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Fairness considerations: Increasing understanding of intentionality during adolescence

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ABSTRACT

The development of fairness considerations in decision making is not well understood. Here we tested the hypothesis that increased understanding of intentionality during adolescence underlies increased fairness considerations in social decision making. We conducted three experiments using an adapted version of the Ultimatum Game with participants during four stages of adolescence: 9, 12, 15, and 18 years of age. Participants made or evaluated monetary offers, and we manipulated the intentionality context of offers. Results show that strategic thinking is already present at 9 years of age. There was no age difference in fairness of offers when the responder could not reject an offer (Experiment 1), but when they could reject an offer there was an age-related increase in taking into account the perspective and intentionality of other players when making offers (Experiment 2) and evaluating offers (Experiment 3). Taken together, the results demonstrate a linear developmental transition in fairness considerations that may have important implications for our understanding of social interactions during adolescence.

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Introduction

Social competence is one of the most important markers of healthy development across the life span (Burt, Obradovic, Long, & Masten, 2008). During adolescence, peer relationships gain significance and the nature of social interactions changes qualitatively from spending time together to understanding and evaluating each other's opinions (Rubin, Bukowski, & Parker, 2006). Experimental studies also

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point out that even the mere presence of peers is found to influence adolescents' behavior in social settings and that peer-specific affect influences cognition and behavior within interactions (Gardner & Steinberg, 2005; Nummenmaa, Peets, & Salmivalli, 2008). Understanding simple social decision-making processes in interactions is essential for gaining a better comprehension of not only social development across childhood and adolescence but also the developmental roots of human social interaction (Fehr, Bernhard, & Rockenbach, 2008).

One way to study the motivations in social interactions is by having two (or more) players divide certain goods. When dividing goods, at least two factors influence our behavior. The first concept concerns our self-interest, and economic theories assume this to be the main motivation of human behavior (Miller, 1999). Second, there has been increasing evidence that other-regarding preferences also motivate our behavior in social interactions, particularly in settings characterized by cooperative exchanges (Camerer & Fehr, 2006). The payoff between these two considerations underlies our judgment of *fairness*, which is a key factor in interpersonal contexts where exchanges result in the subjective comparison of self-interest and other-interest (van Dijk & Vermunt, 2000). On the one hand, individuals try to maximize self-gain (i.e., *absolute* payoff component); on the other hand, they have self-other concerns based on the equality of outcomes (i.e., *comparative* component) that is termed fairness. Thus, it is the comparative component of concerns that results in other-regarding behavior in social exchanges.

Two-person monetary exchanges prove to be useful in teasing apart the absolute payoff and comparative components in social decision making (van Dijk & Vermunt, 2000). Interestingly, the relative importance of these two components seems to be different for different age groups. Using a task called the Ultimatum Game, Sutter (2007) demonstrated that the comparative component is more important than the absolute payoff for younger children than it is for adults. In the Ultimatum Game, two individuals divide a prespecified amount of money (the stake). The first player (the proposer) can make an offer, and the second player (the responder) can accept or reject the proposal. If the responder rejects, both players receive nothing (Güth, Schmittberger, & Schwarze, 1982). Children and teen responders were more likely to judge monetary offers based on their comparative outcome for the two players than to judge the intentionality behind Ultimatum Game offers. In other words, inequity aversion was more common among younger participants than among adults. Similarly, Murnighan and Saxon (1998) showed that younger children exercise a stricter criterion of fairness by rejecting unfair offers more often than young adults reject them.

Based on the assumption that understanding of others' points of view and other-regarding preferences emerge across childhood, one can also expect to find increasing concern for others with age, and this should be associated with an increase in fair offers. One other developmental study that examined fairness considerations in similar two-person monetary exchanges demonstrated less concern for others in children relative to adults (Harbaugh, Krause, & Liday, 2003). Older children were found to make higher offers and reject unfair offers more often than younger participants, indicating that older children have stricter fairness considerations. Thus, there are inconsistent findings in the literature regarding the developmental pattern of fairness considerations in decision making.

Results of prior studies may be confounded by two factors related to the relative role of other-regarding preferences in decision making. First, in the display of fairness, choices may be influenced by strategic intentions aiming to maximize absolute payoff. Research shows that what seems like a comparative component might only *appear* to reflect fairness and be driven by the absolute payoff component aimed to maximize self-gain out of fear of social rejection (Forsythe, Horowitz, Savin, & Sefton, 1994; Pillutla & Murnighan, 1995, 2003). For example, proposers may anticipate that an unfair offer will be rejected; therefore, they may propose a fair split not because of their concern for others but rather because they fear that they will not receive anything if they propose an unfair offer. In this case, fair behavior is guided by *strategic* considerations rather than pure *fairness* considerations. Increasing levels of strategic behavior with age suggest a development in understanding of what is considered to be fair. Development in understanding perspectives of others can result in the development of strategic behavior that is reflected in age differences in decision-making tasks. For example, kindergartners were found to be quite nonstrategic and to offer everything they have (Harbaugh et al., 2003); similarly 7-year-olds did not seem to differentiate between offers in the Ultimatum Game and the Dictator Game (a version of the task in which the responder cannot reject) (Leman, Keller,

Takezawa, & Gummerum, 2009). After 9 or 10 years of age, ultimatum offers are found to increase with age (Harbaugh et al., 2003; Leman et al., 2009).

Second, in the evaluation of fairness, individuals are typically influenced by the intentions of the exchange partner. In other words, other-regarding preferences might depend on the perceived intentions of the other. For example, one may be more likely to accept an unfair offer when knowing that the other player had no other choice because fair splits were not allowed by the experimenter. Understanding intentionality in others' behaviors requires the cognitive capacity to take others' perspectives into account combined with interpersonal understanding, and both capacities undergo major developmental changes during adolescence (Selman, 1980; Underwood & Moore, 1982). That is, children become more generous and less self-interest-oriented with age (Zarbatany, Hartmann, & Gelfand, 1985), and prosociality in general becomes more prevalent from preschool to adolescence (Eisenberg & Fabes, 1998). These developmental changes led us to predict that setting concern for self against others may rise during adolescence because this is a time period when perspective-taking abilities become better along with high expectations of others' understanding for their perspectives (Martin, Sokol, & Elfers, 2008; Selman, 1980).

To test this hypothesis, we examined developmental differences in fairness considerations across adolescence by making use of a modified version of the Ultimatum Game that allowed us to test intentions behind monetary proposals to others (Falk, Fehr, & Fischbacher, 2003). In the modified version of the Ultimatum Game, the proposer is offered a fixed set of two distributions to choose from so as to share the stake with the responder. In the four conditions we employed, an unfair offer, where the proposer receives 8 coins and the responder receives 2 coins (hereafter 8/2 offer), is pitted against four alternative offers: (a) 2/8 offer (hyper-fair), (b) 5/5 offer (fair), (c) 8/2 offer (no alternative), and (d) 10/0 offer (hyper-unfair).

The tasks used in this study were aimed toward testing three questions concerning fairness considerations: (a) developmental differences in considerations of fairness per se, (b) developmental differences in strategic fairness, and (c) developmental differences in intention sensitivity. To test the first question (Experiment 1), participants were asked to play the Dictator Game. To test the second question, proposer choices in a Dictator Game setting in which the responder cannot reject the offer (Experiment 1) were compared with proposer choices in the Ultimatum Game (Experiment 2). This comparison allowed us to test fairness versus strategic considerations. Finally, to test the third question, responder choices in a context of alternative offers were examined (Experiment 3), allowing the examination of fairness and intentionality considerations. To test the second and third questions, it was necessary to manipulate the context of the offers. To make the results across studies comparable, all three experiments were performed in the format where intentionality of offers was manipulated.

Sutter (2007) examined the role of intentionality in proposals and rejection of unfair offers and its development across children (7–10 years of age), teens (11–15 years of age), and adults (19–25 years of age) who played the proposer as well as the responder in the Ultimatum Game with the same experimental manipulations employed here. No age differences were found in Ultimatum Game proposals, but rejection of unfair offers decreased with age when the alternative was also unfair, suggesting the increasing role of intentionality in decision making. Building on these prior studies, our current study differs in at least three crucial aspects. First, we conducted three experiments in which we compared Ultimatum Game proposals with Dictator Game proposals and determined the role of fairness (absolute vs. relative payoff components) in decision making involving intentionality. Second, participants played one-shot games multiple times, increasing the power of our results. Third, we employed four age groups, enabling us to perform a more thorough developmental examination of decision making.

Children have been found to show strategic thinking by 9 or 10 years of age; thus, we expected that fairness considerations would be displayed by even the youngest participants (Harbaugh et al., 2003; Leman et al., 2009). However, we expected to find increasing intentionality considerations with age. Based on developmental theories of interpersonal understanding (Selman, 1980; Westenberg, Drewes, Goedhart, Siebelink, & Treffers, 2004), we predicted that intention sensitivity would develop linearly during four developmental stages. During preadolescence (9 years of age), when relationships are mainly *unilateral*, participants were expected to value fairness but to fail to differentiate between intentions of others. During early adolescence (12 years of age), when relationships are starting to be *reciprocal*, participants were expected to value fairness but to also take intentionality into account,

although not yet at adult levels. During mid-adolescence (15 years of age), when relationships are *mutual* and conforming to group norms is important, sensitivity to considerations of others was expected to be even higher at nearly adult levels. Finally, during late adolescence (18 years of age), when relationships become *egalitarian* and individuals are able to understand that motives of others can be different from their own, participants were expected to be most sensitive to intentionality.

Experiment 1

The aim of Experiment 1 was to examine fairness considerations across adolescence by examining proposer behavior in the Dictator Game. We expected that participants would pursue self-interest and make 8/2 offers more often in the fair and hyper-fair alternative conditions and 10/0 offers more often when the alternative is hyper-unfair (Camerer, 2003; van Dijk & Vermunt, 2000). Prior studies have reported inconsistent findings with respect to the development of fairness in the Dictator Game (Benenson, Pascoe, & Radmore, 2007; Gummerum, Keller, Takezawa, & Mata, 2008; Harbaugh et al., 2003). By examining context effects, the results of the current study were expected to further our understanding of the development of fairness and intentionality considerations.

Method

Participants

In total, 135 participants completed Experiment 1 and were subdivided into four age groups: 9-year-olds (mean age = 9.06 years, $SD = 0.39$, 16 boys and 17 girls), 12-year-olds (mean age = 12.15 years, $SD = 0.45$, 15 boys and 15 girls), 15-year-olds (mean age = 15.03 years, $SD = 0.30$, 23 boys and 25 girls), and 18-year-olds (mean age = 18.14 years, $SD = 0.48$, 9 boys and 15 girls). Participants were recruited from local elementary and high schools, and consent was received from school authorities and parents. Analyses indicated no differences in the gender distribution across the four age groups, $\chi^2(3) = 1.02$, $p = .80$.

All participants were administered the pen-and-paper version of the Raven Standard Progressive Matrices (SPM) (Carpenter, Just, & Shell, 1990) to assess their inductive reasoning ability and obtain an estimate of their intelligence quotient (IQ). One-way analyses of variance (ANOVAs) yielded no age differences, $F(3, 134) = 2.48$, $p = .64$, $\eta_p^2 = .05$, or gender differences, $F(1, 134) = 0.03$, $p = .87$, $\eta_p^2 = .00$, in IQ scores.

Materials

To make the task understandable to even the youngest participants, and to control for confounding influence of developmental differences in number representation, dictators made a selection from two baskets with visually presented coins (see Fig. 1A). Each trial started with the presentation of a fixation cross for 1 s, followed by a visual presentation of the two offers. Red coins in the buckets were for the first player (the dictator), and blue coins were for the second player (the responder). The participants saw Fig. 1A and were asked to choose one of the two distributions to share the 10 coins. Participants had an unlimited amount of time to make an offer ($M = 1.9$ s, $SD = 1.2$), followed by a feedback screen showing their offer for 1.5 s (indicated by a red circle around the selected offer). Participants played numerous rounds of each of the three conditions (i.e., fair game with 5/5 as alternative offer, hyper-fair game with 2/8 as alternative offer, and hyper-unfair game with 10/0 as alternative offer) with unknown same-sex and other-sex player partners, and all conditions were presented in counterbalanced order, yielding 4 trials of each condition and 48 trials in total. In each condition, participants were presented with an 8/2 offer as well as the alternative offers (i.e., 5/5, 2/8, and 10/0).

Procedure

Informed consent was obtained from school authorities, teachers, and parents. Data collection was carried out by trained researchers. Participants first completed the Raven's SPM and then completed the task. The computer tasks were presented on individual laptop computers with 15-in. monitors. This was carried out in groups of four participants in a separate quiet room.

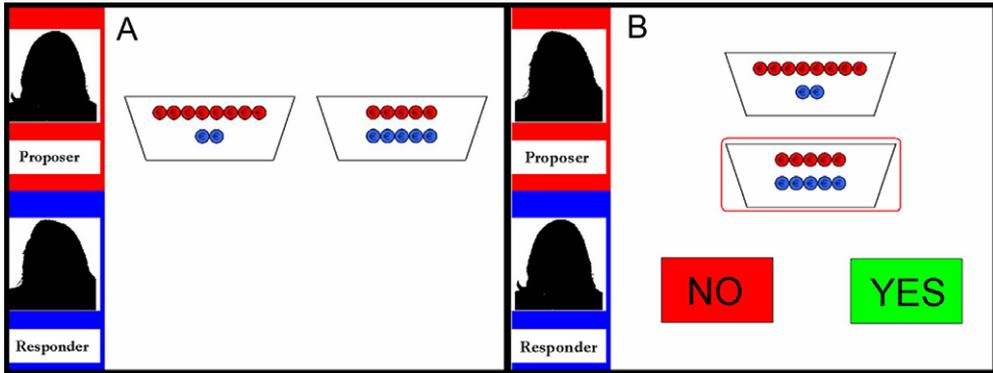


Fig. 1. Visual display for the proposer (A: Experiments 1 and 2) and for the responder (B: Experiment 3). Two offers, each containing red and blue coins, indicate the share for the proposer and the responder, respectively (here 8/2 vs. 5/5). The left panel displays the name of the proposer (participant in Experiments 1 and 2) in red (here “proposer”) and the name of the responder (participant in Experiment 3) in blue (here “responder”). (B) The red circled option indicates the offer made by the proposer. The responder is asked to select Yes or No to accept or reject, respectively, the offer made by the proposer.

Participants were told that they were going to play all games online with anonymous children of their age from other schools and that they would play each round with a new player. In reality, participants played all rounds with computer-generated participants. In each round, the participants were presented with a screen where they saw their own name at the top of the left panel (in red) (see Fig. 1A) and the first name of their play partner at the bottom of the red panel (in blue).

All participants were told that at the end of the session the computer would randomly select five rounds that would determine their total earnings and that their outcomes would be given to them at the end of the experiment. To emphasize the interactive character of the games with consequences for themselves *and* the other players, the participants were told that the same rule applied to the other players who would also receive their outcomes at the end of the study. Care was taken to ensure that all participants understood the instructions. Including instructions and breaks, the computer task took approximately 45 min. Participants were paid at the end of the experiment. Because the school administration did not approve of children being paid with money, the youngest two age groups were told at the end of the experiment that the experimenters had bought candies with the money the children had earned. Participants from the oldest two age groups were paid 3 euros (~5 U.S. dollars) each. This procedure was approved by The Local Ethics Commission of The University.

Results and discussion

A repeated measures analysis of covariance (ANCOVA) for percentage of 8/2 offers with condition (3 conditions: 10/0 vs. 5/5 vs. 2/8) as a within-participants factor, age (4 age groups: 9, 12, 15, or 18 years) as a between-participants factor, and IQ as a covariate yielded only a main effect of condition, $F(2, 256) = 4.21, p < .05, \eta_p^2 = .03$. As can be seen in Fig. 2, with increasing cost of making the 8/2 offer (i.e., 10/0 vs. 5/5 vs. 2/8), participants made the 8/2 offer more often (41, 60, and 86%, respectively). The lack of age differences in the percentage of 8/2 offers made in the three Dictator Game conditions indicated that 9-, 12-, 15-, and 18-year-olds made the same fairness considerations when the task did not require perspective taking, as in the Dictator Game. As expected, the offers made in the Dictator Game were more often driven by the desire to optimize self-gain.¹ It should also be noted that

¹ To examine the role of self-interest in making offers, we ran one-way ANOVAs for the three conditions, with the percentage of altruistic offers as dependent variables (i.e., 8/2 offer in the 10/0 vs. 8/2 condition, 5/5 offer in the 5/5 vs. 8/2 condition, and 2/8 offer in the 2/8 vs. 8/2 condition) and age as a between-participants factor. These analyses yielded no significant age differences in altruistic behavior in the Dictator Game.

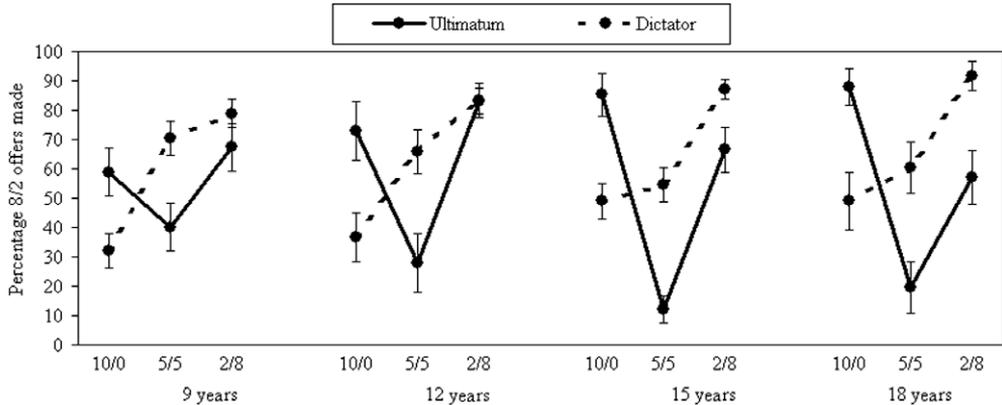


Fig. 2. Mean percentages and standard errors of 8/2 offers made by four age groups in the three conditions of the Dictator Game (Experiment 1) and the Ultimatum Game (Experiment 2).

overall 40% of the participants made a fair offer in the 8/2 versus 5/5 condition, showing that self-interest was not the only driving force in decision making in social interactions. These results are consistent with prior research demonstrating no developmental differences in fairness (or inequity aversion) across childhood and adolescence (Gummerum et al., 2008; Sutter & Kocher, 2007) and suggest that fairness considerations develop before early adolescence (see also Fehr et al., 2008).

Experiment 2

To examine the development of strategic considerations in social decision making across adolescence, Experiment 2 focused on proposer behavior in the Ultimatum Game. Previous research has pointed out that proposers make lower offers in the Dictator Game than in the Ultimatum Game, suggesting that the equal split offers commonly observed in the Ultimatum Game are strategic considerations aiming to appear fair and maximize self-outcome (Forsythe et al., 1994; van Dijk & Vermunt, 2000).

Prior research employing the Ultimatum Game with children, adolescents, and adults has suggested age-related differences in Ultimatum Game proposals, but the results are inconsistent (Gummerum et al., 2008; Harbaugh et al., 2003; Hoffmann & Tee, 2006; Murnighan & Saxon, 1998; Sutter, 2007). We expected that increasing perspective-taking capacity with increasing age would result in more 8/2 offers when the alternatives were hyper-fair or hyper-unfair (Selman, 1980).

Method

Participants

In total, 56 participants took part in Experiment 2. Distribution of the participants in the four age groups was as follows: 9-year-olds (mean age = 9.01 years, $SD = 0.42$, 7 boys and 7 girls), 12-year-olds (mean age = 12.08 years, $SD = 0.32$, 8 boys and 7 girls), 15-year-olds (mean age = 15.03 years, $SD = 0.30$, 10 boys and 4 girls), and 18-year-olds (mean age = 18.10 years, $SD = 0.37$, 5 boys and 8 girls). Gender was evenly distributed among the four age groups, $\chi^2(3) = 3.06$, $p = .38$. There were no age differences, $F(3, 52) = 0.98$, $p = .41$, $\eta_p^2 = .05$, or gender differences, $F(1, 54) = 0.83$, $p = .77$, $\eta_p^2 = .00$, in IQ scores.

Materials, procedure, and instructions

In Experiment 2, all participants played the proposer in an Ultimatum Game. The only difference from Experiment 1 was that the proposers were told that the responder could reject the offer. The presentation of the trials was the same as in Experiment 1 with the exception that, after the feedback on

the offer, participants were presented with a screen for 2 s saying that they were waiting for the responder to make a decision as to whether to accept or reject the offer. The latter feedback aimed to emphasize the interactive character of the game, but proposers were not given feedback on whether the responder accepted or rejected the offer so as not to create learning effects based on feedback. Each condition was repeated 16 times, yielding a total of 48 trials. The procedure and instructions were as described in Experiment 1. We tested for repetition effects by comparing the first 20 trials of the experiment with the last 20 trials and found no significant order effects in making 8/2 offers, $F(1, 39) = 0.61$, $p = .44$, $\eta_p^2 = .02$, and no interaction between age and order, $F(3, 39) = 0.99$, $p = .41$, $\eta_p^2 = .07$.

Results and discussion

A repeated measures ANCOVA was conducted with condition (3 conditions: 10/0 vs. 5/5 vs. 2/8) as a within-participants factor, age group (4 age groups: 9, 12, 15, or 18 years) as a between-participants factor, IQ as a covariate, and the percentage of unfair (8/2) offers as a dependent variable. The main effects of condition and age were not significant, $F(3, 102) = 0.72$, $p = .46$, $\eta_p^2 = .01$, and $F(3, 52) = 0.94$, $p = .43$, $\eta_p^2 = .05$, respectively, but there was a significant interaction between condition and age, $F(6, 102) = 2.59$, $p < .05$, $\eta_p^2 = .13$ (see Fig. 2). As expected, 9-year-olds did not differ in the amount of 8/2 offers made in different conditions, $F(2, 26) = 2.28$, $p = .12$, $\eta_p^2 = .15$, suggesting that the ability to anticipate perspective taking by the responder is not yet present in young children. In contrast, the three older age groups differed in the percentage of 8/2 offers across conditions such that they made fewer 8/2 offers in the 5/5 condition than in the other two conditions, replicating the findings of the Sutter (2007) study, all $F_s(2, 24-28) > 7.88$, all $p_s < .01$, $\eta_p^2 > .36$. Further post hoc analyses demonstrated that whereas 12- and 15-year-olds made the same amounts of 8/2 offers in the 10/0 condition and the 2/8 condition, 18-year-olds further distinguished between these two conditions and made 8/2 offers more often in the 10/0 condition ($M = 88\%$, $SD = 6$) than in the 2/8 condition ($M = 57\%$, $SD = 9$). These results are consistent with the hypothesis that perspective taking increases over the course of adolescence; the 12- and 15-year-olds might expect the responder to value their decision to make an 8/2 offer when the alternative is hyper-fair (2/8). It was not until late adolescence (18 years of age), however, that proposers expected the responder to reject 8/2 offers when the alternative was hyper-fair (2/8). The latter scenario requires the most advanced form of perspective taking and has the most protracted developmental trajectory.²

Furthermore, proposer choices in Experiment 1 and Experiment 2 differed significantly, as indicated by an interaction between the three conditions and the experiment type, $F(2, 104) = 39.35$, $p < .001$. Post hoc tests showed that participants of all ages made more 8/2 offers in the 10/0 condition but fewer 8/2 offers in the 5/5 condition, suggesting that strategic thinking is already present by 9 years of age. In the 2/8 condition, there was an interaction of context with age such that 9- and 12-year-olds did not differ in their 8/2 offers in Experiment 2 and Experiment 1, whereas 15- and 18-year-olds made unfair 8/2 offers more often in Experiment 1 than in Experiment 2, $F(3, 54) = 2.74$, $p = .05$.

Experiment 3

In Experiment 3, we assessed developmental differences when responding to fair or unfair proposals. In this version of the Ultimatum Game, the responder's decision was expected to be determined by the battle between fairness considerations and perspective taking in which the participant takes the proposer's perspective and has two options to choose from in each condition. Here we tested the frequency of rejecting an unfair (8/2) offer and expected rejection of the 8/2 offers to be the highest in the 5/5 game but the lowest in the 8/2 and 10/0 games because we expected the responder to consider the

² We again ran one-way ANOVAs to examine age differences in altruistic behavior for the three conditions, with the percentage of altruistic offers as dependent variables (i.e., 8/2 offer in the 10/0 vs. 8/2 condition, 5/5 offer in the 5/5 vs. 8/2 condition, and 2/8 offer in the 2/8 vs. 8/2 condition) and age as a between-participants factor. Similar to the results in the Dictator Game, Ultimatum Game offers yielded no age differences in altruistic behavior.

proposer's intentions and that he or she did not have a better option in these conditions (Sutter, 2007). We also hypothesized that increasing perspective-taking capacity with age would lead to increasing consideration of the proposer's intentionality. In particular, we predicted that preadolescent participants would have the least sensitivity to the perspective of the proposer (Selman, 1980; Westenberg et al., 2004).

Method

Participants

In total, 79 participants took part in Experiment 3. The distribution into four age groups was as follows: 9-year-olds (mean age = 9.09 years, $SD = 0.38$, 7 boys and 12 girls), 12-year-olds (mean age = 12.21 years, $SD = 0.56$, 7 boys and 8 girls), 15-year-olds (mean age = 15.03 years, $SD = 0.41$, 13 boys and 21 girls), and 18-year-olds (mean age = 18.18 years, $SD = 0.61$, 5 boys and 6 girls). There were equal numbers of girls and boys in the four age groups, $\chi^2(3) = .87$, $p = .83$. One 13-year-old participant with IQ scores less than 2 standard deviations below the mean ($M = 113.23$, $SD = 13.55$) was excluded from the analyses. There were no age differences, $F(3, 75) = 0.91$, $p = .44$, $\eta_p^2 = .04$, or gender differences, $F(1, 77) = 0.46$, $p = .50$, $\eta_p^2 = .01$, in IQ scores.

Materials, procedure, and instructions

All participants played the role of the responder in the Ultimatum Game. This time, the participants saw their name at the bottom of the left panel (in blue) (see Fig. 1B) and the name of the proposer at the top of the left panel (in red). The participants were first presented with the two distributions that were available to the proposer for 1–3 s, and subsequently the offer made by the proposer was indicated by a red circle around one of the two options available to the proposer, followed after 1 s by Yes and No buttons appearing on the screen while the choice distributions remained visible. The responder was asked to accept or reject the offer by choosing Yes or No using the keyboard (see Fig. 1B). The participants had an unlimited amount of time to make a decision, and the options available to the proposer and the offer made were presented on the screen during the decision-making process ($M = 2.7$ s, $SD = 1.2$). Participants were presented with their response for 1.5 s. The Ultimatum Game consisted of four conditions for the responder, yielding a total of 64 trials of the game. The procedure and instructions were as described in Experiment 1. The rejection rates of 8/2 offers did not differ in the first and last 20 trials of the game, $F(1, 39) = 3.04$, $p = .09$, $\eta_p^2 = .07$, and there was no interaction between order and age, $F(1, 39) = 0.35$, $p = .79$, $\eta_p^2 = .03$, excluding possible repetition effects.

Results and discussion

We examined the percentage of unfair offers (8/2) that were rejected by responders in different conditions of the Ultimatum Game. A repeated measures ANCOVA was conducted for percentage of rejected 8/2 offers with condition (4 conditions: 8/2 vs. 10/0, 8/2 vs. 8/2, 8/2 vs. 5/5, or 8/2 vs. 2/8) as a within-participants factor, age (4 age groups: 9, 12, 15, or 18 years) as a between-participants factor, and IQ as a covariate. There were no main effects but only a significant interaction of condition and age, $F(9, 222) = 4.03$, $p < .001$, $\eta_p^2 = .14$, indicating that participants evaluated an 8/2 offer differentially depending on context (i.e., the alternative option) and their age (see Fig. 3).

Post hoc repeated measures ANOVAs per age group further demonstrated that 9-year-olds did not differ in their rejection rates of the 8/2 offer in different conditions, $F(3, 54) = 0.51$, $p = .68$, $\eta_p^2 = .03$, whereas context effects were observed for 12-, 15-, and 18-year-olds, $F(3, 42) = 7.73$, $p < .001$, $\eta_p^2 = .36$, $F(3, 99) = 24.20$, $p < .001$, $\eta_p^2 = .42$, and $F(3, 30) = 15.65$, $p < .001$, $\eta_p^2 = .61$, respectively. These effects were borne out by analyses demonstrating that 12-, 15-, and 18-year-olds rejected the 8/2 offers more often when the alternative was a 5/5 offer, $F(1, 14) = 8.59$, $p < .05$, $\eta_p^2 = .38$, $F(1, 33) = 25.73$, $p < .001$, $\eta_p^2 = .44$, and $F(1, 10) = 10.73$, $p < .01$, $\eta_p^2 = .52$, respectively, and rejection rates for the 8/2 versus 10/0, 8/2 versus 8/2, 8/2 versus 5/5, and 8/2 versus 2/8 conditions did not differ significantly, all $F_s(1, 10-33) < 4.30$, $p > .05$, $\eta_p^2 = .12$. Higher rejection rates of 8/2 offers in the 5/5 condition than in the other conditions replicated Sutter's (2007) findings.

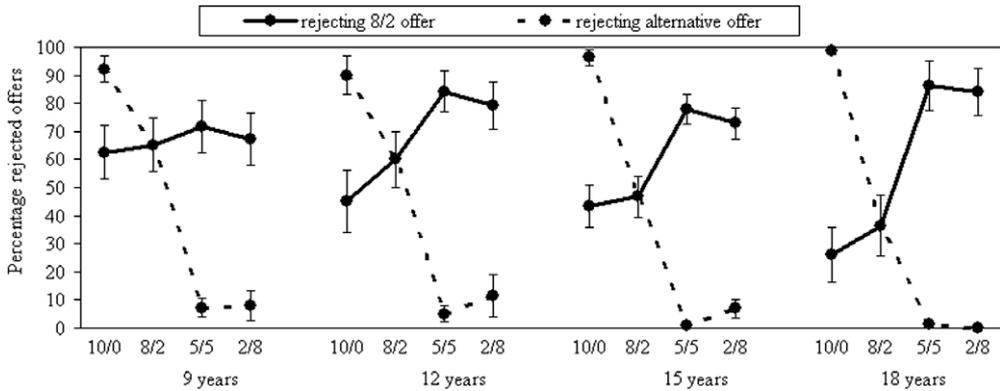


Fig. 3. Mean percentages and standard errors of rejected 8/2 offers and rejected alternative offers in the Ultimatum Game by the responders in four age groups.

We also examined age differences in the rejection rates of the alternative offers (i.e., the 10/0, 5/5, and 2/8 offers) in each of the three conditions (see Fig. 3). A repeated measures ANCOVA analysis similar to that conducted for the 8/2 offers above yielded no significant age differences, $F(3, 74) = 0.32$, $p = .82$, $\eta_p^2 = .01$. Considered against an 8/2 option, the 10/0 offer was nearly always rejected by all age groups ($M = 94.5\%$), whereas the 5/5 and the 2/8 offers were nearly always accepted ($M_s = 3.2$ and $M = 7.1\%$ rejection rates, respectively). Thus, all participants accepted fair and hyper-fair offers and rejected hyper-unfair offers, consistent with Experiment 1 in which it was demonstrated that there are no developmental differences in basic fairness evaluations.

General discussion

Judicious task manipulations of intentionality in the three experiments reported above elucidate how fairness and strategic considerations develop across childhood and adolescence and demonstrate that late developing perspective-taking skills underlie developmental changes in fairness considerations in social decision making. This conclusion was supported by three main findings showing that (a) basic fairness considerations are already developed before early adolescence; (b) strategic fairness offers are dependent on the context, and context understanding increases throughout adolescence; and (c) there is a linear developmental trajectory in incorporation of intentionality into decision making across adolescence.

Results from the Dictator Game experiment (Experiment 1) showed that 30–40% of choices are guided by other-regarding preferences even when the responder cannot reject an unfair offer. The absence of age differences indicates that these basic other-regarding preferences are already in place before 9 years of age. This finding supports the findings from other studies, each conducted with a slightly different experimental paradigm, showing that even by 4 years of age there is an early basis for altruistic behavior. Several of these developmental studies examining altruistic behavior between 3 and 9 years of age indicate an increase in Dictator Game offers with age (Benenson et al., 2007; Fehr et al., 2008; Harbaugh et al., 2003). However, our results support other studies that show adult-level altruistic behavior after 6 years of age (Harbaugh & Krause, 2000; Leman et al., 2009), suggesting that other-regarding behavior is, if not innate, acquired by very early experiences.

When offers served a strategic purpose to maximize self-interest, as in the Ultimatum Game experiment (Experiment 2), developmental changes were observed demonstrating that strategic motives were influenced by more refined forms of perspective taking. Prior research has demonstrated that even young children of approximately 9 or 10 years of age have a basic understanding of strategic considerations, as indicated by higher Ultimatum Game offers than Dictator Game offers (Harbaugh et al., 2003; Leman et al., 2009; Murnighan & Saxon, 1998; Sally & Hill, 2006). Such strategic behavior

requires the ability to understand other people's mental states, and the "theory of mind" literature suggests that even 3-year-olds have this understanding (Wellman, Cross, & Watson, 2001).

The use of contexts with varying intentionality information related to offers further allows us to elaborate on the use of strategic behavior in decision making at different ages. All participants made fewer unfair 8/2 offers in the Ultimatum Game relative to the Dictator Game when the alternative was fair as well as more 8/2 offers when the alternative was hyper-unfair (10/0), suggesting that it is reasonable to conclude that by 9 years of age children have a capacity of perspective taking. However, when the alternative was hyper-fair (2/8), 9- and 12-year-olds made as many 8/2 offers in the Dictator Game as in the Ultimatum Game (~80%), whereas 15- and 18-year-olds made fewer 8/2 offers in the Ultimatum Game (~60%) than in the Dictator Game (~90%). Thus, older adolescents most likely expected the responder to reject 8/2 offers, whereas preadolescents and early adolescents might reason that, compared with a 2/8 distribution, it must be understandable that they make an 8/2 offer. This interpretation is supported by responder behavior in that approximately 80% of 8/2 offers in the 2/8 condition are indeed rejected. In other words, adolescents might have developed a lay theory that the responder will get upset if they are offered the 8/2 distribution, whereas preadolescents might not have this lay theory. Interestingly, 9- and 12-year-olds also reject 8/2 offers in the 2/8 condition as often as the older age groups reject them. However, they still make more often 8/2 offers in this condition. Although this is not tested with a within-participants design, we can suggest with caution that the younger age groups lack the ability to incorporate this level of perspective taking into their decision-making process. In sum, although the perspective-taking capacity to think strategically is already present at 9 years of age, there are age differences in the integration of these skills into the fairness inferences made in decision making in a social context.

It should be noted that there were no age differences in making selfish offers in the Ultimatum Game (i.e., making 10/0 offers in the 10/0 vs. 8/2 condition but making 8/2 offers in the 5/5 vs. 8/2 and 2/8 vs. 8/2 conditions), suggesting that self-interest considerations are similar across ages. However, we find age differences in making an 8/2 offer in different conditions, and this informs us as to whether intentionality considerations are incorporated into decision making across contexts. The social interaction involved in the Ultimatum Game is highly complex and might require a higher level of incorporating one's perspective with that of the other, which is more complicated than the ability required for simple theory of mind tasks. Several other studies support the idea that efficiency and strategy of perspective taking develops across adolescence after 12 years of age and that the use of perspective-taking abilities in tasks might be rather unreliable even with adults (Dumontheil, Apperly, & Blakemore, 2009; Keysar, Lin, & Barr, 2003). The decision-making task employed here demands perspective-taking skills to be combined with executive functioning and regulation skills where intentionality of the other needs to be weighed against self-interest and fairness beliefs in reaching a decision. This interpretation is also in line with the protracted brain development in regions that play a role in mental state attributions as well as the increase in psychosocial development and prosocial behavior across mid- and late-adolescence requiring sophisticated forms of perspective taking (Blakemore, den Ouden, Choudhury, & Frith, 2007; Choudhury, Blakemore, & Charman, 2006; Eisenberg, Cumberland, Guthrie, Murphy, & Shepard, 2005).

An alternative explanation might be that 15- and 18-year-olds are less willing to take risks because by making a 2/8 offer they guarantee two coins, whereas by making an 8/2 offer they would be risking losing eight coins. However, this is unlikely considering that there is increased risk taking, rather than decreased risk taking, during mid-adolescence (Steinberg, 2005). These age differences in rejection rates of unfair offers were also reported by Sutter (2007), where higher rejection rates of unfair offers by children and teens were interpreted as higher inequity aversion in younger participants who perceive outcomes as more important than intentions. In either case, both explanations indicate increased perspective-taking skills, understanding of intentionality, and/or other-regarding preferences that are more readily incorporated into decision making during mid- and late-adolescence, in accordance with the higher level of interpersonal understanding suggested by Selman (1980; see also Gurucharri & Selman, 1982). According to this theory, the capacity to integrate perspectives from a third person's point of view develops during mid-adolescence, and this allows for commitment, intimacy, and trust to develop at the interpersonal level. The higher percentage of 2/8

offers after mid-adolescence indicates that 15-year-olds might be able to incorporate fairness into their social interactions at a higher level.

The change in intention considerations from across 9 and 12 to 15 years of age is further supported by the results of the responder Ultimatum Game study (Experiment 3). That is, 9-year-olds did not distinguish between intentionality of unfair offers in their responses, whereas 12-year-olds showed an understanding of intentionality, consistent with the presumed development of perspective taking across 9–12 years of age (Martin et al., 2008; Selman, 1980). The transition from the first level to the second level of perspective taking in Selman's model involves the self/other differentiation and the incorporation of others' perspectives that might differ from one's own. Still, perspective taking is not at adult levels because one has difficulty in considering more than one perspective at a time. The 18-year-olds display a similar but even more distinguished pattern of intentionality consideration in their rejection of unfair offers, suggesting that perspective taking continues to develop throughout adolescence.

The developmental changes reported here may have important implications for understanding relationships across childhood and adolescence. Social decision-making processes play an important role in the development of relationships across adolescence. Reward is a strong socialization agent and plays an important role in social relationships; in particular, interactions with friends are perceived as rewarding experiences at the interpersonal level (Fehr & Fischbacher, 2003; Güroğlu, van den Bos, & Crone, 2009), all the more so throughout adolescence because there is a reorientation toward peers (Steinberg, 2005). Here we have shown that complete understanding of intentions in social interactions cannot yet be expected until late adolescence, and this may be informative for school or social orientation programs. Future research should focus on investigating the heightened sensitivity to fairness considerations and disentangle how this rise is related to different levels of social complexity from neural mechanisms to dyadic relationships.

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