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Currency value moderates equity preference among young children

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Abstract

Cooperative behavior depends in part on a preference for equitable outcomes. Recent research in behavioral economics assesses variables that influence adult concerns for equity, but few studies to date investigate the emergence of equitable behavior in children using similar economic games. We tested 288 3- to 6-year olds in an anonymous Dictator Game to assess how the value of the currency used affects equity preferences in children. To manipulate value, children played the game with their most or least favorite stickers. At all ages, we found a strong value effect with children donating more of their least favorite stickers than their favorite stickers. We also found a dramatic increase with age in the percentage of children who were prosocial (i.e. donated at least one sticker). However, children who were prosocial tended to give the same proportion of stickers at all ages – about half of their least favorite stickers and 40% of their favorite stickers. These findings highlight the influence of resource value on children's preference for equity, and provide evidence for two different processes underlying altruistic giving: the decision to donate at all and the decision about how much to donate.

Keywords: Cooperation; Dictator game; Development; Children

1. Introduction

Humans exhibit an unparalleled propensity for cooperative behavior with unrelated individuals. Cooperation is costly – one individual must pay a cost for another to receive a benefit – and, therefore, could not evolve without mechanisms to support cooperators (Nowak, 2006). These mechanisms in turn depend on social norms to regulate the behavior of individuals.

Social norms play a key role in two central mechanisms for the evolution of cooperation among unrelated individuals: reciprocity (Alexander, 1987; Axelrod & Hamilton, 1981; Binmore & Samuelson, 1992; Fudenberg & Maskin, 1990; Nowak & Sigmund, 1992, 2005; Trivers, 1971) and multilevel selection (Bowles, 2001; Boyd & Richerson, 1990; Paulsson, 2002; Traulsen & Nowak, 2006; Wilson, 1975; Wynne-Edwards, 1962). In the case of reciprocal altruism, one's actions today have future consequences, and this can incentivize cooperation. Here, norms are essential to specify when people are expected to cooperate with others, and to what degree (e.g., Ohtsuki & Iwasa, 2006). In the context of multilevel selection, cooperative groups can outcompete groups of defectors. However, in order for cooperation to succeed in large groups, strongly enforced social norms are required to sanction potential defectors (Boyd, Gintis, Bowles, & Richerson, 2003).

Among the social norms that support cooperation, a preference for equity (i.e., inequity aversion, Fehr & Fischbacher, 2004) has received particular attention in both evolutionary biology (Bräuer, Call & Tomasello, 2006; Brosnan & de Waals, 2003; Fehr & Fischbacher, 2003) and behavioral economics (Bolton & Ockenfels, 2000; Fehr & Schmidt, 1999). An extensive experimental literature describes adult preferences for equity in different cultures using strategic and economic games (Camerer & Fehr, 2006; Fehr & Fischbacher, 2003; Henrich et al., 2005). However, less is known about how a preference for equity develops in childhood. The research reported in this article used an anonymous distribution task to investigate altruistic giving in children. By manipulating the type of currency (and thus

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the value) of the resource at stake, the results provide insight into the development of children's altruistic behavior, specifically, the decision to give at all (prosociality) and how much to give for a particular currency value.

Experimental tests of altruistic behavior have largely focused on a two-person, anonymous economic game called the Dictator Game (DG) (Camerer, 2003). In the standard DG, one subject plays the role of the proposer (or dictator) who is given an amount of money. The proposer is told that she can either keep all of the money for herself or give as much as she wants to the other player (the receiver). Both the proposer and the receiver remain anonymous to each other, and, therefore, reciprocity and other strategic concerns should not motivate the dictator's decision. If players were concerned only with their own payoffs, no proposer would give anything to the receiver. However, across cultures, some adult proposers do give away a portion of the stake, with many splitting the stake equally (Henrich et al., 2005). For example, in one study using American college students approximately 20% give nothing, 20% give half the stake and the remainder give between zero and half (Forsythe, Horowitz, Savin, Sefton, 1994).

Despite the altruism apparent in the DG, self-interest plays a key role. For example, a concern for one's reputation significantly affects distributions in the game. In double-blind versions of the game, where the experimenters cannot identify individual's offers, over 60% of adults give nothing and only 6% offer half (Hoffman, McCabe, Shachat, & Smith, 1994). By contrast, priming dictators with social terms like "police" and "jury" (Shariff & Norenzayan, 2007) or placing eyespots on a background (Haley & Fessler, 2005) has been shown to increase altruism and decrease selfish behavior.

Given that self-interest strongly affects outcomes in the DG, one might expect the value of the resource being divided to impact levels of donation. Some economic models (Rabin, 1993) predict that concerns for equity will decrease as the value of the stake increases. The larger the stake, the more it costs the dictator to achieve an equitable outcome. Thus, an individual might split a $10 stake equally in a DG, incurring a $5 cost, but be unwilling to sacrifice 50% of a $1 million stake. Surprisingly, experimental manipulations of stake size have shown little effect. In DGs with stakes of $5 and $10 (Forsythe et al., 1994) and $10 and $100 (Carpenter, Verhoogen & Burks, 2005; List & Cherry, 2008), researchers found no significant difference in the distributions of offers. Other DG experiments have manipulated the "price of giving" by varying the value of a token (1 unit of the stake) to the proposer and the receiver. For example, Andreoni and Miller (2002) asked adults to allocate tokens that were worth $.30 to the proposer but only $.10 to the receiver in one game and then switched the value to each player in another game. They found that despite these changes, individuals tended to show consistent altruistic behavior with many choosing equity at any price. A reanalysis of this data also revealed gender differences with women tending to prefer equity more than men (Andreoni & Versterlund, 2001). A similar experiment done with children between 6 and 12 years of age varied the total number of units used in different allocations and found that children were generally consistent with the adult behavior (Harbaugh & Krause, 2000).

The DG experiments described above altered the value of the stake by holding the currency constant—the payout was money or tokens to be used as money—and varying the number of units in the stake or their price to each player. However, stake value can also be manipulated directly by comparing different currencies, i.e., money versus food or different types of consumables. Previous experiments with adults and children (Harbaugh, Krause & Berry, 2001) have compared individual preferences using different kinds of goods in non-social tasks and found that, generally, subjects showed consistent preferences for one good over another. Resource value has also been shown to affect behaviors such as delay of gratification. For example, given a choice to wait for a large reward or receive a smaller reward immediately, adults are far more willing to wait for more money than they are for more food (i.e., M&Ms) (Rosati, Stevens, Hare & Hauser, 2007). However, no experiments that we are aware of examine the effect of varying the currency type on social behavior, such as altruism in a DG. This approach makes particular sense for testing altruism in children, who have limited experience with money but much experience with consumables such as stickers. Developmental psychologists have only recently begun to use the methods of behavioral economics to investigate altruism in children (Gummerum, Hanoch & Keller, 2008). The results from several of these experiments suggest that 3- to 4-year-old children are willing to share some resources but that a preference for equal allocations does not emerge until 7 years of age or later (Benenson, Pascoe & Radmore, 2007; Fehr, Bernhard & Rockenbach, 2008; Harbaugh, Krause & Liday, 2003; Murnigham & Saxon, 1998). To assess the impact of currency value on children's altruistic preferences, we had children from 3 to 6 years old participate in two dictator games, one using 10 copies of a sticker selected as their favorite, and one using 10 copies of a sticker selected as their least favorite.

2. Method

Two hundred eighty-eight children (147 females) between 36 and 83 months of age were tested at the Museum of Science in Boston, MA, USA. Pilot testing revealed that children younger than 3 years of age could not understand the instructions, and 7-year olds did not care very much about stickers. Approximately 68% of the visitors to the museum come from Boston, Cambridge, and the surrounding areas, including New Hampshire and Rhode Island. The majority of the visitors are white and fall in a middle- to upper-middle-class income bracket.

Parents with children were recruited in an exploratory learning center for children in the museum. They were told that the researchers were playing a "game with stickers" and that participation was voluntary. Parents were given more information about the purpose of the study only after their child completed the experiment, in order to avoid any influence on the child's behavior.

Each child received one of four different treatments: the baseline condition and three control conditions. In the baseline condition (n=94; mean ages: 3;6, 4;6, 5;6, 6;5), children were asked to identify their favorite (high value) and their least favorite (low value) stickers from a set of four different sticker types. Children were then told that they would play a game using either the high- or low-value stickers. The experimenter placed 10 identical stickers in a circle pattern in the middle of a felt square used as a game board. The square had dividing lines on both sides of the stickers, separating them from the child on one side, and the experimenter on the other. The experimenter then told the child that all of the stickers were hers, but that if she wanted to, she could give some away to another child who would come tomorrow. Children were told that the other child was of the same gender as themselves in order to suggest that the other child would prefer the same types of stickers. Children were also told that the experimenter did not know who the specific receiver would be. One blank envelope was placed on the child's side, and one was placed on the experimenter's side. Children were instructed to divide the stickers between the envelopes as they wished. A "privacy box" was placed over the game board so that children could divide the stickers without anyone watching. Before playing the game, the experimenter verified that the child understood the instructions (see Supplementary materials for full instructions). After completing the game, the envelope for the other child was placed in a stack of envelopes, and children were told that they would play again with the other-value stickers. At the end of the game, children were allowed to take the envelopes that they used for themselves and were given an additional sticker to thank them for participating. The order of high- and low-value rounds was counterbalanced within age and gender. The contents of the envelopes were recorded after the child had left the testing area and out of view of potential participants, and donations were distributed at a later date (see Supplementary materials for more details).

The first control condition (n=74; mean ages: 3;6, 4;7, 5;4, 6;5), Facilitated Split (FS), addressed the concern that young children may not be able to divide the stickers equally if they have limited experience counting and working with sets of 10 items. The FS condition followed the same procedure as the baseline condition with the following modification: the stickers were placed in two parallel rows of five, one closer to the child's envelope and one closer to the other child's envelope. The experimenter verified that children understood that they could distribute all 10 stickers (both rows) as they saw fit. The second control condition (n=65; mean ages: 3;6, 4;6, 5;4, 6;5), High Only (HO), addressed the concern that children might make different levels of donation in a two-round DG than in a one-round DG, as has been found in other repeated games (Harbaugh, Krause & Liday, 2003). In the HO condition, children selected only their favorite sticker and played a one round DG using that sticker type. The procedure and layout of stickers from the baseline condition were used. The third control condition (n=55; mean ages: 3;5, 4;5, 5;5, 6;5), No Choice (NC), eliminated possible value framing effects that may have occurred when children chose their favorite and least favorite sticker. Explicitly identifying the relative value of the stickers may have encouraged children to treat them differently when deciding how many to donate. Using the data from the prior three conditions, children were presented with the most popular sticker type for their gender and played a one-round game.

The results for all four conditions were examined using multiple regression procedures in Stata 9.2. To maximize the power of the analysis, the data from all four conditions were aggregated and dummy variables were added for the three control conditions. All analyses were clustered on subject to account for the repeated measures design. Two analyses were performed: (i) a logistic regression to examine the conditional probability of donating by age and (ii) an ordinary least squares (OLS) regression to examine the average donation among those who gave. In both analyses, seven predictors were considered: Age (in months), Sticker Value (High or Low), Order (for conditions with two DG rounds), Gender, and the 3 dummy variables for the control conditions (FS, HO, and NC).

3. Results

The conditional probability that children would donate any stickers at all in a given DG round was analyzed with logistic regression models (Table 1). The M4 model was selected as optimal based on sizeable improvements to the −2 log likelihood statistic (−2LL) for each predictor. In the M4 model, Age was positively associated with proportion of donors ($z_{4,288}$=4.32, P<.001), and there was a negative Age×Sticker Value interaction ($z_{4,288}$=−2.19, P=.028). There was also a main effect of Gender with females significantly more likely to donate than males ($z_{4,288}$=2.60, P=.009). There was no significant main effect for Sticker Value ($z_{4,288}$=1.73, P=.084) or any of the control dummies: FS ($z_{4,288}$=−1.78, P=.08), HO ($z_{4,288}$=1.01, P=.31) and NC ($z_{4,288}$=0.02, P=.98), and no additional significant interaction terms (P>.05 for all interactions). A separate regression including only the conditions with two rounds (Baseline and FS) showed no significant effect of the order of the two DGs ($z_{5,168}$=−0.99, P=.32) and no significant interactions with Order (P>.05 for all interactions).

Fig. 1A shows the proportion of children that were donors by age (in years) and sticker value. The proportion that donated either sticker type increases with age. Age

Table 1
Logistic regression models for probability of giving

	M1	M2	M3	M4
Age (months)	0.048	0.049	0.075	0.074
Sticker Value (0=low, 1=high)		−0.418	1.6	1.54
Age×Value			−0.037	−0.036
Sex (0=male, 1=female)				0.637
Intercept	−2.154	−1.925	−3.322	−3.536
Pseudo-R^2	0.06	0.066	0.073	0.089
Observations (decisions)	456	456	456	456
Subjects	288	288	288	288
−2LL	557.9	554	550.3	540.8

Dependent variable: donation probability. Robust standard errors clustered on subject.
Pb.05.
Pb.01.
Pb.001.

Table 2
OLS regression models for average donation for donors only

	M1	M2	M3
Age (months)	0.005		0.004
Sticker value (0=low, 1=high)		−1.151	−1.151
Intercept	4.265	5.231	4.981
R^2	0.0008	0.084	0.085
Observations (decisions)	294	294	294
Subjects	205	205	205
−2LL	1224.971	1199.3908	1199.1684

Dependent variable: donation. Robust standard errors clustered on subject.
Pb.001.

comparisons revealed that children are significantly more likely to donate low-value than high-value stickers at 6 years of age [22.6% difference, Pearson ^{2}(1,n=91)=6.39, P=.011], but not at younger ages [3 years of age: 0.3% difference, Pearson ^{2}(1,n=111)=0.001, P=.98; 4 years of age: 11.3% difference, Pearson ^{2}(1,n=160)=2.03, P=.15; 5 years of age: 1.7% difference, Pearson ^{2}(1,n=94)=0.04, P=.85]. This result indicates that some children gave some of one type of sticker (high or low) but not the other. Examining donations in the two round conditions (the baseline and FS control) revealed that 20.8% of the children (n=35) gave in only one of the rounds. The majority (28 of 35) only donated in the round with the low-value stickers.

The second analysis examined the level of donation among children who gave at least one sticker in a given DG round (Fig. 1B). A regression model was fitted to the sub-sample of donors for each sticker value (Table 2). The M2 model was selected as optimal based on sizeable improvement to the −2LL when Sticker Value is included in the model, but a negligible improvement when Age is included (M3). The M2 model revealed a main effect for Sticker Value ($t_{1,204}$=−5.05, Pb.001). There was no significant effect of Age ($t_{1,204}$=0.46, P=.64), no effect of Gender ($t_{1,204}$=−1.33, P=.19), or the FS ($t_{1,204}$=−0.05, P=.96), HO ($t_{1,204}$=0.73, P=.47) and NC ($t_{1,204}$=−0.36, P=.72) control dummies. There were no other significant interactions (PN.05 for all interactions). A separate regression including only the conditions with two rounds (Baseline and FS) produced no significant effect for the order of the two rounds ($t_{2,213}$=0.49, P=.63) and no significant interactions with Order (PN.05 for all interactions). Fig. 1B shows the average donations among donors, by age and sticker value.

A closer examination of the donations reveals further differences in the distributions for low-and high-value stickers. Across all ages, donors showed more extreme variation in their donations of low-value stickers compared to high-value stickers (Levene F test for homogeneity of variances, F=2.11, Pb.001). The results from the two round games show that children became increasingly likely with age to donate 5 low-value stickers: 21% of 3-year olds, 33% of 4-year olds, 42% of 5-year olds, and 47% of 6-year olds

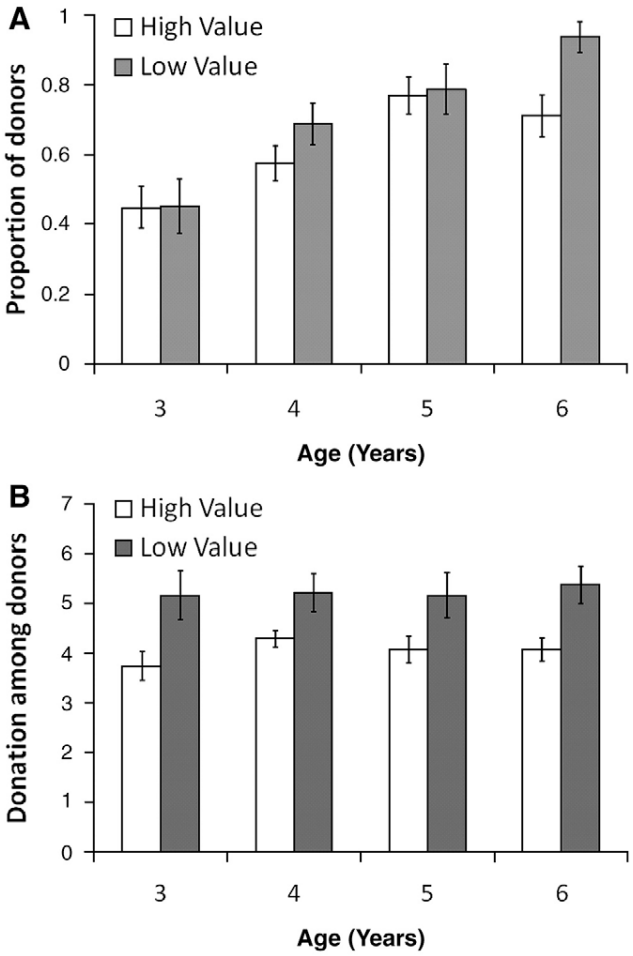

Fig. 1. The proportion of children that give at least one sticker increases with age, but the average amount donated does not. (A) Proportion of children donating High and low-value stickers at each age. (B) Average donations among children who gave at least 1 sticker for High and low-value stickers at each age. Error bars indicate standard error of the mean. All conditions aggregated.

(Fig. 2A). By contrast, no such consensus emerged for the high-value stickers (Fig. 2B). Low proportions of children (b 25%) at each age level donated three, four, or five high-value stickers.

4. Discussion

The current experiment makes three contributions to our understanding of how altruistic behavior emerges in childhood, specifically among American children from middle to upper socioeconomic status (SES) families. First, we have shown that the proportion of children who make any donation at all increases with age. Second, we have shown that children's preference for equity changes based on how they value the resource at stake. This value effect is apparent for 3-year olds and remains stable at least through the early elementary school years. Third, our results provide a description of the cognitive processes that underlie altruistic giving and how those processes emerge in development. Specifically, the decision to give or not (prosociality) and the decision of how much to give (preference for equity) appear to be separate processes with different developmental trajectories. We discuss each of these findings in turn.

Donating anything in the DG is an indication of prosociality. Our results show that children are more likely to engage in this form of prosociality with age. About 40% of 3-year olds donated at least one sticker, a proportion which steadily increased to about 80%, on average, for 6-year olds (see Fig. 1A). This trajectory could reflect a maturing ability to inhibit the desire to take all of the stickers present. However, in the current DG, 5- and 6-year olds are far more likely to resist this temptation for immediate gratification than same age children in classic delay of gratification tasks (Mischel & Metzner, 1962; Thompson, Barresi & Moore, 1997). Thus, any effects of developing inhibitory control must be supplemented by a process of socialization as children adopt social norms for giving (Eisenberg & Fabes, 1998).

In contrast to the effect of age on prosociality, children of all ages had quite similar preferences for how many of the low and high-value stickers to give. Children who did not keep all the stickers gave away on average 50% of their least favorite stickers and 40% of their favorite stickers. This difference shows that even young children show a stronger preference for equity when the resource being distributed has a lower value. Although the average donation is constant across ages, the frequency of the equitable split increases with age for the low-value stickers. By 6 years of age, almost half of the children (47%) gave away exactly five low-value stickers. By contrast, for the high-value resource (i.e., for their favorite stickers), children behaved more in accord with the pattern observed among adults. Among 5- and 6-year olds, about 20% gave away half of their favorite stickers, while 20–35% kept them all. This approximates the findings of Forsythe et al. (1994) for a $10 DG with American college students. However, it remains to be seen how adults would distribute a low-value currency—for example, 10 pencils. Based on our findings, we predict that an equitable split would be more frequent.

One possible criticism of our value finding is that children were influenced by the demands of the task, specifically by being asked to evaluate the stickers as more or less valuable relative to each other. However, this concern was addressed by the "no choice" (NC) control. The choice of stickers at the beginning of the experiment was removed, and donations were not affected. The NC control shows that differential distribution of a high and low-value resource does not rely on any explicit prompting by the experimenter. Children engage in a spontaneous assessment of value that affects their level of donation.

Another possible criticism is that children consider the value of the sticker to the other child when deciding whether to give and how much to give. In other words, children may simply believe that the other child places different values on the stickers than they do. We tried to limit this possibility by telling the children that the donated stickers were for a child of the same gender. Further, if children were indeed considering the value of the stickers to another child of the same gender, the correct conclusion would be that the other child would select the same sticker types as their favorite and least favorite. The majority of the boys chose dinosaur stickers as their favorite and heart stickers as their least favorite; for girls, the majority preferences were exactly the opposite. The value effect also provides some evidence against an assessment of sticker value to the recipient. Children would have to believe, inaccurately, that the recipient valued the high-value stickers less than they did themselves in order to justify the 40% average donation we observe among givers with high-value stickers. Conversely, they would have to accurately assess that the recipient valued the low-value stickers exactly as they did in order to justify the 50% average donation we observe among givers with low-value stickers. It seems more plausible that children considered only their own interests and balanced the value of the stickers to themselves against a preference for equity.

The origin of children's intuitions about how much to give is not clear. From classic work in child development (Piaget, 1932; Damon 1977, 1980) as well as more recent studies (Olson & Spelke, 2008), we know that children as young as 3 years of age are aware of an equal split as a norm for dividing resources. Some researchers (Henrich et al., 2005) point to research on imitative altruism (e.g., Bryan, 1971; Elliot & Vasta, 1970; Presbie & Coiteux, 1971) to argue that children model their altruistic behavior on adult behavior in their cultures. While children may learn norms for equity from others, the current research demonstrates that they do not rigidly apply such norms. Rather, children weigh the norm of equity against other considerations such as the value of the resource to oneself.

The value effect has important implications for interpreting the results of other economic games with children.

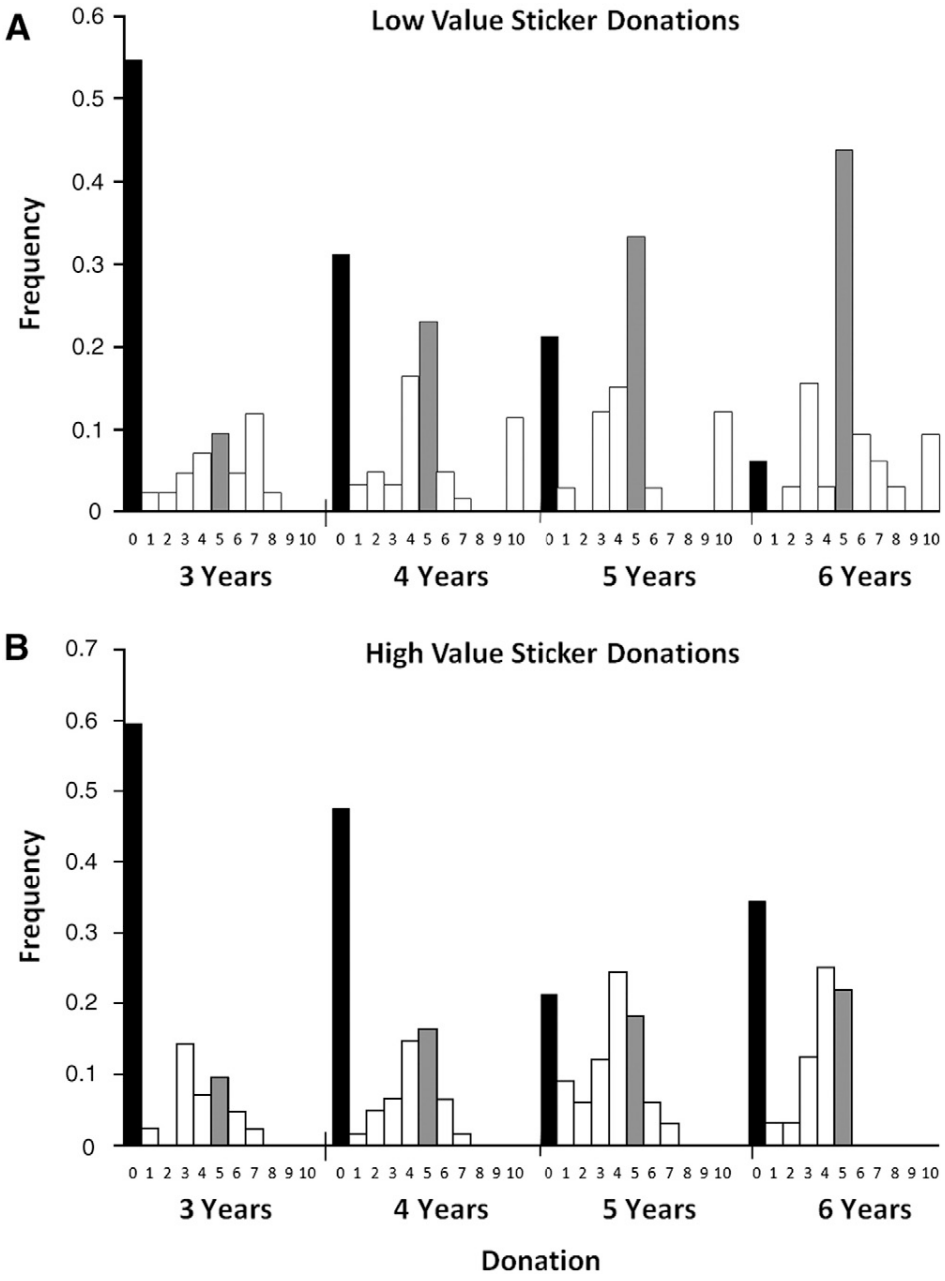

Fig. 2. With increasing age, children converge on the equal distribution of 5 low-value stickers, but no such consensus appears for high-value stickers. Frequency of each donation by age are shown, using data from two round games. For clarity, zero donations are colored black and equitable donations of 5 are colored grey. (A) low-value stickers. (B) high-value stickers.

Specifically, children's subjective valuation of resources may vary with culture, suggesting that considerable caution is needed in interpreting different patterns of donations across cultures. Children from different cultural backgrounds may place a premium on stickers or candy simply because these are scarce resources for them or because they are highly prized by the culture. If true, lower rates and levels of donation could reflect the greater value of the resource, as opposed to cultural differences in altruistic norms. This hypothesis could explain the results from two recent cross-cultural studies of DGs with children. Benenson et al. (2007) tested children from high and low SES levels in a 10 sticker DG. By 6 years of age, children in the high SES group were less likely to keep all of the stickers than children in the low SES group. This difference became even more dramatic by 9 years of age. The authors interpreted this result as an indication of learning local norms for altruistic behavior, with higher SES children adopting stronger fairness norms. However, the results could also be attributed to the greater value of stickers among low SES children. A more recent

study (Rochat et al., 2009) tested 3- to 5-year olds in seven cultures in a non-anonymous DG. Here, the poorest children, those living on the streets of Recife, Brazil, were most likely to keep all of the stake. This result can again be attributed to the greater value of candy to this group. It should be noted that middle class American children did not differ significantly from the Recife children, but again, candy may be more prized in America than in other cultures.

The flexible application of norms exhibited by the children in our study has important parallels in other contexts. For example, norms for appropriate behavior are strongly affected by the group membership of one's interaction partner among both children and adults, with people preferentially cooperating with in-group members (Fehr et al., 2008; Tajfel et al., 1971; Yamagishi et al., 1999). Moreover, norms governing the classification of others as in-group versus out-group are dynamic and have been shown to change over time (Rand et al., 2009). The results of the present study demonstrate that a flexible approach to norms develops very early in life, and continues through childhood. The context-dependence of cooperative norms in both children and adults merits further study.

In addition to the importance of currency value, the current study suggests a more detailed account of the cognitive processes involved in cooperative behavior. Our data suggest that children engage in two separate decisions when choosing how to allocate resources between themselves and others: (a) whether to give or not and (b) how much to give. These two steps have different developmental trajectories, which implies that different processes are involved: the probability to give increased with age whereas children's level of donation did not change with age. The latter finding is notable because one might expect the fraction of stickers donated to increase with age, but this did not occur. Instead, for those who decided to be donors, the youngest children gave the same amount, on average, as the oldest children.

The effect of value on each of the two decisions involved in giving provides further evidence that prosociality and the preference for equity are governed by separate processes. The value of the resource did not influence the decision of whether or not to give until about 6 years of age. At this age, children were significantly more likely to give away some of their least favorite stickers as opposed to their favorite stickers. By contrast, among those who decided to give, value significantly affected their level of donation at all ages.

To our knowledge, this study is the first to report such a developmental difference between prosociality and equity preferences. However, examining previous dictator game studies with children suggests that a similar effect may exist in others' data as well. Benenson et al. (2007), whose procedure most closely resembles ours, reports the average donation and the fraction of givers among 4-, 6- and 9-year olds. With this information, it is possible to back-calculate the average donation among givers. The data show that among high-SES children, the fraction of children that give at all increases consistently with age: approximately 58% of 4-year olds, 83% of 6-year olds, and 92% of 9-year olds. For the same group, however, there is no consistent change in the average donation among those who choose to give: approximately 4.5 of 10 stickers for the 4-year olds, 3.8 of 10 stickers for the 6-year olds, and 4.4 of 10 stickers for the 9-year olds. This analysis is in general agreement with our results.

The finding that even 3-year olds will be prosocial in an anonymous DG accords with other DGs done with children (i.e., Benenson et al., 2007) but conflicts with recent findings that children do not exhibit preferences for prosocial options until 7 years of age (Fehr, Bernhard, & Rockenbach, 2008). The discrepancy in results could be explained by differences in experimental design. In the experiment of Fehr et al., children were asked to choose between two predetermined options with different allocations of candy for themselves and another child who was not present. Because children were not allocating the resources themselves, they may have attended only to their own payoff. Additionally, in the 10 sticker DG, children have a wider range of options available to them. If children were asked to allocate 10 candies as opposed to two in Fehr et al., the results might have been closer to the current findings. Lastly, the use of different types of resources in these studies could also have contributed to the discrepant findings. Fehr et al. used candy, a resource which children appear to value more than other currencies in economic games (Murnigham & Saxon, 1998). If children value candy more than stickers, this would lead to a smaller average donation in the candy game.

The current study also found gender effects that fall in line with previous research. Girls were more prosocial (more likely to donate stickers) than boys, but within the prosocial group, the two genders donated similar amounts of stickers. Andreoni and Versterlund (2001) found a similar gender effect for college students. In their anonymous DG, women were more likely than men to donate, but they donated less on average. Two other economic game studies have found that girls between the ages of 9- and 17-years-old are more generous than boys (Gummerum, Keller, Takezawa & Mata, 2008; Murnigham & Saxon, 1998). It seems safe to conclude that careful analysis of male and female behavior in economic games can reveal significant differences that appear early in life and persist into adulthood. More systematic experiments are needed to determine how these differences should be linked to the initial decision to donate and/or the subsequent decision about how much to donate.

The clear cross-cultural differences in adult preferences (Henrich et al., 2005) highlight the importance of cross-cultural research studying altruism in children. The extent to which our findings generalize to children with differing socioeconomic, geographic, and ethnic backgrounds is unclear. Further work is needed to explore cultural differences in the developmental trajectories of prosociality and equity preferences, and the role of currency type and value in altruistic giving.

The evolution of cooperation among humans relies upon norms specifying when to help others and to what extent. Research examining the developmental origins of such cooperative norms has made great strides in recent years by adopting the methods of experimental economics. Future work can build on existing economic experiments to investigate the origins of variables known to impact adult decisions. For example, when do children become concerned about their reputation for fairness? Will young children be more generous towards recipients they have met or know something about (Bohnet & Frey, 1999)? Furthermore, research on adults can also benefit from findings in developmental psychology. To take the current study as an example, adults may be more sensitive to stake value than suggested by previous research. Experiments using low as well as high-value resources may reveal a valuation process similar to that found here and possibly a ceiling effect for high-value stakes.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found in the online version, at doi:10.1016/j.evolhumbehav.2009.06.012.

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