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Development of Equity Preferences in Boys and Girls Across Adolescence

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The aim of the current study was to examine the development of equity preferences across adolescence, for boys and girls separately. Participants from 8 to 18 years old (M = 14.09 years; N = 1,216) played four economic allocation games. Analyses revealed a decrease in equity preferences with age and this decrease was stronger for boys than for girls. There was also an age-related increase in the preference for efficient outcomes (i.e., maximization of total available resources), which was again stronger for boys than for girls. Overall, although equity remains as a strong social norm, adolescents are decreasingly strict in adhering to the equity norm and show increasing flexibility in equity preferences.

Social decision making often involves a comparison between benefits or consequences of decisions for the self and others. For example, when considering how to split $10 between yourself and another person, an important component involves how much you are willing to sacrifice your own gain for the benefit of the other person. Prior research has shown that most individuals value a sense of equity in social decisions (Camerer, 2003; Dawes, Fowler, Johnson, McElreath, & Smirnov, 2007; Fehr & Fischbacher, 2003; Fehr & Schmidt, 1999; Loewenstein, Thompson, & Bazerman, 1989). That is to say, the equity norm dictates an equal split of money rather than a split in which one party benefits more than the other. This equity norm is violated when the other person receives more than you do (i.e., disadvantageous inequity) or when you receive more than the other person (i.e., advantageous inequity).

While most individuals prefer to receive an equal amount of valuable goods when compared to other individuals, in some situations the equity norm needs to be violated in order not to waste resources. Inequity can thereby lead to maximization of the use of all available resources, referred to as efficiency (based on utilitarian theory by Mill, 1906). Importantly, disadvantageous efficiency can be driven by efficiency considerations as well as by prosocial motives. Similarly, preferring advantageous efficiency rather than equity may not only be driven by efficiency motives but can also be driven by self-maximization. To fully understand these motives, it is important to examine decisions across a variety of social decision-making situations.

The preference for equity in middle childhood strongly increases, such that children are even willing to waste resources to achieve equity (i.e., at the cost of efficiency). At 8 years of age, most children do not only reject efficient disadvantageous inequity but also efficient advantageous inequity is rejected (Blake & McAuliffe, 2011; Shaw & Olson, 2012). In contrast, adults have a stronger preference for disadvantageous efficiency than for equity (Charness & Rabin, 2002). As expected, a decrease in strong equity preferences (i.e., choosing for equity at all times) and an increase in efficiency considerations can be observed in adolescents from 8 to 19 years old (Almås, Cappelen, Sørensen, & Tungodden, 2010; Fehr, Glätzle-Rützler, & Sutter, 2013; Martinsson, Nordblom, Rützler, & Sutter, 2011). Most of these studies on the development of the preference for efficiency focus on efficiency when this is disadvantageous for the individual; only in a few studies researchers have examined the development of both disadvantageous and advantageous efficient decisions (Blake & McAuliffe, 2011; Shaw & Olson, 2012).

One of the outstanding questions concerns the development of both advantageous and disadvantageous

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inequity aversion from pre- to late adolescence, especially when equity is competing with efficiency. Adolescence is a period of social reorientation (Steinberg & Morris, 2001) characterized by an increasing concern with social interactions and group norms due to quantitative changes in relationships (e.g., more time spent with peers, increasing size and complexity of the peer group, decreasing supervision by adults) as well as qualitative changes (e.g., disclosure and intimacy within friendships, better conflict-resolution styles, different types of social activities; see Rubin, Bukowski, & Parker, 2007). Furthermore, this is a time in which there are crucial changes regarding social decision-making patterns involving fairness considerations. With increasing age, adolescents are better at incorporating social information such as consequences for others or reputation into their decisions regarding distribution of resources (Güroğlu, van den Bos, & Crone, 2009; Overgaauw, Güroğlu, & Crone, 2012; Will, Crone, van den Bos, & Güroğlu, 2013).

Fehr, Bernhard, and Rockenbach (2008) used a set of three allocation games to test equity preferences in young children and showed that children's preferences for equity outcomes increase from 3 to 8 years of age. Using the same set of games, Steinbeis and Singer (2013) further tested developmental differences in equity preferences across 7–13 years of age. They found that equity preferences increased with age, both when equity choices were not self-costly and when they were costly. However, they found no developmental changes when participants could choose between equity and disadvantageous efficiency. Finally, Fehr et al. (2013) demonstrated a decrease in equity preferences across adolescence (ages 8–17 years old), which is inconsistent with the findings by Steinbeis and Singer. Disadvantageous efficiency choices as well as the preference for efficient non-costly equity increased with age. Another study on the development of equity and efficiency preferences in 8- to 19-year-old adolescents also showed that strong equity preferences decrease and that efficiency considerations increase with age (Almås et al., 2010). However, in this study equity and efficiency were not completely competing with each another, making it impossible to distinguish between equity and efficiency preferences.

Several questions remain when interpreting these developmental patterns. First, the development of equity preferences has been inconsistent in prior studies with some studies reporting an increase (Steinbeis & Singer, 2013) and others reporting a decrease in equity preferences over the course of adolescence (Fehr et al., 2013). Second, the question of the development of efficiency considerations was only examined in terms of disadvantageous efficiency, where the other benefits from efficiency when the decider deviates from equity, but it is not clear if this is due to efficiency or prosocial motives. These motives can be disentangled by examining advantageous efficiency, where the decider benefits from efficiency. In addition, the question about whether there is a shift from equity preferences to efficiency considerations across adolescence requires a design in which equity is directly competing with efficiency, while keeping other factors constant. Taken together, the goal of the current study was to examine the development of equity profiles by taking into account different underlying motives.

In this study, children and adolescents played four allocation games. The first three games were similar to the games previously employed by Fehr and colleagues (Fehr et al., 2008; Fehr et al., 2013) and Steinbeis and Singer (2013). A fourth game was added to measure advantageous efficiency preferences. In each game players were asked to distribute coins between themselves and an anonymous peer. The choice for the player was between an equal division of coins (one coin for the self and one for the other, i.e., 1-1) and an alternative division of coins, the alternative being different in each of the four games. In the *noncostly efficient equity* game the other player receives nothing in the inequity option (i.e., 1-0); in this case the equity option is not costly for either player and is efficient. In the *self-costly equity* game, the inequity option entails two coins for the self and zero for the other (i.e., 2-0), resulting in the equity option being costly for the self, but not being different in terms of efficiency. In the *other-costly inefficient equity* game, the inequity alternative provides the participant with only one coin and the other player gets two coins (i.e., 2-1); here the equity option is costly for the other and is inefficient as well. In the fourth game, the *self-costly inefficient equity* game, the inequity choice of two coins for the self, and one coin for the other player (i.e., 2-1) allows the participant to receive one extra coin when compared to the equity distribution; in this case the equity choice is both costly for the self and inefficient. Importantly, the willingness to incur costs to achieve equity, even if this is not beneficial to the other player's outcome, demonstrates a strong preference for equity.

We first examined responses in all games separately. Additionally, we combined responses from the four games in order to construct meaningful decision-making profiles that allowed us to

differentiate equity preferences from other motives. For example, choosing equity (1-1) in the noncostly efficient equity game (alternative 1-0) may indicate a preference for equity, but this could also be interpreted as a display of prosocial behavior. If participants choose the equity option in the noncostly efficient equity game as well as in the remaining three games, this then indicates a strong preference for equity. If they choose the equity option in all games, except for when it is costly for them, it indicates a weak preference for equity. Similarly, choosing a 2-0 distribution rather than equity (1-1) might indicate a preference for self-outcome maximization, but if this choice is accompanied by a preference for the 1-0 distribution in the noncostly efficient equity game, where the participant does not gain more by choosing inequity, it indicates spitefulness.

In the current study, by incorporating a fourth game (i.e., the self-costly inefficient equity game), we were able to examine efficiency considerations. Choosing for both advantageous and disadvantageous efficiency indicates a strong preference for efficiency. We distinguished between a self-oriented and an other-oriented preference for efficiency: In the *self-costly equity* game, where efficiency is not at stake, the more self-oriented individual would choose for self-maximizing inequity, whereas the more other-oriented individual would choose for self-costly equity.

On the basis of social reorientation and accompanied changes in social decision-making patterns across adolescence, we hypothesized that equity preferences would continue to develop from age 8 until late adolescence. Consistent with previous research findings, we expected a decrease in overall equity preferences together with an increase in efficiency considerations (Almås et al., 2010; Fehr et al., 2013; Martinsson et al., 2011). Whereas advantageous efficiency is averted in 8-year-old children (Blake & McAuliffe, 2011; Shaw & Olson, 2012), it seems to evoke only mild negative reactions in adulthood (Loewenstein et al., 1989) or is perceived to be almost as pleasant as equity, even when inequity is purely self-maximizing and does not result in efficiency (Fliessbach et al., 2012). Furthermore, adults have a stronger preference for efficient inequity than for equity, even though this efficiency is disadvantageous (Charness & Rabin, 2002). Therefore, we expected not only an increase in the preference for disadvantageous efficiency across adolescence (Fehr et al., 2013) but also an increase in advantageous efficiency.

One additional research question concerned the possible gender differences within the development of equity preferences. Studies with children between 3 and 8 years old do not find gender differences in equity preferences (Blake & McAuliffe, 2011; Fehr et al., 2008; Shaw & Olson, 2012), whereas most studies find gender differences in equity or efficiency preferences in adolescence (Almås et al., 2010; Fehr et al., 2013; Gummerum, Keller, Takezawa, & Mata, 2008). Findings show that girls have a stronger preference for equal allocations (Fehr et al., 2013; Gummerum et al., 2008; Murnighan & Saxon, 1998) and that they give away more coins in a Dictator game (i.e., where the allocator can freely choose how many of his or her coins to give to another player; Leman, Keller, Takezawa, & Gummerum, 2009). On the basis of the results by Fehr et al. (2013), we hypothesized that girls would not only be more willing to sacrifice resources to achieve equity but also have a stronger preference for equity when the alternative distribution is disadvantageous. Almås et al. (2010) report a stronger increase in efficiency considerations for boys than for girls over the course of adolescence. In summary, current evidence led us to hypothesize that developmental trajectories in equity preferences for boys and girls deviate over the course of adolescence.

Method

Participants

A total of 1,216 children aged 8–18 years (M = 14.09 years, SD = 2.07; 51.2% boys) were recruited from two public elementary schools and two public high schools. The participants were grouped into five age groups: 8- to 9-year-olds, 10- to 11-year-olds, 12- to 13-year-olds, 14- to 15-year-olds, and 16- to 18-year-olds, with an equal distribution of girls and boys across the age groups (df = 4; N = 1,216; χ^2 = 1.39, p = .85; see Table 1). Of all participants, 92.3% were of Dutch origin; the rest was of minority origin (Moroccan, Turkish, Surinamese, Pakistani, and Curaçaoan). The relative amount of participants of Dutch origin differed between schools (df = 3; N = 1,213; χ^2 = 51.90 $p < .001$). Therefore, we controlled for school membership in all analyses.

Instruments

Participants played four allocation games assessing equity preferences. In these games participants were presented with a dichotomous choice to share coins with an anonymous peer (see Figure 1). In

Table 1
Number (and Percentage) of Boys and Girls per Age Group

	8–9	10–11	12–13	14–15	16–18	Total (%)
Boys	34	53	194	233	108	622 (51.2)
Girls	28	51	177	240	98	594 (48.8)
Total (%)	62 (5.1)	104 (8.6)	371 (30.5)	473 (38.9)	206 (16.9)	1,216 (100)

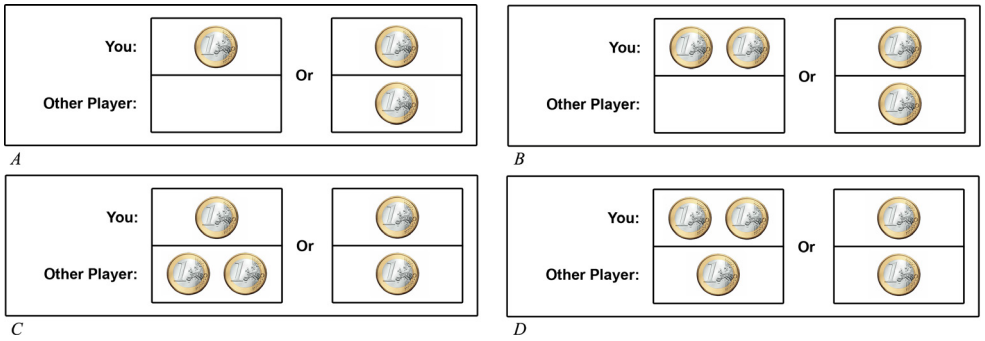

Figure 1. (A) Noncostly efficient equity game; (B) self-costly equity game; (C) other-costly inefficient equity game; (D) self-costly inefficient equity game.

each game one of the two choices was an equal allocation of coins (1-1), pitted against an inequity distribution. The alternative option in the four games was as follows: one coin for self and no coins for the other player (1-0) in the noncostly efficient equity game; two coins for self and zero for the other (2-0) in the self-costly equity game; one coin for self and two coins for the other (1-2) in the other-costly inefficient equity game; and two coins for the self and one for the other (2-1) in the self-costly inefficient equity game. Participants played each of the four games once and each time with a new anonymous peer in, randomized order, on the computer. Before the games were presented, participants were told that the players were other same-age and same-gender participants of the study. For each individual game they viewed a new screen stating: "You can choose between the following distributions. You decide how the coins will be divided between you and the other player," followed by the images presenting the distributions. After choosing a distribution by a mouse click the next game was presented. There was no time limit for responding.

Based on decisions in the four games, six behavior profiles were constructed. Choosing the equity option in all games indicates a strong preference for equity (*equity-strong* profile). Preferring equity except if this is self-costly indicates a weaker preference for equity (*equity-weak* profile). Another response pattern involved maximizing efficiency by choosing inequity in the other-costly inefficient equity and self-costly inefficient equity games (1-2 and 2-1, respectively, i.e., three coins in total for the two players instead of a total of two coins as in the 1-1 option). Choosing for efficiency combined with choosing for equity in the other two games was identified as the *efficiency-other* profile; when efficiency was combined with avoiding costs to the self by not choosing equity when it is costly (i.e., a more selfish orientation), this was identified as the *efficiency-self* profile. Always making choices that minimize outcomes for the self indicates a preference for humility (*humility* profile) and always making choices that minimize outcomes for the other indicates spitefulness (*spitefulness* profile). Table 2 summarizes these decision-making profiles.

Procedure

Local schools were contacted for participation in the study; informed consent was obtained from the school principal and the parents of participants. All participants were tested in their own classroom as part of a larger study, with classroom sizes ranging from 10 to 30 participants and accompanied by four trained experimenters. The first half of the testing session consisted of questionnaires measuring different aspects of development, such as psychosocial functioning, social behavior, and peer relationships,

Table 2
Choices in Each Game Determining the Construction of Decision-Making Profiles

	Allocation games			
	Noncostly efficient equity	Self-costly equity	Other-costly inefficient equity	Self-costly inefficient equity
Equity-strong	1-1	1-1	1-1	1-1
Equity-weak	1-1	2-0	1-1	2-1
Efficiency-other	1-1	1-1	1-2	2-1
Efficiency-self	1-1	2-0	1-2	2-1
Humility	1-1	1-1	1-2	1-1
Spitefulness	1-0	2-0	1-1	2-1

followed by eight different economic games, starting with the four games used in the current study. Finally, participants in high schools completed a short cognitive capacity test. Each testing session lasted approximately 60 min.

Before the testing session started participants were encouraged to ask questions. It was emphasized that participation was voluntary and it was ensured that all data would be handled confidentially and anonymously. The first screen that was presented before the economic games provided a reminder that the participants were playing the allocation games for real money and that at the end of data collection one person within every class would be randomly chosen to receive the money he or she earned in the four games. Each coin in the game was worth €1. Two weeks after testing the experimenters returned to the schools to give one participant in each class their earnings; participants received €5 on average. All procedures have been approved by the local ethics committee.

Statistical Analysis

In order to investigate age and gender-related trends in equity choices we conducted a series of logistic regression analyses for each game, as well as for each behavioral profile, and examined the best model fit. For analyses involving the choice in each game, the dependent variable was the choice made (i.e., equity or inequity); for analyses with the decision-making profiles, the dependent variable was the membership in a certain profile. The initial null model included dummy variables for school membership to correct for nested data effects. We tested several models, where in each following model one coefficient was consecutively added over the coefficients included in the previous model. The first model included gender; in the second model a linear term for age was added. In the third model the interaction term of Gender × Age was added. We also examined further models where the quadratic term for age and interactions with the quadratic term were included. There were no significant quadratic (interaction) effects and these were thus further excluded from the results.

Model selection was divided into two steps: First, we selected the models that showed a significant increase in chi-square values. Of these models, we selected our final model based on the Akaike information criterion (AIC; Akaike, 1974). The AIC is in favor of the model with the best predictability, while keeping the amount of parameters at a minimum. Age (M = 14.09) was centered to increase interpretability of the results and to avoid multicollinearity between the main effect of age and the interaction effect of age and gender. Gender was coded as 1 for boys and 0 for girls. Choices in the games were coded as 1 for the equity (1-1) option and 0 for the inequity option in analyses with the individual games; for each of the six decision-making profiles membership in the profile was coded as 1, and belonging to any of the other five profiles was coded as 0.

Results

Descriptives

A total of 85.9% of the participants chose the equity option in the noncostly efficient equity game. In the self-costly equity game, 74.3% of the participants chose equity (i.e., to share). In the other-costly inefficient equity game, 78.2% of the participants chose equity, and finally in the self-costly inefficient equity game, 49.7% chose the 1-1 option. Figure 2 displays the choice patterns for each age group for boys and girls before correcting for school membership in the logistic regression analyses, separately for each game. In the analyses below, we test for gender and age differences in choice patterns using logistic regression analyses. See Table S1 in the online Supporting Information for a detailed overview of the frequency of choices per game.

We were able to classify the decisions of 843 (69.5%) participants of our total sample using the six decision-making profiles. The highest observed prevalence was for the equity-strong profile (30.4%

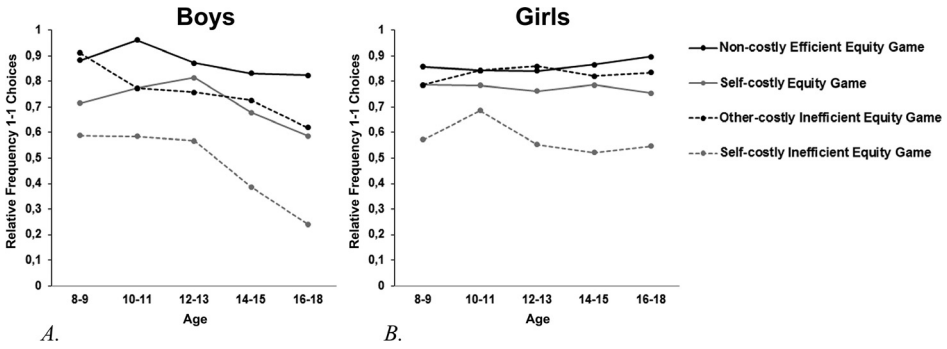

Figure 2. Proportion of equity decisions over age groups for (A) boys and (B) girls.

for boys and 40.4% for girls). Together with the equity-weak profile, the highest observed prevalence of the two equity profiles combined was 58.8% in 8- to 9-year-old boys and the second highest was 55.7% in 16- to 18-year-old girls. The highest observed prevalence of the two efficiency profiles combined was 28.7% for boys and 13.4% for girls, both in the age group of 16- to 18-year-olds. The lowest observed prevalence was for the profiles spitefulness and humility. The spitefulness profile had relative frequencies ranging from 0.0% in 10- to 11-year-old boys to 7.1% in 8- to 9-year-old girls, and the humility profile from 2.8% in 12- to 13-year-old girls to 14.3% in 8- to 9-year-old girls. Figure 3 shows the distribution of profiles over the age groups before correcting for school membership in the logistic regression analyses, for boys and girls separately. See Table S2 for a detailed overview of the frequency of decision-making profiles per gender. Table S3 provides correlations between several psychosocial measures and choices in each game and the decision-making profiles to support the validity of the games and the profiles.

Equity Choices

The results for model selection are shown in Table 3 and the regression coefficients for the model with the best fit are shown in Table 4. Figure 4 displays the results from the logistic regression analyses with school membership correction, separately for each game. In half of the analyses testing the initial null model, model fit increased after including the control variable for school membership. In the noncostly efficient equity game (Figure 4A), despite a significant age and gender interaction in the best fitting model ($\hat{b} = -0.21$, $p = .02$), there were no age-related changes for girls and boys separately. In both the self-costly equity game (Figure 4B) and the other-costly inefficient equity game (Figure 4C), the best fitting model included the main terms gender ($\hat{b} = -0.31$, $p = .02$ and $\hat{b} = -0.61$, $p < .001$, respectively) and age ($\hat{b} = -0.13$, $p = .008$ and $\hat{b} = -0.13$, $p = .01$, respectively), which indicates that girls had a stronger preference for equity than boys and that equity preference decreased with age for both genders. Finally, best model fit for the prediction of decisions in the self-costly inefficient equity game

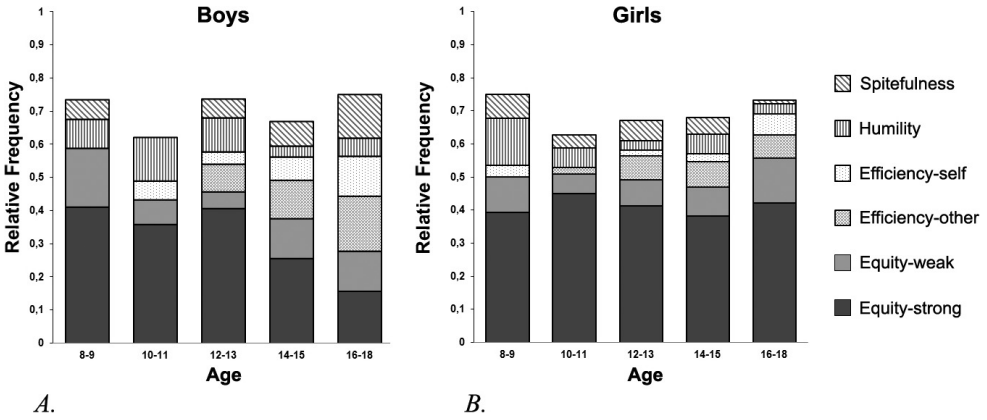

Figure 3. Proportion in decision-making profiles over age groups for (A) boys and (B) girls.

Table 3
Model Selection Based on Step Chi-Square and AIC

		Model ID							
		0		1		2		3	
Dependent variable	*N*	χ^2	AIC (*df* = 5)	χ^2	AIC (*df* = 6)	χ^2	AIC (*df* = 7)	χ^2	AIC (*df* = 8)
Allocation games									
Noncostly efficient equity	1,213	5.89	990.84	0.08	992.76	0.09	994.67	**5.90***	**990.77**
Self-costly equity	1,216	2.76	1,392.14	5.40*	1,388.74	**7.00****	**1,383.74**	3.74	1,382.00
Other-costly inefficient equity	1,215	13.67**	1,270.87	18.69***	1,254.18	**6.41***	**1,249.77**	2.91	1,248.86
Self-costly inefficient equity	1,213	16.64**	1,674.90	13.67***	1,663.23	16.04***	1,649.19	**6.23***	**1,644.96**
Decision-making profiles									
Equity-strong	1,213	14.22**	1,570.72	13.07***	1,559.65	10.72**	1,550.93	**6.86****	**1,546.06**
Equity-weak	1,213	0.91	769.69	0.15	771.54	2.94	770.60	0.04	772.56
Efficiency-other	1,213	29.92***	670.73	**4.14***	**668.59**	3.00	667.59	1.78	667.81
Efficiency-self	1,213	8.43*	449.33	8.95**	442.38	**10.40****	**433.98**	0.32	435.66
Humility	1,213	6.36	555.48	2.37	555.11	1.28	555.83	0.07	557.76
Spitefulness	1,213	4.36	551.96	3.09	550.87	0.12	552.75	**8.75****	**546.00**

Note. Model 0 consisted of only intercept and control variables; Model 1 consisted of the variables in Model 0 and gender; Model 2 consisted of the variables in Model 1 and age; Model 3 consisted of the variables in Model 2 and the interaction term Gender × Age. Best model in bold font. AIC = Akaike's information criterion.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 4
Regression Coefficients and Standard Errors for the Best Fitting Model

	Coefficient			
Dependent variable	Intercept (*SE*)	Gender (*SE*)	Age (*SE*)	Gender × Age (*SE*)
Allocation games				
Noncostly efficient equity	1.69 (0.15)***	−0.06 (0.17)	0.14 (0.08)	−0.21 (0.09)*
Self-costly equity	1.35 (0.12)***	−0.31 (0.13)*	−0.13 (0.05)**	—
Other-costly inefficient equity	1.87 (0.14)***	−0.61 (0.14)***	−0.13 (0.05)*	—
Self-costly inefficient equity	0.34 (0.11)**	−0.46 (0.12)**	−0.09 (0.05)	−0.15 (0.06)*
Decision-making profiles				
Equity-strong	−0.19 (0.11)	−0.49 (0.12)***	−0.07 (0.05)	−0.16 (0.06)**
Equity-weak	—	—	—	—
Efficiency-other	−2.77 (0.21)***	0.43 (0.22)*	—	—
Efficiency-self	−4.00 (0.32)***	0.85 (0.31)**	0.31 (0.09)**	—
Humility	—	—	—	—
Spitefulness	−2.94 (0.24)***	0.44 (0.26)	−0.25 (0.14)	0.41 (0.15)**

*$p < .05$. **$p < .01$. ***$p < .001$.

(Figure 4D) yielded a model with the main terms gender ($\hat{b} = -0.46$, $p < .001$) and age ($\hat{b} = -0.12$, $p = .08$) and the interaction term of Gender × Age ($\hat{b} = -0.15$, $p = .01$). This reveals a decrease in equity preferences with age for boys, but not for girls.

Equity-Related Decision-Making Profiles

See Tables 3 and 4 for the model selection and regression coefficients of the best fitting model, respectively. Figure 5 displays the results from the logistic regression analyses, correcting for school membership, separately for each decision-making profile. For the equity-strong profile (Figure 5A), logistic regression analyses showed the best model fit for a model including the interaction term of gender and age ($\hat{b} = -0.13$, $p = .02$), which indicated a linear decrease in strong equity preferences with age for boys only. In both efficiency profiles, boys chose more often according to the efficiency-other and efficiency-self (Figure 5B) profiles than

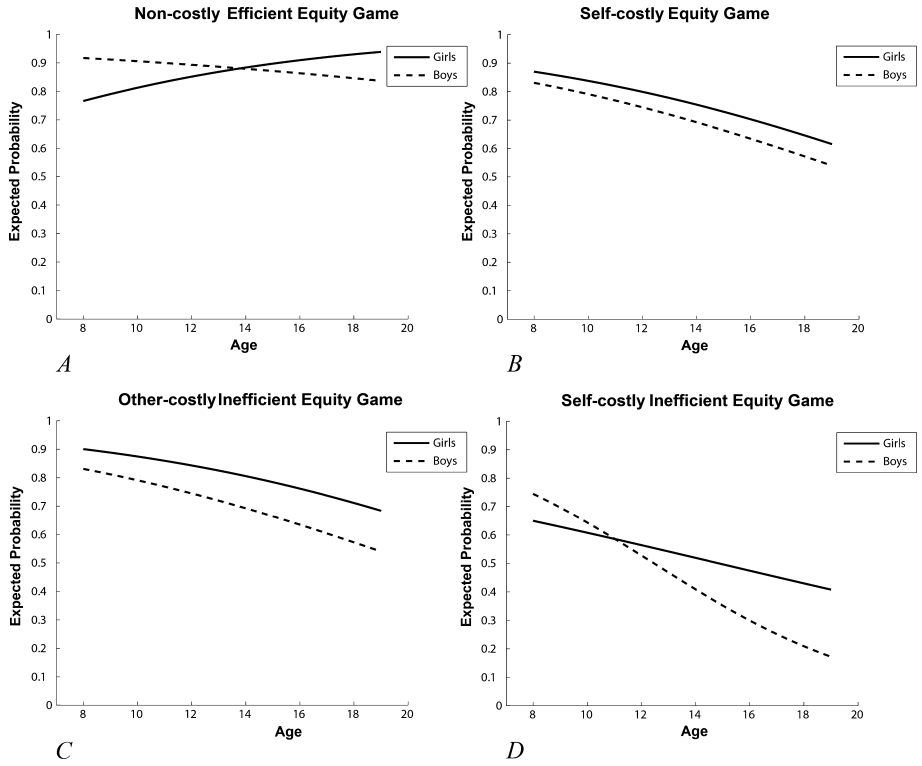

Figure 4. Estimated curves for the expected probability of equity preferences in each game, separately for girls and boys. (A) Noncostly efficient equity game; (B) self-costly equity game; (C) other-costly inefficient equity game; (D) self-costly inefficient equity game.

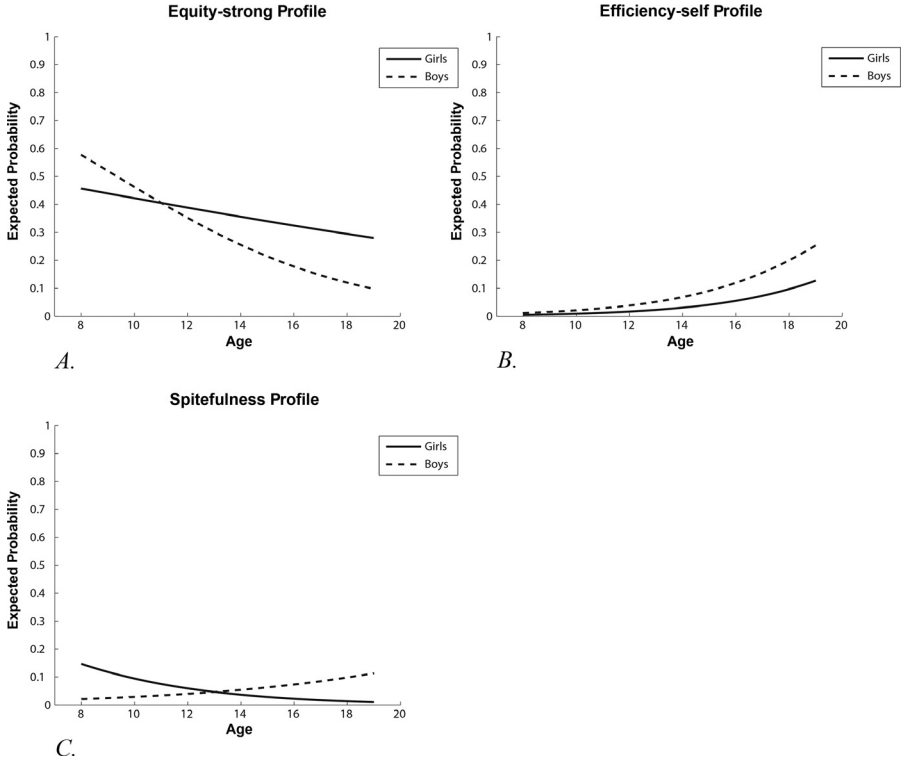

Figure 5. Estimated curves for the expected probability of choosing according to the decision-making profiles, separately for girls and boys. (A) Equity-strong; (B) efficiency-self; (C) spitefulness.

girls ($\hat{b} = 0.43$, $p = .04$ and $\hat{b} = 0.85$, $p = .006$, respectively). Furthermore, in the efficiency-self profile there was a significant effect of age ($\hat{b} = 0.31$, $p = .001$), indicating that boys had a stronger preference for self-oriented efficiency and this increased with age for both genders. In the spitefulness profile (Figure 5C), there was a significant interaction between gender and age ($b = 0.41$, $p = .005$). Although the slopes for boys and girls differed significantly, age-related patterns for boys and girls separately did not yield significant results. For other profiles, no best fitting models were identified.

Discussion

The current study aimed to examine the developmental patterns of equity preferences across adolescence. First, we tested developmental changes in four individual allocation games, where the results showed different gender-related patterns in making equity-related decisions pitted against different self- or other-benefiting outcomes. Although the preference for noncostly prosocial equity over inequity did not show age-related changes, there was a decrease in costly prosocial equity preferences, as well as in inefficient equity preferences, for both genders. For boys only, we also showed an age-related decrease in equity preferences when the alternative was advantageous efficiency. Second, we combined equity-related decisions in four games and demonstrated a developmental increase for a self-oriented efficiency preference across adolescence and a decrease for a strong equity preference in boys only.

Developmental Patterns in Equity Choices

We hypothesized a decrease in equity preferences in adolescence, and our findings predominantly supported this hypothesis. Specifically, we identified no age-related changes in noncostly equity preferences for boys or girls. Previously, both Fehr et al. (2013) and Steinbeis and Singer (2013) showed an age-related increase in the preference for noncostly equity in adolescence. One explanation for the lack of developmental changes in our findings might be a ceiling effect. In our sample, the preference for equity in the noncostly efficient equity game was already at very high levels (close to 90%) in the youngest age group.

Interestingly, we observed a different pattern when equity choices were costly: With increasing age, adolescents were less willing to sacrifice a coin in order to achieve equity. Steinbeis and Singer (2013) found an increase and Fehr et al. (2013) found no differences in equity preferences in this game. Consistent with our expectations, girls had a relatively stronger preference for equity in this game compared to boys, suggesting that boys are even less willing than girls to incur costs for equity. Similar to the results in the self-costly equity game, girls chose equity more often than boys in the other-costly inefficient equity game; this equity preference decreased across adolescence, consistent with the findings by Fehr et al. (2013). It is important to note that equity choices in this context indicate that the participant is not willing to give more to the other player even though this is not costly, suggesting feelings of envy toward the other player.

Although adolescence is known as a period important for the further development of prosociality through an increase in perspective taking, prosocial reasoning, and empathy skills (Eisenberg, Cumberland, Guthrie, Murphy, & Shepard, 2005; Eisenberg, Miller, Shell, McNalley, & Shea, 1991; Güroğlu et al., 2009; Siu, Shek, & Law, 2012; Van den Bos, Westenberg, van Dijk, & Crone, 2010), the results in the self-costly equity game indicate that adolescents seem to become less prosocial with age when this incurs costs. On the other hand, adolescence is also characterized by progressive individuation in prosocial behavior (Hay, 1994). This individuation theory implies an increase in differentiation in prosocial behaviors across different contexts. Our results support the latter theory, especially when comparing the results in the self-costly equity game with the results in the other-costly inefficient equity game: As prosocial behavior decreases when this is costly for the allocator, prosocial behavior increases when this is disadvantageous but not costly. This reveals a pattern moving from a more homogeneous equity norm toward a more heterogeneous account of prosocial behavior.

It might be that adolescents, compared to children, are capable of using various justifications to explain their decision not to share. Research shows that when negotiating a fairness-related group decision with peers, involving how much to share with another anonymous group in a Dictator game, children tend to argue in simple terms of fairness and egoism, whereas adolescents also employ more complex conditional justifications for fairness-related decisions (e.g., "If I can decide, I will not give them half"; "Maybe they are unfair people in the other group"; "I don't think they'd give us much

either"; Gummerum et al., 2008). The availability of these more complex justifications in older adolescents' schemata can provide them with an opportunity to make a selfish decision in the self-costly equity game. The extent to which older adolescents might be using such justifications during individual fairness-related decisions needs to be investigated in future studies.

Finally, in the self-costly inefficient equity game we identified a pattern of decreasing equity preferences with age for boys, but not for girls. In other words, boys were more likely to allow themselves an extra coin, as this makes no difference in the outcome for the other player. The most rational decision (i.e., achieving efficiency by using all available resources) would be to choose advantageous efficiency. However, the results remarkably show that even at older ages more than one third of the participants chose an equal allocation. Note that, as in the self-costly equity game, equity decisions in the self-costly inefficient equity game are self-costly, the main difference being that choosing inequity in the self-costly inefficient equity game does not result in a relative loss for the other player compared to the equity option. Therefore, a decrease in equity preferences in the self-costly equity game reflects an increase in selfishness, whereas a decrease in equity preferences in the self-costly inefficient equity game indicates an increase in self-outcome maximization with no costs for the other party. While the latter decrease is not inconsistent with expectations based on previous findings, the first one is.

Developmental Patterns in Equity-Related Decision-Making Profiles

Importantly, our analyses based on decision-making profiles provide additional valuable information beyond the results provided by the analyses of the individual games. In the games used in this study, the meaning of choosing for equity depends on the available alternative distribution. Integrating information from the individual games allows us to analyze developmental changes in underlying motives in equity decisions. Importantly, the current study extends previous findings on decision-making profiles (Fehr et al., 2008; Fehr et al., 2013; Steinbeis & Singer, 2013) by including a fourth game and thereby incorporating the role of efficiency in equity-related decisions. Consistent with previous research (Almås et al., 2010; Fehr et al., 2013; Martinsson et al., 2011), the findings from the equity-strong profile reveal that boys, but not girls, show a decrease with age in the strong preference for equity in all games. Nevertheless, even in the oldest age group a considerably large proportion of adolescent boys and girls prefer equity, regardless of possible alternative outcomes.

As expected, efficiency considerations increase across adolescence. For the efficiency profiles, in the efficiency-self profile adolescents showed an increase with age, and boys showed a stronger preference for both other- and self-oriented efficiency than girls. Note that the decrease in equity preferences in both inefficient equity games and in the self-costly equity game is reflected in the increase in the efficiency-self profile. These findings are consistent with previous studies (Almås et al., 2010; Fehr et al., 2013; Martinsson et al., 2011).

Although Fehr et al. (2013) and Steinbeis and Singer (2013) found a decrease in the occurrence of the spitefulness profile over the course of adolescence, we did not find developmental changes. Nevertheless, since the occurrence of the spitefulness profile was already relatively low in the younger age groups in the current study, a reversed ceiling effect might be responsible for the absence of an age effect. See Tables S4–6 and Figure S1 for direct comparisons with Fehr et al. (2013) and Steinbeis and Singer (2013) based on reanalysis of our data with the same decision-making profiles as in these previous studies.

It is intriguing that the steep increase in equity preferences in early development as reported earlier (Blake & McAuliffe, 2011; Fehr et al., 2008; Shaw & Olson, 2012) is followed by a decrease in the preference for equity across adolescence, as observed in the current and other studies (Almås et al., 2010; Fehr et al., 2013; Martinsson et al., 2011). Similar findings have previously been reported using different economic games, such as the Ultimatum game, in which 8-year-old children had the strongest preference for an equal distribution (Güroğlu et al., 2009). The exact underlying processes of the development of equity preferences remain unclear. Already around 20 months of age infants are able to recognize equity norm violations (Geraci & Surian, 2011; Sloane, Baillargeon, & Premack, 2012; Sommerville, Schmidt, Yun, & Burns, 2013) and several studies have shown that around 6–8 years of age most children act upon the norm of equity (Blake & McAuliffe, 2011; Fehr et al., 2008; Shaw & Olson, 2012). One study revealed that the development of strategic behavior in equity-related decisions from middle childhood to early adolescence is related to inhibitory control (Steinbeis, Bernhardt, & Singer, 2012).

In contrast to the study by Steinbeis et al. (2012), in a design where the experimenter observes the

decision of the young participant in an adaptation of the Dictator game, inhibition did not predict equity decisions (Smith, Blake, & Harris, 2013). Interestingly, in another study using the Dictator game where children made their decisions hidden from the experimenter, inhibition predicted whether children were willing to share candy at their own cost (Aguilar-Pardo, Martínez-Arias, & Colmenares, 2013). Furthermore, equal sharing in this study was very rare. Smith et al. (2013) explain an increase in equal sharing between ages 3 and 8 by the weight that older children attach to the norm of equity. An additional explanation is given by Shaw et al. (2013) such that an important motive for acting upon the equity norm seems to be an increasing concern to appear fair to others.

When the increasing importance of appearing fair is responsible for an increase in equity preferences in middle childhood, the question remains whether the inverse of that development accounts for the decrease in equity preferences in adolescence. We propose two hypotheses: First, a decrease in adult supervision may open up opportunities to deviate from equity norms that previously have been strongly promoted by caretakers. Teachers and parents teach young children to value equity above selfishness because being able to understand equity principles and to behave accordingly is a key prerequisite for social development in childhood. Once most children display behavior according to this norm with an adult present, there is no further need to strongly enforce this equity norm. More freedom in the construction of social norms in adolescence, together with an increase in the cognitive skills that allow for the construction of more complex inequity justifications, gives room for individual differences in equity preferences.

Second, the shift toward a more conditional preference for equity in adolescence may be due to the narrow applicability of the norm in a strict sense (i.e., equity for every individual under all conditions) in adult social interactions. Understanding the norm remains important after childhood, but its application becomes more flexible. Being successful in navigating our complex society requires flexibility in the appreciation of equity principles. In summary, more freedom to deviate from the equity norm in adolescence and the adaptation of adult distributive norms can explain a decrease in equity preferences. Future research should focus on the influence of adult and peer observers on equity-related decisions to investigate whether peers and adults differentially influence equity decisions in adolescence.

Gender Differences

The general pattern we observed for gender differences is that toward late adolescence, girls still have a relatively strong preference for the strong equity norm, whereas boys tend to differentiate more between equity-related decisions. Individual differences in equity preferences in boys become more apparent in adolescence. Consistent with expectations, girls had a stronger preference for equity choices in the other-costly inefficient equity game, implying that they are more envious than boys, but looking at the patterns in the self-costly equity game, girls are also more willing to incur costs to achieve equity.

Although most studies on the development of equity preferences in adolescence find gender differences, these differences do not seem to emerge before the onset of adolescence (Blake & McAuliffe, 2011; Fehr et al., 2008; Shaw & Olson, 2012). One of the strengths of the current study is the large sample size, which allowed us to investigate gender differences in developmental patterns of equity preferences. Whether a small sample size in the studies with younger children is responsible for not detecting a difference in that age group, or gender differences really start to develop at older ages requires attention in future studies.

Limitations and Concluding Remarks

Results in the current study showed some inconsistencies with the two prior developmental studies by Fehr and colleagues' (Fehr et al., 2008; Fehr et al., 2013) and by Steinbeis and Singer (2013). For example, in our study the 8- to 9-year-old children chose for equity in the self-costly equity game approximately 70%–80% of the time, but in the study by Fehr et al. (2008), this was approximately 40% of the time for the 7- to 8-year-olds, approximately 10% for the same age group in the study by Steinbeis and Singer (2013), and in the Fehr et al. (2013) study this was even lower (6% for the 8- to 9-year-olds).

Due to slight differences across the methodologies employed in the three studies, it is difficult to make a strict comparison of the findings. There might be several possible reasons for these discrepancies. First, as Steinbeis and Singer (2013) already point out, one of the main differences in their study design compared to that of Fehr et al.'s (2008) was the type of rewards used in the allocation games. In the Steinbeis and Singer study participants could earn tokens, which they could trade in for age-appropriate toys directly after the experiment; in the study by Fehr

et al. (2008) children distributed candy placed right in front of them; and the adolescents in Fehr et al. (2013) could earn points by playing the games, these points were exchanged for money after the experiment, with the exchange rate being age dependent. Finally, in the current study, we used euro coins (local currency) that the participants distributed. Although these differences may be responsible for the discrepancies in the findings, studies on the influence of the value of the stakes on the willingness to sacrifice own benefit in a Dictator game are somewhat inconsistent. On one hand, Blake and Rand (2010) found that children share more of their least favorite stickers than of their favorite stickers. On the other hand, Forsythe, Horowitz, Savin, and Sefton (1994) report that doubling the amount of money to be divided does not influence the relative amount of money adults are willing to share. Whether young children are more sensitive than adolescents and adults to the value of stakes needs to be further investigated.

Second, variations in the proximity of the rewards across the four studies could account for the differences in results. In our study we used (pictures of) euro coins as resources to be divided and the chance of receiving the reward was determined by lottery. Numerous studies on children's sensitivity for the proximity of reward through delay discounting tasks support this point (see Green, Fry, & Myerson, 1994). How reward proximity might influence the perception of the stake and subsequent behavior should be considered in future developmental research on equity preferences.

Third, an important aspect to take into account in future studies is to examine individual differences in social economic and cultural background. There are now several studies showing that already at a young age social decision making in children differs over cultural backgrounds (e.g., House et al., 2013; Rochat et al., 2009; Stewart & McBride-Chang, 2000). In the analyses of the current study we corrected for school membership to minimize the influence of differences in socioeconomic status and cultural background between schools. Correcting for school membership did alter the results by suppressing the effects in some of the analyses (see Table 3 for the increase in model fit due to school membership). However, correcting for school membership does not account for socioeconomic status and cultural differences between children within schools. In future research it is important to systematically examine the role of socioeconomic status and cultural backgrounds in the development of social values such as fairness considerations and equity preferences.

Taken together, to our knowledge this is the first study testing age-related changes in both equity and efficiency preferences across a broad age range from preadolescence to late adolescence. We showed that although adolescents across the age of 8 to 18 years old value equity, they also show an increasing deviation from the equity norm, which is established earlier in childhood (3 to 8 years). Over the course of adolescence, efficiency considerations gain importance over the equity norm, especially in boys. We were able to measure the development of both disadvantageous and advantageous efficiency through the inclusion of a fourth game. A major strength of this study is the large sample size, which allowed us to employ modeling approaches and demonstrate different developmental patterns in girls and boys for equity preferences. These findings reveal flexibility in application of the equity norm, and attitudes toward efficiency, and thereby extend previous reports showing increases in equity and efficiency preferences in early childhood and adolescence (Almås et al., 2010; Blake & McAuliffe, 2011; Fehr et al., 2008; Fehr et al., 2013; Martinsson et al., 2011; Shaw & Olson, 2012). The approach in which equity preferences are studied across the early life span (3 to 18 years) is of value for understanding how cognitive processes and socialization processes in childhood and adolescence together contribute to the development of views on social justice in adulthood.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Table 1: Descriptives for Choices in the Allocation Games

Table 2: Descriptives for the Decision-making Profiles

Table 3: Partial Point-biserial Correlations Between Equity Decisions and Psychosocial Measures

Table 1: Choices in Each Game Determining the Construction of Decision-making Profiles Based on Three Games (Excluding the Self-costly Inefficient Equity Game)

Table 4: Choices in Each Game Determining the Construction of Decision-making Profiles Based on Three Games (Excluding the Self-costly Inefficient Equity Game)

Table 5: Model Selection Based on Step Chi-square and Akaike's Information Criterion for Decision-making Profiles Based on Three Games (Excluding the Self-costly Inefficient Equity Game)

Table 6: Regression Coefficients and Standard Errors for the Best Fitting Model for Decision-making Profiles Based on Three Games (Excluding the Self-costly Inefficient Equity Game)

Figure S1: Proportion in decision-making profile over age groups based on three games (excluding the Self-costly inefficient equity game) for boys (A) and girls (B).