example and were asked whether they had any questions. After each game, participants were given quiz questions to test their understanding of the game. It should be noted that in contrast to the standard protocol used in experimental economic research deception was used, as all players played the same roles in the three economic games.

In the dictator game, participants were told that some of them were randomly picked to play the proposer and some to play the responder, and that it was randomly determined whether they would play with a member from their own or the other group. In fact, all participants played the dictator game as a proposer. Because the participants could guess who was a proposer and who a responder by simply observing who filled out an answer sheet, they were told that while the proposers made their decisions responders would fill out a sheet on an irrelevant task.

In the sequential prisoner's dilemma, participants were told that it was randomly determined whether they would play the first or second player and also whether they would

play with a member from their own group or the other group. The game consisted of two time points separated by 5 min of waiting time. At the first time point, the first players would write down their decisions on answer sheets. At the second time point, the second players were informed of the first players' decisions and made their own decisions. To avoid having players guess who was a first or second player from observing the others, participants were told that while the first players decided at the first time point, the second players would be performing an irrelevant task, and vice versa. In fact, all participants were playing the role of second players.

In the third-party punishment game, participants were told that it was randomly determined whether they would be Player A, B, or C and also whether they would play with people from their ingroup or outgroup. This game consisted of two time points, separated by 5 min of waiting time. Participants were told that while Player A decided at the first time point, Players B and C would perform an irrelevant task. At the second time point, Player C would decide and Players A and B would perform an irrelevant task. In fact, all participants played the role of Player C.

While the second experimenter determined the payment for every participant outside the lab, the first experimenter handed out a questionnaire not related to the present study. After participants finished the questionnaire, they received their payment, sealed in an envelope, from the first experimenter and were debriefed and dismissed.

Child Sample. A whole class was tested together during the school day. Only the data of students who brought a signed parental consent form were included in this experiment; the data of the other students were destroyed. Three female experimenters and, in some cases, the class teacher were present. The first experimenter explained the games to the children. The other two experimenters assisted children who had difficulties with reading and writing, especially in second grade, and made sure that children worked on the tasks independently.

Participants were instructed that they would decide in three consecutive tasks with different partners, and that they could earn some money in these games. After all the experiments were finished, the experimenters would randomly pick one of the games and all students would be paid according to their decision in this game. Decisions would not be divulged to their classmates, parents, or teachers.

A dot-estimation task was conducted to classify students into a blue and a red group in the ingroup and outgroup condition. Instructions and procedures for this task were the same as for the adult sample. The dot-estimation task was omitted in the neutral condition. The experiment consisted of three consecutive games explained by the main experimenter using the blackboard. Because in a pilot study the order dictator game–sequential prisoner's dilemma–third-party punishment game proved to be most easily understood, particularly by second graders, we used only this order in the experiment. All games were explained with the help of paper cartoon figures and paper coins. Furthermore, participants were given several examples and quiz questions to ensure understanding of the game structure.

For the dictator game, participants were told that it was randomly determined whether they would play with a member from their own group or a member from the other group. On the answer sheets the group membership of proposer and responder, respectively, was indicated by a blue or a red circle. All participants played the dictator game as a proposer. After the children made their decisions, the sheets were collected by the second experimenter.

It was randomly determined whether participants would play with a member from their own group or the other group in the sequential prisoner's dilemma. The group membership of the first and second player, respectively, was indicated by a blue or a red circle on the answer sheet. All participants played the role of second player. After the children made their decisions, the answer sheets were collected by the second experimenter.

For the third-party punishment game, participants were told that it was randomly determined whether they would play with people from their own group or the other group. The group memberships of Players A, B, and C, respectively, were indicated with blue or red circles on the answer sheet. For the ingroup condition, Players A, B, and C shared the same color. For the outgroup condition, only Players A and B had the same color; Player C had the complementary color. All participants played the role of Player C.

Results

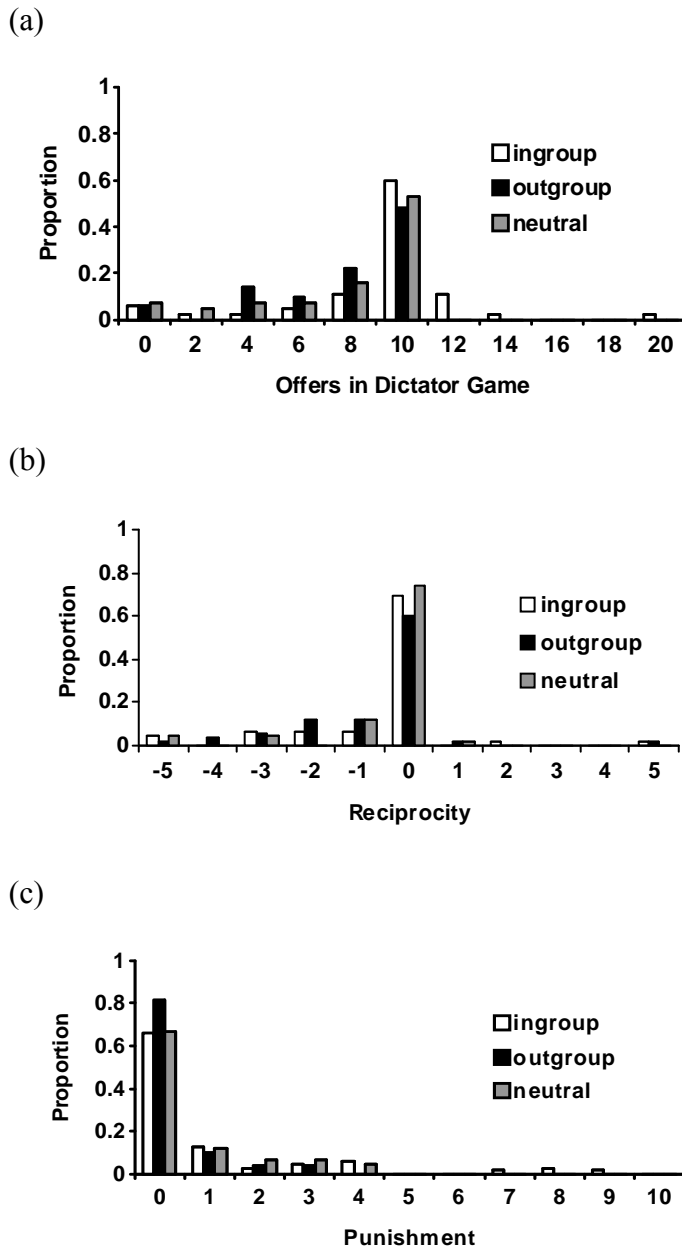
Analyses were conducted separately for the adult and the child sample because of the different settings in which the data were collected (laboratory setting for the adult sample, classroom setting for the child sample). A set of preliminary analyses (available from the authors for interested readers) was carried out to examine gender effects. Two effects of gender were found, and these are reported in the text. Otherwise the data were collapsed across gender and the findings are reported accordingly.

Adult Sample

Dictator game. Figure 1a displays the distributions of offers in the dictator game for the different conditions of group status (ingroup/outgroup/neutral), and Table 1 shows the mean offers in the dictator game for the same three conditions. We conducted a univariate analysis of variance (ANOVA) with group and task order as independent variables. The main effect for group membership was significant, $F(2, 152) = 3.76, p = 0.03$. As can be seen from Table 1, when dictators played with ingroup responders, they gave on average around 1.40 euros more than when they were playing with outgroup responders or in the neutral condition. The average offers for neutral and outgroup responders were almost the same. Post hoc Scheffé tests ($\alpha = 0.05$) revealed, however, that the average offers to ingroup members were significantly higher than the average offers to outgroup members, but that there was no significant difference between the ingroup and neutral condition.

The distributions presented in Figure 1 confirm this trend: Participants who played in the ingroup condition were more generous than participants playing with an outgroup member. Interestingly, offers larger than an equal split emerged only for the ingroup condition. To test whether the group membership effect would also emerge if offers larger than the equal split were excluded from analysis, an ANOVA with the same three independent variables was run but excluding the participants who offered more than 10 coins. This time, there was no significant difference in dictator game offers in the three group conditions, $F(2, 141) = 0.88, p = 0.42$.

Figure 1. Adult sample: (a) Distribution of offers in the dictator game; (b) reciprocity in the sequential prisoner's dilemma; and (c) punishment in third-party punishment game by group membership.



Sequential prisoner's dilemma. To analyze results for the sequential prisoner's dilemma, we calculated the variable "reciprocity," which measures to what degree the offer of the second player was reciprocal to the offer of the first player. Reciprocity is the difference between the second player's and the first player's offers. Thus, a value of zero indicates perfect reciprocity, as the second player gave as much back as he or she received from the first player. Negative values imply that the second player gave less than he or she

received from the first player, and positive values suggest that the second player gave more to the first player than the other way round. Figure 1b shows the distribution of reciprocity for the three conditions of group membership. In all conditions, the majority of second players reciprocated perfectly, although there was also a minority of players who sent less to the first player than they received. Only very few players, however, showed positive reciprocity and gave more to the first player than they got.

A univariate ANOVA with group membership, gender, and task order as independent variables revealed a significant interaction effect of only Group \times Gender, $F(2, 152) = 3.32$, $p = 0.04$. However, follow-up analyses which tested the effect of group membership on reciprocity separately for each gender did not reveal any significant differences. Furthermore, when the independent variable task order was removed from the ANOVA, the Group \times Gender effect did not remain significant. These analyses suggests that this effect is not very robust and very likely an artifact.

Table 1. Means and standard deviations of offers in the dictator game, reciprocity in the sequential prisoner's dilemma game, and punishment in the third-party punishment game by age and group membership.

		Dictator game		Sequential prisoner's dilemma		Third-party punishment game	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Second graders Group	Ingroup	4.54	1.48	-1.36	1.25	2.18	1.39
	Outgroup	4.04	2.61	-1.08	2.04	2.70	1.22
	Neutral	4.11	1.83	-1.24	1.48	1.93	1.19
Sixth graders Group	Ingroup	4.32	1.54	-0.79	1.10	2.07	1.39
	Outgroup	3.40	1.76	-1.28	1.10	1.44	1.33
	Neutral	4.41	1.14	-0.55	0.67	2.22	1.19
Adults Group	Ingroup	9.31	3.25	-0.53	1.56	1.50	2.52
	Outgroup	7.94	2.77	-0.68	1.54	0.60	1.09
	Neutral	8.00	3.08	-0.48	1.25	1.07	1.57

Third-party punishment game. Figure 1c shows the distribution of punishment by Player C for the three conditions of group membership in the third-party punishment game. A univariate ANOVA that tested the effects of group membership and task order revealed a significant main effect of group, $F(2, 154) = 3.53$, $p = 0.03$. As indicated in Table 1, the punishment for unfair dictators was on average more than twice as high when they came from the ingroup than from the outgroup, and this difference was significant in post hoc Scheffé tests ($\alpha = 0.05$). Moreover, the ANOVA revealed a significant main effect for task

order, $F(1, 154) = 4.45, p = 0.04$. Participants punished significantly more when the dictator game preceded the sequential prisoner's dilemma game than vice versa.

Child Sample

Dictator game. Figure 2a, b shows the distribution of offers in the dictator game in second grade and sixth grade for the different conditions of group membership. Table 1 displays the mean offers in the dictator game for the same two conditions. For each of the two grades, we separately conducted a univariate ANOVA to test the effects of group membership on the dependent variable offer in the dictator game. In second grade, none of the main or interaction effects reached statistical significance. Although children gave on average 50 eurocents more when they played against an ingroup member as opposed to an outgroup or neutral responder, as shown in Figure 2a the distribution of offers was similar across group conditions.

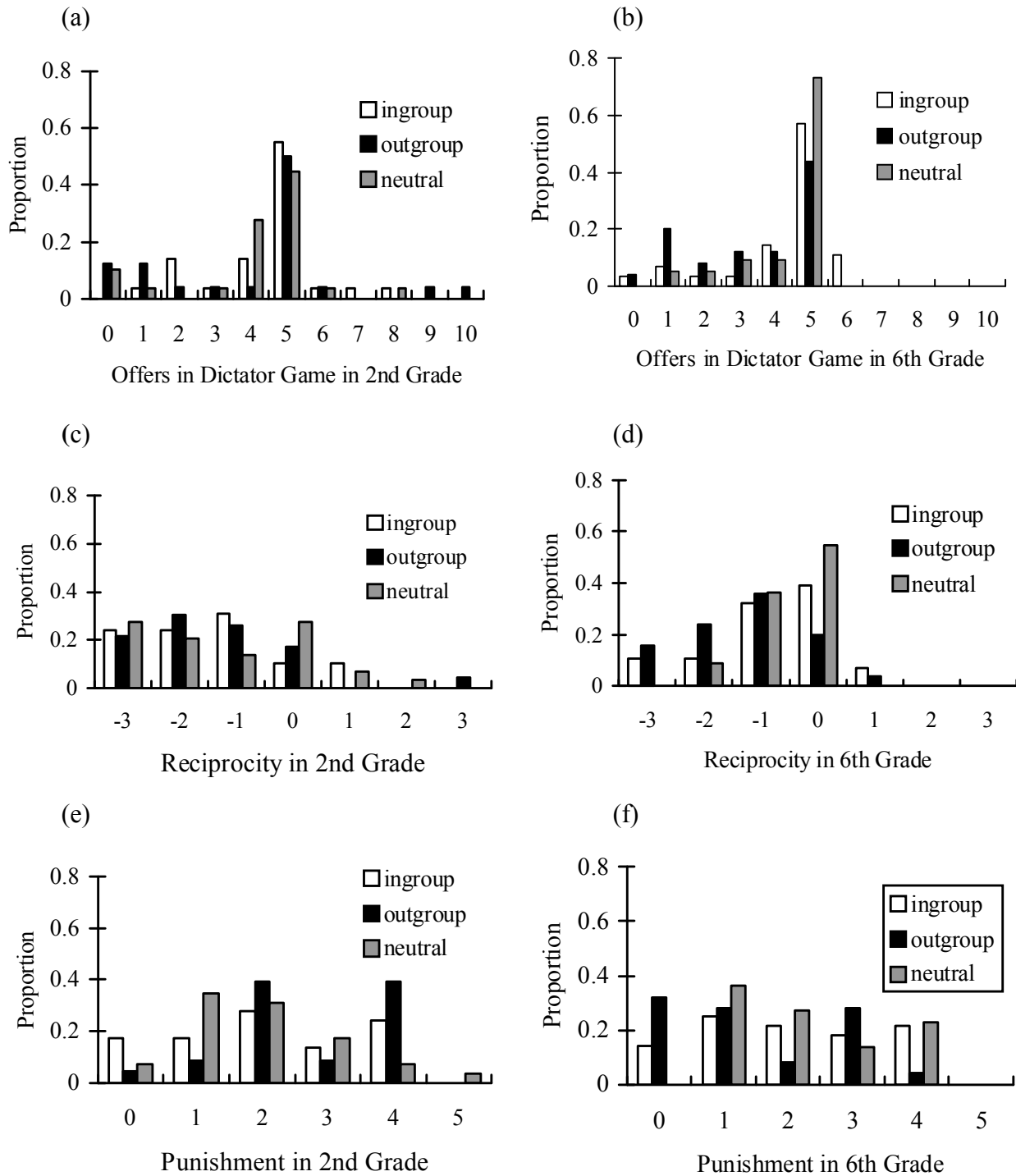
In sixth grade, an ANOVA with group membership and gender as independent variables revealed two significant main effects, for group membership, $F(2, 75) = 4.82, p = 0.01$, and gender, $F(1, 75) = 6.30, p = 0.01$. Post hoc Scheffé tests ($\alpha = 0.05$) indicate that the significant effect of group membership was mainly due to the difference in offers between the ingroup and neutral condition on the one hand and the outgroup condition on the other. When participants played with outgroup responders, they gave on average about 1 euro less compared to when they played against ingroup and neutral responders. Figure 2b also shows that offers larger than the equal split were only offered to ingroup members. The equal split, on the other hand, was the most common choice in the neutral condition. Girls ($M = 4.38, SD = 1.31$) in the role of proposer gave significantly more than boys ($M = 3.61, SD = 1.77$).

Sequential prisoner's dilemma. Similar to the adult sample, we calculated the variable reciprocity (second player's offer minus first player's offer), which measures to what extent the offer of the second player was reciprocal to the offer of the first player. As can be seen from the distribution in Figure 2c, children in second grade did not tend to reciprocate but gave less to the first player than they received from him or her. A univariate ANOVA with the independent variables group membership and gender did not show any significant main or interaction effects.

In sixth grade, a very high number of participants displayed negative reciprocity (see Figure 2d). However, perfect reciprocity (i.e., giving as much back to the first player as the first player has given to you) was the modal choice for participants playing with an ingroup or neutral first player, whereas participants in the outgroup condition reciprocated far less (see also Table 1). This main effect of group membership was significant in an ANOVA with group membership as independent variable, $F(2, 75) = 3.39, p = 0.04$.

Third-party punishment game. Figure 2e, f and Table 1 display the distributions and means of punishment in second and sixth grade for the two conditions of group membership. In contrast to the adult sample, students preferred to punish unfair proposers. An ANOVA with group membership and as independent variable obtained a marginally significant main effect for group membership in sixth grade, $F(2, 75) = 2.46, p = 0.09$.

Figure 2. Child sample: (a, b) Distribution of offers in dictator game; (c, d) reciprocity in the sequential prisoner's dilemma; and (e, f) punishment in the third-party punishment game by grade and group membership.



Discussion

Evolutionary theories have focused on two major accounts to explain altruism among non-kin: reciprocity (e.g., Trivers, 1971) and cultural group selection (e.g., Henrich, 2004; Richerson and Boyd, 2005), with people acting more altruistically toward members of their ingroup. In this study we were interested in whether social information about direct reciprocity (i.e., past behavior) or group membership influences the behavior of adults and elementary school children in three economic games measuring altruistic allocations, reciprocity, and punishment.

Social Information and Altruistic Behavior in Adults

Overall, the results of this study support the importance of social information for adults' altruistic behavior. When information about the group membership of the interaction partner was presented, adults behaved more altruistically with ingroup than with outgroup players. This finding is consistent with numerous studies on ingroup favoritism in social psychology and experimental economics (e.g., Bornstein, 2003; Tajfel et al., 1971; Yamagishi et al., 1999). Interestingly, information about the ingroup status of the receiver in the dictator game led to an increase in offers that were larger than the equal split. Thus, some dictators gave more to ingroup receivers than they kept for themselves. Even though adult participants shared significantly less with outgroup than with ingroup receivers, it would be wrong to call the offers to outgroup members "selfish." In all group conditions, the equal split was the modal offer and most participants allocated some money to the receiver. These findings might thus indicate that playing the dictator game with an ingroup member motivates people to be especially prosocial. This interpretation echoes Brewer's (1999) proposition that ingroup bias might mainly stem from evaluating and treating one's ingroup more positively without necessarily derogating or devaluing the outgroup.

Ingroup bias also occurred in the third-party punishment game. On average, adult participants punished unfair ingroup or neutral group members significantly more than unfair outgroup members. This is similar to results of the study by Shinada and colleagues (2004) in which adult participants punished ingroup cheaters more severely than outgroup cheaters. Yamagishi (2003) suggested that ingroup bias can be attributed to a norm of generalized reciprocity within groups. This norm expects group members to not only directly reciprocate altruistic behavior with a specific person but behave altruistically towards every ingroup member. Group members who do not follow this norm are punished more severely by fellow ingroup members than uncooperative people, who do not belong to the ingroup. Thus, whereas ingroup members do enjoy the benefits of a system of indirect reciprocity in a group, they are also expected pay the cost of acting altruistically toward other ingroup members.

Punishment of norm violators was relatively rare in the current study, especially compared to earlier investigations with the third-party punishment game (e.g., Fehr and Gächter, 2002; Shinada et al., 2004). In previous studies, participants usually interacted with each other (albeit anonymously) before they made their punishment decisions. For example, in Fehr and Gächter's study, participants played one round of a public goods experiment first before they had the opportunity to punish. In Shinada and colleagues' experiment players participated in two rounds and observed another round of a gift-giving game before punishing. In contrast, in the present study participants were presented with a

scenario with two anonymous other players with whom the participants might or might not have interacted before. Thus, it is possible that the experience of interaction within a defined group of people (and possibly the experience of unfairness from others in this group) might lead to higher amounts of punishment.

It has been suggested that punishment of non-cooperators is supported by strong negative emotions on the side of the violator, such as anger (Fehr and Fischbacher, 2004). Other emotions, such as spite, might have triggered punishment in our study. In that case, punishment would not have been motivated by altruistic concerns for another person's payoff and the enforcement of cooperative norms. One way to differentiate between these two types of motivation (punishment motivated by altruistic concerns versus punishment motivated by spite) would be to present punishers with a fair or self-less dictator in the third-party punishment game, that is a dictator that gives half or more than half to the responder. If punishers are motivated by altruistic considerations, they should not punish (as the dictator behaves cooperatively); if punishers are motivated by spite, they should.

In line with Yamagishi and colleagues (Kiyonari et al., 2000; Yamagishi et al., 1999; Yamagishi and Kiyonari, 2000), we expected that ingroup bias would disappear in situations with information about both direct (partner's past behavior) and indirect (partner's group membership) reciprocity. In support of this hypothesis we did not find an effect of group membership on the reciprocal behavior of adults in the sequential prisoner's dilemma. Thus, when presented simultaneously, social information related to direct reciprocity overrides expectations proposed by a group norm of indirect reciprocity with ingroup members.

Social Information and Altruistic Behavior in Children

Whereas our hypotheses concerning the relationship between types of social information and prosocial behavior were overall supported for the adult sample, the results were more complex for children. We found a significant effect of group membership in the dictator game in sixth but not in second grade. Similar to adults, participants in sixth grade allocated significantly more money to ingroup compared to outgroup responders. Students in sixth grade seemed to have developed an understanding of the group norm of indirect reciprocity toward ingroup members even when information about ingroup and outgroup is minimal and based on trivial social categories. This is not the case for students from second grade.

Why, then, do sixth but not second graders show this ingroup bias? Bigler and colleagues (Bigler et al., 1997; Bigler and Liben, 2007; Patterson and Bigler, 2006) proposed that the salience of group membership for young elementary school children seems to be based on adults' use of social categories. Thus, young first children develop ingroup bias for social categories that are commonly used to sort people into groups (e.g., gender, ethnicity, caste) in their specific culture. But young children only develop ingroup bias toward trivial social groups if group membership is visually salient and when others, particularly authority figures, use these novel group categories in a functional way. Furthermore, after some characteristics have been perceived as salient, children have to classify individual persons according to these dimensions into ingroup and outgroup. Age-related changes in children's classification skills will affect the degree of this categorization process (Bigler and Liben, 2007).

Consistent with this research, second grade children might not have interpreted the

trivial social categories color groups in our study as salient attributes used for classifying people into in- and outgroups. Our findings thus indicate that although humans might be prepared by evolution to pay attention to group membership status of others, information about what or who constitutes an ingroup or outgroup member has nevertheless to be learned over ontogenetic development (see Hirschfeld, 2001). That is, evolution has not “hard wired” certain dimensions to be used as a basis for classifying people into ingroups and outgroups. Instead, children deduce from their own experiences, environmental regularities, and the social reactions of others which classifications are significant in a specific context and culture (Bigler and Liben, 2007). This might be the reason why even North-American 3- to 4-year-old children show ingroup bias on the basis of gender or ethnicity (Aboud, 1988) — because these are very salient categories for classifying people in the culture they grow up in — but not for trivial group categories, as in our study. A way to test this assumption would be to replicate this study with real social categories instead of trivial ones. If our assumptions are correct, then also children in the youngest age group should exhibit ingroup favoritism for real and meaningful social categories, such as gender and ethnicity.

In (developmental) psychology, ingroup bias has generally been regarded as a negative phenomenon, forming the basis of stereotyping and prejudice. In line with Gigerenzer (2008), we propose that ingroup bias qualifies as a moral heuristic. Heuristics in the moral domain are not (morally) bad or good per se but, a heuristic can lead to morally laudable behavior as well as an action that would be condemned from a moral point of view. In our case, a heuristic such as “share with members of your ingroup” can lead to positive (moral) actions towards ingroup members, but it can lead to immoral behavior if moral obligations and empathy to outgroup members are neglected.

Children from both age groups reciprocated less than adults in the sequential prisoner’s dilemma. This might indicate that elementary school children do not follow the norm of reciprocity. However, this interpretation seems not to be supported by previous research that has shown that even young children use reciprocity norms for interpreting and evaluating (reciprocal) interactions (e.g., Berndt, 1977; Suls et al., 1981), expect future reciprocation from peers toward whom they have acted prosocially (e.g., Dreman and Greenbaum, 1973), can identify violations of reciprocal contracts, and attribute negative emotions to violators of such contracts (e.g., Keller et al., 2004). Preschool children also adopt reciprocal behavior when interacting with friends and peers (e.g., swapping toys, taking turns, Parrot and Gleitman, 1989; Youniss, 1980). Thus, a more likely interpretation might be that children in this study did not interpret the other player’s past behavior as a cue to behave reciprocally. In the studies mentioned above, reciprocal behavior was usually embedded in ongoing relationships. One way to make the other player’s behavior in the sequential prisoner’s dilemma more meaningful for children would be to let them experience the consequences of their own and others’ decisions by participating in, or even observing, several rounds of the sequential prisoner’s dilemma game.

In contrast to adults, students in sixth grade did not treat the direct reciprocity information in the sequential prisoner’s dilemma as more important but continued to reciprocate more with ingroup and neutral than with outgroup members. Indeed, groups, and especially peer groups start to play an important role in late childhood and early adolescents and peers constitute a major part of adolescents’ social networks (see Brown, 1990). Adolescent peer groups are often organized in cliques, which provide the main

social context in which peers interact, and generally members of one clique appreciate each other more than people outside the clique. Furthermore, adolescents are part of and identify with certain crowds, large groups who share a common feature (e.g., ethnicity, neighborhood) or share a common image or reputation among peers. As pointed out by Newman and Newman (2001), crowds provide an important basis for adolescents' identity; usually the membership in one crowd excludes membership in another. It is possible that the importance of group membership that young adolescents experience in their real-life interactions with peers generalizes to the abstract game situation in which group membership is only delineated by minimal cues.

To our knowledge, this is the first study that has investigated elementary school children's behavior in the third-party punishment game. However, previous research on children's social exclusion of peers by Abrams and colleagues (2007, 2008) has shown that elementary school children treat ingroup members who violate loyalty norms of their own group more negatively than outgroup members who exhibit the same behavior. Children who show more ingroup bias tend to punish disloyal ingroup members more than children with less ingroup bias. Based on this research and the findings of Bigler and colleagues (1997, 2001) who showed that young elementary school children do not show ingroup bias to trivial social categories, we expected that sixth- but not second-grade children would punish an uncooperative ingroup member more severely than an uncooperative outgroup member. The results of the present study show that elementary school children punish violators of altruistic norms even if this entails a cost to them. Although only marginally significant, children from sixth grade tended to punish more in the ingroup than the outgroup condition, which mirrors the results found for adults.

Only one gender effect emerged in the sample of sixth-grade students: Females tended to allocate more in the dictator game than males independent of group membership. This is in line with other developmental studies that have shown that girls act and reason in a more prosocial way than boys, particularly from late childhood onward (see Fabes and Eisenberg, 1998; Gummerum et al., 2008). Helpful and altruistic behavior is generally considered more appropriate for girls than for boys, and girls are more likely to be reinforced for such actions by parents and teachers (Power and Shanks, 1989). These findings are consistent with evolutionary research that has found consistent sex differences in aggressive, competitive, and affiliative behavior that are based on the different reproductive strategies employed by males and females (e.g., Campbell, 1999). However, overall very few gender differences were obtained in the current study in either the adult or child sample. Previous research with economic games has either not tested for sex differences or found only inconsistent results (e.g., Eckel and Grossman, 1998; Fehr and Gächter, 2002; Shinada et al., 2004; Yamagishi and Kiyonari, 2000). Benenson and colleagues (2007) argue that females should only exhibit more altruistic behavior than males in interactions with kin and that no evolutionary rationale exists for them to be more altruistic than males in anonymous interactions with non-kin.

Conclusion

Altruistic behavior plays a fundamental role in human social life. In line with previous research (e.g. Fehr and Henrich, 2003; Gintis, Bowles, Boyd, and Fehr, 2003) this study found that adults and children sacrifice some of their monetary resources to share with unrelated and anonymous individuals, to reciprocate others' good deeds, and to punish

uncooperative behavior directed at a third party. Adults and, to some extent, older elementary school children integrate information about their interaction partners' past behavior and their group membership into their altruistic decisions. For younger elementary school children, on the other hand, an individual's past behavior and his or her group membership do not serve as salient social information that influence their altruistic behavior. This suggests that while even young children exhibit altruistic behavior towards non-related and anonymous individuals (Benenson et al., 2007) they still have to learn what kind of social information is important for what kind of behavioral reactions (see Hirschfeld, 2001), and this understanding is likely influenced by both developmental processes and socialization practices. With age, children are able to better understand norms guiding altruistic behavior (i.e., norms concerning direct and indirect reciprocity), to follow these norms and, to some extent, to enforce these norms through punishment of norm violators.

Acknowledgements: Many thanks to all participants, teachers, and parents; our colleagues at the Center for Adaptive Behavior and Cognition and the Max Planck Research School LIFE for feedback; Jutta Mata, Maren Hoffmann, and Selver Temur-Erman for help in data collection; and Anita Todd for editing the manuscript.

Received 13 March 2009; Revision submitted 31 May 2009; Accepted 10 June 2009

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