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Prospective thinking and decision making in primary school age children

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Abstract

In this study, we seek to widen our understanding of the developmental processes underlying bargaining behaviour in children addressing the concept of prospective thinking. We argue that the emergence of the capacity to think prospectively about future outcomes or behaviours in response to current actions is a required precedent to strategic decision making. To test this idea, we compared 6, 8 and 10 years old children's performance on three tasks: the ultimatum game assessing fairness/inequality aversion, the marshmallow task, an intertemporal choice task evaluating the ability to delay gratification, and the dictator game assessing altruism. The children's socio-demographic and cognitive variables were also evaluated. We hypothesized that development of strategic thinking in the ultimatum game is related to an increased ability to delay gratification – given that both tasks require looking at prospective benefits – and, crucially, not to altruism, which benefits from immediate selfless reward. Our results confirmed our hypothesis suggesting that increased strategic planning with age would also stem from the development of competencies like prospective thinking.

Keywords: Psychology, Education

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1. Introduction

Fundamental to the development of social competencies is understanding that behaviour is continuously modulated by mental states such as intentions, desires, believes and that it is strictly related to the system of social norms and values in everyday life (Bosacki and Astington, 1999; Caputi et al., 2012). One of the most significant aspects among several social competencies is the capacity to make decisions. Decision-making does not only imply the analysis of evaluative and deliberative aspects of situations, but also of psychological components such as emotions (Van't Wout et al., 2006), mentalising or the Theory of Mind (Marchetti et al., 2008; Takagishi et al., 2014; Cowell et al., 2015; Schug et al., 2016) and the sensitivity to social and moral norms (Bicchieri, 2006; Marchetti and Castelli, 2012). The developmental trajectory of decision-making processes, so as known in literature, can be synthetically described as the evolution of behaviour in a continuum from "homo oeconomicus" in the earliest age, aimed to maximise one's own profit, to the periods of childhood and then adolescence, which involve the development of different psychological components, from simple motivation to maximisation gain (e.g., Castelli et al., 2010). The study of decision-making during development has commonly addressed the constructs of fairness and altruism. These two aspects share – although to different degrees – several competencies (e.g., the sense of reciprocity and inclination to pro-sociality) and still diverge, particularly in late childhood, to some extent. Differences between altruistic and fair behaviour associated with age increase may account for the emergence in late childhood of specific competencies. In this respect, our proposal is that increased cognitive abilities (e.g., Mischel et al., 1989; Posner and Rothbart, 2007; for review, see Duckworth and Kern, 2011) as well as, importantly, the emergence of prospective thinking abilities emerging at around 8–10 years may account, at least in part, for the development of fairness, distinguishing it from altruism.

Altruism stems from reliance on current behaviour and related consequences and is much related to one's predisposition to pro-sociality. In this respect, a large body of work shows that children help and share with others already during the second and third years of life (Warneken and Tomasello, 2006; Melis et al., 2006; Jensen et al., 2007; Warneken and Tomasello, 2008, 2009b), independently of the parents' desire or material rewards (Warneken and Tomasello, 2013). These findings support a "nativist" conception associated with the development of human altruism (Warneken and Tomasello, 2009a, b) that emerges as an unconditional prosocial tendency and develops into the adoption of reciprocal strategies in later life. Reinforcing this finding, using a physiological measure of children's arousal, Hepach et al. (2012b) found that 2-year-olds are not motivated primarily by a need to help a person themselves (and thus to benefit themselves via reciprocity or an improved reputation) but rather by a need just to see the person helped (for review, see Tomasello and Vaish, 2013). Propensity to altruism appears thus to emerge

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early in life to stabilize in early school-age (e.g., Harbaugh and Krause, 2000; Benenson et al., 2007).

Compared to altruism, fairness is firstly hallmarked by the sense of reciprocity, according to which individuals accept or refuse a certain offer to positively or negatively repay the other (Rabin, 1993, 1998; Bolton and Ockenfels, 2000). This notion is strongly in line with the classical studies on the development of the sense of justice and equity as considered by rationalist models on the development of the moral sense (Piaget, 1932; Kohlberg, 1975, 1981; Turiel et al., 2014). Sensitivity to fairness emerges in early infancy and develops between 3 and 8 years of age (Fehr et al., 2008). Around early school age, it becomes evident that children behave more like adults when distributing resources (House et al., 2013) with effects – in scholar age – on judgment and behaviour (see also, Castelli et al., 2013). For example, comparing altruistic and fair behaviour in children age 7 through 18 years, Harbaugh et al. (2003) found substantial changes with age, with bargaining abilities present already in the youngest children and an increase of preference for fairness in the older age range.

Fair behaviour is shown to develop with increased cognitive abilities (e.g., Mischel et al., 1989; Posner and Rothbart, 2007; for review, see Duckworth and Kern, 2011). Additionally, and importantly for the present purpose, we suggest that development of fairness may also result from maturation of prospective thinking enabling the individual to anticipate future outcomes in response to current conducts. Prospective thinking is supposed to develop around the age of 9–10 years (Natterson and Knudson, 1960), or even around 7 years of age (Piaget, 1960; Melaer, 1973), when an awareness of ourselves as individuals in time is reached. With the present work, we investigated this idea by assessing relational competencies in 94 children of three sensitive age groups (6, 8 and 10 years) with respect to decisional processes associated with fairness and altruism, highlighting the role played by prospective thinking in such behaviours. To our knowledge, the specific temporal aspect that defines prospective thinking in altruistic or fair behaviour has never been directly approached in empirical studies. Aid in this respect can come from the study of delay of gratification, and namely the capacity to forgo current gains for greater future outcomes, which also involves prospective thinking in decision-making. In everyday life people, in fact, are called to make decisions between choices that would give an immediate benefit, and choices that will bring bigger benefits in the future. This circumstance has been named intertemporal choice (Berns et al., 2007; Marchetti et al., 2009a, b; Paglieri et al., 2015; Marchetti et al., 2014) that is classically investigated through a delay of gratification paradigm (e.g., Mischel, 1958; Mischel and Baker, 1975; Duckworth and Seligman, 2005; Mischel et al., 1988, 1989; Eigsti et al., 2006; Casey et al., 2011).

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In the present study, children's performance was evaluated against three most commonly used psychological decision-making tasks: the Dictator Game (DG), the Ultimatum Game (UG), and the Marshmallow Task (MT), i.e. an intertemporal choice task. The Dictator Game (DG; Kahneman et al., 1986), which investigates propensity to prosociality and, in particular, altruism, is an economic game that is designed to question the standard economic assumption that individuals will act solely out of self-interest, pushing the concept of "homo oeconomicus" to the limit. In the DG, in fact, the proposer can freely decide how to allocate resources knowing that the responder cannot refuse any offers. The Ultimatum Game – UG – (Güth et al., 1982; for a review on UG development see Güth and Kocher, 2014) is used to delineate development in terms of equity and negotiation ability in decision-making, thus focusing on sensitivity to fairness and inequality aversion (Fehr and Schmidt, 1999). Differently from the DG, in the UG the responder can refuse the offered amount, in which case neither player would get anything. Therefore, in this game, strategic behaviour, which requires to ability to anticipate the other's responses to the proposed divisions, is important to self-assure some payoffs. Finally, delay of gratification was assessed through the marshmallow task (MT; Mischel et al., 1972). In this task, the temporal component underlying decision-making is reflected in the ability to self-control and, hence, to delay gratification for greater future gains. Some of our hypotheses were meant to be confirmatory of current literature, whereas other were exploratory of our core idea, and more specifically:

1.1. Confirmatory hypotheses

1. On the DG task, on the basis of a "nativist" conception associated with altruism, we expected to observe an altruist behaviour already in the youngest age group.
2. On the UG task, as suggested by current literature, we expected to find an increase in fair behaviour with age when the children played as proposers. Similarly, we predicted greater inequality aversion with age increase when the children played as responders.
3. On the basis of previous findings, as well as on commonalities observed between the constructs of altruism and fairness, we expected a positive relationship between performance at the DG and UG tasks, at least in the youngest age group.
4. On the MT task, we predicted an increasing ability to delay gratification with age, also in line with the idea that the ability to wait for greater future gains goes along the development of cognitive competencies and prospective thinking.

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1.2. Exploratory hypotheses

1. Delay of gratification (MT) is *not* related to altruism (DG). Altruistic individuals do not need to wait to gain a reward since reward is immediate: the individual feels rewarded by the altruistic action itself and by giving immediate pleasure to the other person.
2. Delay of gratification (MT) is positively related to fairness (UG proposer) – at least in the oldest age group – based on the idea that fairness and delay of gratification share the ability to look prospectively at future gains, independently of whether the future outcome will benefit oneself or another person.

2. Method

2.1. Participants

Ninety-eight (98) children took part in the study. Of these, 94 children (42 females, 52 males) – who passed the CPM Raven test for cognitive abilities – were included in the analysis. The Raven's Coloured Progressive Matrices (CPM, Raven, 1947) were submitted as a measure of basic cognitive functioning to ensure the sample's cognitive homogeneity. The children included in the present analyses scored above the 25th percentile for each age group as reported in the Italian validation manual (Belacchi et al., 2008).

The children were recruited from two public primary schools in the North (N = 43) and Centre (N = 51) of Italy. After receiving the school directors' approval to carry out the research, the caregivers were informed of the aim and procedure of the study and provided a written consent for their children's participation in the study. Children were divided in age groups as follows: 6-year olds (N = 34, M = 80 months, SD = 3.63); 8-year-olds (N = 30, M = 103 months, SD = 3.6); and 10-year-olds (N = 30, M = 126 months, SD = 6.11). Participants belonged to the middle socio-economic status as assessed through the Family Affluence Scale (Currie et al., 2008). Children were neither referred to social services nor reported by teachers for learning and/or socio-relational difficulties. See Table 1 for a summary of the sample's socio-demographic and cognitive data. The study was approved by the Local Ethic Committee (Università Cattolica del Sacro Cuore, Milan).

2.2. Tasks

2.2.1. Altruism and fairness

Altruism and fairness were assessed in one single session. A standard version of the Dictator Game (DG; Kahneman et al., 1986) and a standard version of the

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Table 1. Description of the sample subjects. Cognitive abilities were evaluated through the Raven's Coloured Progressive Matrices (CPM, Raven). The socio-economic status (SES) was assessed through the Family Affluence Scale (FAS).

	Age (months)		N	Gender		School		CPM Raven			SES (FAS range 0–9)	
Age group	M	SD		Male	Female	North	Centre	Range	Mean	SD	Mean	SD
6	80	3.63	34	17	17	14	20	17–33	24.5	4.18	5.7	1.73
8	102	3.6	30	20	10	13	17	23–36	28.87	3.69	6.36	1.88
10	125	6.11	30	15	15	16	14	28–36	32.9	2.2	6.5	1.59

Ultimatum Game (UG; Güth et al., 1982) were used to evaluate altruism and fairness, respectively. In both games, the child (playing as proponent) could decide how to distribute 10 preferred goods – selected among candies, biscuits or chocolates – between him/her and a passive player, represented by a graphic representation of a child (e.g., Castelli et al., 2010). During the DG, the dictator (proponent) could offer any divisions and the receiver (the other child – graphic representation) could *not* decline the offer. The minimum amount that could be offered was 0, the maximum 10. The children played one round, in which the offered amount was scored.

During the UG, the children played one round as proposer and three rounds as responder, for a total of four rounds. Playing as proposer, the child could decide how to divide the goods with the other child (graphic representation) and, playing as responder, the child could decide whether to accept or refuse the proposed division. In case of acceptance, both children (the participant and the child depicted in the drawing) received the respective proposed amounts; in case of refusal, neither child gained anything.

When playing as responder, each round (3 in total) corresponded to a specific type of proposal: *hyperfair* (2–8: two goods for the proposer and eight goods for the responder); *fair* (5–5: equal division of goods); *unfair* (8–2: eight goods for the proposer and two goods for the responder). The rounds were randomized across children. For each round, the child could accept or refuse the offered amount, receiving a score 1 in case of acceptance and 0 when refusing. A total of 3 independent scores were hence obtained, one for each type of proposal.

In both DG and UG, the children were actually given a final amount of goods that could not be converted into monetary incentives for several reasons. First, monetary incentives are generally considered unethical in developmental research on decision-making (see Castelli et al., 2013). Most importantly, children's comprehension of monetary exchanges is quite difficult, particularly for the

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youngest ones, and progresses slowly during development in a succession of phases (Berti and Bombi, 1981; Webley, 2005). On the other hand, the options proposed in this study can be regarded as appropriate economic incentives considering age. As a matter of fact, monetary-unrelated bargaining in children can be considered economic because carried out with the intention to maximize a certain profit (Sonuga-Barke and Webley, 1993) and it is closer to the children's world based on their social understanding of notions like reciprocity. Since the children could choose among different options, the items represented equally salient incentives according to personal preference and allowed us to join the children's social and economic world, in which monetary incentives – when bargaining – are not as significant as for adults (see also, Webley, 2005; Webley and Lea, 1993; Furnham, 2008; for review, see Marchetti and Castelli, 2012).

2.2.2. Delay of gratification

Delay of gratification was assessed through an intertemporal choice task, and namely the Marshmallow Task (MT). In this task, the child was presented with one preferred good, selected among candies, biscuits, chocolates or marshmallows and could decide to eat the good any time or to wait until a given event (i.e., the researcher returning in the room) to have two goods instead. The waiting time was 15 min. The child scored 0 if could not wait 15 min and 1 if she/he waited for the researcher's return. Waiting time in seconds was also recorded.

2.3. Procedure

The children were tested individually in a quiet room in the schools. In one school (Centre Italy) the tests were administered between June and July 2015. The children of the second school (North Italy) were tested in January 2016. Administrations were carried out by a single researcher within each school both in the morning and afternoon during normal school activity. Children were called in the test room individually and, after evaluation, they were asked to "keep the game secret" from their friends not to spoil the other children's performance. The won prizes were therefore left in their backpack and brought home. We can generally confirm that children were fairly reliable in not tipping off the other children. However, as an "objective" control measure, the delivery order of the tasks was randomised across children to reduce influence of children's experience with specific tasks on other children's performance on the same task on the same day.

Children's performance at the Dictator and Ultimatum Games was evaluated in a single session lasting approximately 20 min in total. Performance at the Marshmallow Task was evaluated on a separate session one week before or after the DG-UG session, depending on session randomisation order. The duration of the

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MT session varied according to the child's performance. If the child waited till the end of the task, the entire session lasted approximately 20–25 min (including instructions). Task administration in two independent sessions was done not to overly tire the children with an excessively long procedure as well as not to significantly disrupt the child's normal school activity.

2.3.1. Altruism and fairness

With respect the DG and UG tasks, the child was seated on a chair at a child Table aside the experimenter. The experimenter showed the good options to the child (candies, biscuits or chocolates) and, after the child's selection, the experimenter left 10 pieces of the preferred goods on the table, together with a drawing representing "the other child/player". The actual game was preceded by a familiarisation procedure, according to which the experimenter presented the child with a drawing depicting two children facing each other and explained the rationale of the game making practical examples using the chosen good. With respect to altruism, the child was told that he/she could divide the goods between him/her and the other child and that the other child could not decline the offer. With respect to fairness, when plying as proposer, the child was explained that he/she could decide any goods divisions but, this time, the other child could accept or refuse the offered amount. In case of refusal, nobody would have gotten anything. The researcher played "the other child's" role, proposing, accepting or refusing offers. Before starting the actual task, the child was tested with possible game scenarios to make sure that he/she properly understood.

2.3.2. Delay of gratification

During the Marshmallow task, the child seated on a chair at a child table, on which a desk bell was placed. The experimenter showed the goods options (candies, biscuits, chocolates or marshmallows) to the child and, after the child's selection, the experimenter left a single piece on the table. The experimenter provided the following explanation: "This - e.g., marshmallow - is for you. You can eat this one piece right now. Or, if you remain seated and wait until I come back, you can have two marshmallows. But if you don't want to wait, you can always ring the bell and make me come back anytime you want. So, if you ring the bell and make me come back, you cannot have two but only one marshmallow." Before leaving the room, the experimenter asked the child three questions to assess whether or not he/she understood the instructions: 1. "What do you get if you wait for me to come back?"; 2. "How can you make me come back if you want to?; 3. "What do you get if you ring the bell and make me come back?". If the child did not answer correctly to one or more questions, the experimenter repeated the instructions. The child was then left alone in the room, while under covert observation until either he/she consumed the good or until 15 min had elapsed. The experimenter could monitor

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online the child's behaviour during his/her waiting time through a webcam placed inside the room and connected with a PC placed in an adjacent room.

2.4. Statistical analyses

Statistical analyses were carried out to assess differences (general linear model – GLM) as well as relationships (Pearson's r) between DG and UG performance when the children played as proposers. Additional relationships were assessed considering demographic, socio-economic (SES) data, as well as cognitive abilities evaluated through the CPM Raven. Performance on the MT as well as on the UG, when the children played as responders, was evaluated through non-parametric tests (Chi^2 tests, Mann-Whitney U, binomial analyses). The relationship between DG, UG and MT performance, including the demographic, socio-economic and cognitive data, were further assessed through regression analyses.

3. Results

3.1. Altruism (DG) and Fairness (UG): Proposals

Within this analysis, we assessed whether the amount of DG and UG proposals increased across age groups and as a function of gender. A repeated general linear model (GLM) was therefore carried out with two levels of task (DG and UG) as the within subject factor, and age-range (6, 7, 8 years) and gender (male, female) as the between group factors. The results showed only a main effect of task (DG < UG; $F_{1,88} = 12.51$, $p < .001$, partial-$\eta^2 = .12$, $\delta = .94$). Additionally, no significant differences in task performance were observed between either age or gender groups, showing that children overall proposed more at the UG than at the DG task independently of age and gender (Fig. 1).

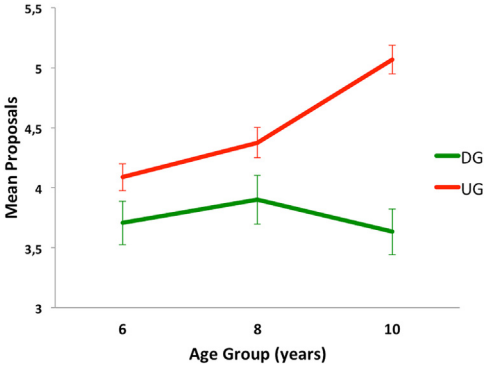

Fig. 1. Mean proposals at the dictator game (DG) and ultimatum game (UG) for each age group (6, 8, 10 years). The bars indicate the Standard Error of the mean.

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3.2. Delay of gratification (MT)

3.2.1. Interclass differences based on binomial response – pass/no pass

With the present analysis, we evaluated whether the frequency of children who successfully passed the MT (i.e., waited until 15 min) was significantly different from that of children who waited less than 15 min. Overall group analysis showed a significant association between the frequency of children who successfully passed the task and age group ($\chi^2_{(2)} = 21.88$, $p < .0001$), with an increasing frequency of children passing the task with age. This was confirmed by paired-group Mann-Whitney *U* comparisons revealing significant differences in the frequency of children who passed between 6 and 10 years ($U_{(1)} = 216$, $Z = 4.65$, $p < .0001$), between 8 and 10 years ($U_{(1)} = 300$, $Z = 2.9$, $p < .005$), and a difference between age groups 6 and 8 years that just failed to reach significance ($U_{(1)} = 386$, $Z = 1.94$, $p = .052$; Fig. 2).

Comparing the children's performance on the MT within each age group (6, 8, 10 years), binomial analyses showed an even distribution of children who passed and failed at the MT at 6 and 8 years, whereas 10-year olds reached significance ($p < .0001$), with a greater frequency of children who passed (obs. prop. = .90) than did not pass the task. It is worth noting that, although 6-year olds scored at the chance level, non-passes compared to passes just failed to reach significance (obs. prop. non-passes = .63, $p = .058$).

Testing for the association between the frequency of children who passed the MT and gender, the analysis revealed no significant association (ns).

3.3. Correlation analyses

The Pearson's correlation analysis was carried out to assess possible associations between the children's age (expressed in months), cognitive abilities (CPM Raven), socio-economic status (SES), DG proposal, UG proposals, and MT

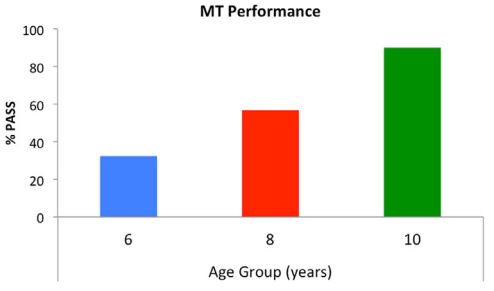

Fig. 2. Percentage of children who passed the Marshmallow Task (MT) – i.e. delayed gratification over 15 min – for each age group (6, 8, 10 years).

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performance. Pearson's correlation statistics is summarized in Table 2. Overall, the analysis showed consistent significant positive linear associations between age, cognitive abilities, UG proposals and MT performance. DG proposals positively correlated only with UG proposals, but not with any of the other tested variables. Socio-economic status (SES) did not correlate with any of the variables.

Testing for these relationships within age group, the results showed that the general positive association observed between DG and UG proposals was significant only at 6 years ($r = .48$, $p < .01$), but not at 8 and 10 years (ns). At 6 years this was the only correlation surviving significance, whereas, at 8 years, we found no significant correlations. Notably, the general positive correlations observed between UG proposals and MT performance was found only at 10 years of age ($r = .44$, $p < .01$).

3.4. Regression analyses: Altruism (DG), Fairness (UG proposer) and Delay of gratification (MT)

To assess the validity of our main exploratory hypothesis, and namely that the relationship between altruism and fairness is moderated by intrinsic abilities required to think prospectively and underlined by the capacity to delay gratification, we carried out a regression model testing the moderating effect of MT performance on the relationship between the DG on UG scores. In particular, we hypothesised that scores on DG significantly predict performance on UG proposals based on a theoretical background, according to which generosity develops and stabilizes earlier than fairness (Warneken and Tomasello, 2009a, b, 2013; for review, see Tomasello and Vaish, 2013). As a first pass, we therefore evaluated the actual predicting power of DG on UG. More specifically, we first regressed DG and UG, separately, on age group (age-range; Table 3), and MT

Table 2. Correlations statistics.

	Pearson's Correlations (N = 94)					
	Age	**Cognitive abilities**	**SES**	**DG proposal**	**UG proposal**	**MT**
Age (months)		0.70**	0.17	-0.01	0.26*	0.31**
Cognitive abilities (Raven)			0.15	-0.06	0.23*	0.29**
SES				0.10	-0.07	0.19
DG proposal					0.31**	-0.17
UG proposal						0.20*
MT performance (sec)						

Raven (Raven's Coloured Progressive Matrices); SES = Socio-Economic Status; DG = dictator game; UG = ultimatum game; MT = marshmallow task.

** The correlation is significant at 0.01 (two-tailed).

* The correlation is significant at 0.05 (two-tailed).

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Table 3. Regression analysis for variables predicting performance at the Dictator Game: Descriptive statistics.

	Model 1			Model 2			Model 3		
Variable	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**
Gender	0.19	0.43	0.05	0.21	0.44	0.05	0.17	0.43	0.04
Age range	-0.02	0.13	-0.01	0.05	0.19	0.04	0.12	0.19	0.09
Cognitive abilities (Raven)				-0.05	0.06	-0.11	-0.04	0.06	-0.09
SES				0.13	0.13	0.11	0.16	0.13	0.14
MT performance (sec)							-0.00	0.00	-0.20
R2		0.00			0.02			0.06	
F for change in R2		0.11			0.77			3.32	
Durbin-Watson	1.89								

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Age range (6, 8, 10 years); Raven (Raven's Coloured Progressive Matrices); SES = Socio-Economic Status; MT = marshmallow task.

(Table 4), controlling for the children' gender, cognitive abilities and the socioeconomic background. We then repeated this analyses using age, expressed in months, as a continuous variable for robustness. Additionally, in order to evaluate causation – and not only correlation between our target variables – we tested the reverse causality (UG/DG on MT; see Table 5, 6 for statistical details).

Table 4. Regression analysis for variables predicting performance at the Ultimatum Game when playing as Proponent (N = 94).

	Model 1			Model 2			Model 3		
Variable	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**
Gender	0.01	0.28	0.00	0.01	0.28	0.01	0.03	0.28	0.01
Age Range	0.24	0.08	0.29^{**}	0.23	0.12	0.28	0.20	0.12	0.24
Cognitive abilities (Raven)				0.02	0.04	0.05	0.01	0.04	0.04
SES				-0.11	0.08	-0.13	-0.12	0.08	-0.15
MT performance (sec)							0.00	0.00	0.14
R2		0.08			0.10			0.12	
F for change in R2		4.19^{*}			0.91			1.59	
Durbin-Watson	1.59								

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Age range (6, 8, 10 years); Raven (Raven's Coloured Progressive Matrices); SES = Socio-Economic Status; MT = marshmallow task.

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Table 5. Regression analysis for variables predicting performance at the Marshmallow task. Predictor: DG proposals. (N = 94).

	Model 1			Model 2			Model 3		
Variable	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**
Gender	-16.00	51.91	-0.03	-23.62	52.34	-0.05	-18.78	51.73	-0.04
Age range	54.02	15.66	0.34***	39.34	22.48	0.25	40.58	22.20	0.26
Cognitive abilities (Raven)				5.14	7.55	0.10	4.09	7.48	0.08
SES				19.16	15.05	0.13	22.08	14.94	0.15
DG proposals							-22.90	12.57	-0.18
R2		0.12			0.14			0.17	
F for change in R2		6***			1.05			3.32	
Durbin-Watson	2.42								

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

DG = dictator game; Age range (6, 8, 10 years); Raven (Raven's Coloured Progressive Matrices); SES = Socio-Economic Status.

Summarizing our findings, we observed no significant effects of MT performance on either DG or UG tasks (DG: $F_{5,88} = 1.03$, ns, $R^2 = .06$, $R^2_{adjusted} = .001$; UG: $F_{5,88} = 3.16$, $p < .05$, $R^2 = .15$, $R^2_{adjusted} = .1$, $F_{mod(1,88)} = 1.59$, $R^2_{mod} = .02$, ns). Introducing age range as a predicting variable (alongside gender, cognitive abilities and SES) in both models – we found a significant positive predicting effect of age

Table 6. Regression analysis for variables predicting performance at the Marshmallow task. Predictor: UG proposals. (N = 94).

	Model 1			Model 2			Model 3		
Variable	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**
Gender	-16.01	51.91	-0.03	-23.62	52.34	-0.05	-23.97	52.16	-0.05
Age range	54.02	15.66	0.34***	39.34	22.48	0.25	33.58	22.87	0.21
Cognitive abilities (Raven)				5.14	7.55	0.01	4.77	7.53	0.09
SES				19.16	15.05	0.13	21.76	15.13	0.15
UG proposals							24.76	19.64	0.13
R2		0.12			0.14			0.15	
F for change in R2		6***			1.05			3.32	
Durbin-Watson	2.58								

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

UG = ultimatum game; Age range (6, 8, 10 years); Raven (Raven's Coloured Progressive Matrices); SES = Socio-Economic Status.

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on UG scores ($F_{2,91} = 4.19$, $p < .05$, $R^2 = .08$, $R^2_{adjusted} = .06$) but not on DG scores ($F_{2,91} = .11$, ns, $R^2 = .002$, $R^2_{adjusted} = -.02$), reinforcing the idea that altruism stabilizes quite early in life and that it possibly develops on factors that are not related to age increase, at least in primary school aged children. These results were confirmed when entering age in months. Finally, testing the reverse causality (DG/UG on MT), we found a significant predicting effect of age group on MT performance in both DG and UG models (DG: $F_{2,91} = 6$, $p < .01$, $R^2 = .12$, $R^2_{adjusted} = .097$; UG: $F_{2,91} = 6$, $p < .01$, $R^2 = .117$, $R^2_{adjusted} = .09$), which disappeared after controlling for cognitive abilities and SES (ns). Crucially, no predicting effect of either DG or UG proposals was found on MT (ns).

After running these analyses, we finally assessed the moderating effect of MT performance (measured as a function of time − sec) on the relationship between DG and UG proposals. To this purpose, the predictor (DG scores) and moderator (MT scores) were centred at their means and the product of the centred variables calculated. Significance of the interaction term would stem from an effect of the moderator (MT performance) on the relationship between DG and UG (see centring procedure and rationale in Baron and Kenny, 1986). Accordingly, we first entered gender and age-range, as well as, in a second step, cognitive abilities and SES to assess the effect of these variables on UG scores. In a third step, we then introduced DG (centred), MT (centred) and the interaction terms between DG-MT centred scores to assess the moderating effect of MT on the strength of the relationship between DG and UG. Descriptive statistics of all variables is reported in Table 7.

Table 7. Regression analysis for variables (centred) predicting performance at the Ultimatum Game when playing as Proponent: Descriptive statistics.

Model		Mean	Std Dev	N
	UG Proposal − DV	4.52	1.39	94
1	Gender	0.45	0.50	94
	Age range	7.91	1.66	94
2	Cognitive abilities (Raven)	28.57	4.91	94
	SES	6.17	1.76	94
3	DG (centred)	0.00	2.06	94
	MT (centred)	0.00	263.33	94
	DG*MT (centred)	-92.93	568.48	94

UG = ultimatum game; DG = dictator game; MT = marshmallow task; Age range (6, 8, 10 years); Raven (Raven's Coloured Progressive Matrices); SES = Socio-Economic Status; DV = dependent variable.

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All 3 models were statistically significant (Model 1: $F_{2,91} = 4.19$, $p < .05$, $R^2 = .08$, $R^2_{adjusted} = .06$; Model 2: $F_{4,89} = 2.54$, $p < .05$, $R^2 = .13$, $R^2_{adjusted} = .06$; Model 3: $F_{7,86} = 4.86$, $p < .0001$, $R^2 = .28$, $R^2_{adjusted} = .23$; Durbin-Watson = 1.73), although only the introduction of the variables in model 3 determined a significant change of explained variance. In fact, the analysis further showed that, within model 1, gender did not significantly predict UG performance (Beta = .003, t = .03, ns), while age range did significantly predict UG performance (Beta = .29, t = 2.9, $p < .01$), confirming the results of the preliminary regression analyses above. After controlling for age and gender, neither cognitive abilities or SES significantly predicted UG performance (cognitive abilities: Beta = .054, t = .36, ns; SES: Beta = -.13, t = 1.27, ns). Crucially, model 3 showed a significant effect of the interaction between performance on the DG and MT tasks (Beta = -.194, t = 2.03, $p < .05$), indicating that, after controlling for the demographic, socio-economic and cognitive variables, children's ability to delay gratification still moderates (negatively) the strength of the relationship between DG and UG tasks. This means that the poorer MT performance, the stronger the relationship between DG and UG (see Table 8 for statistical details).

Finally, to further confirm the direction of the relationship between DG and UG scores, the same model as above was carried out, this time centring UG scores and evaluating the effect of their interaction with MT scores (centred) on DG

Table 8. Summary of Regression Analysis for Variables (centred) Predicting Performance at the Ultimatum Game when playing as Proponent (N = 94).

	Model 1			**Model 2**			**Model 3**		
Variable	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**	**B**	**SE(B)**	**β**
Gender	0.01	0.07	0.00	0.01	0.28	0.01	0.05	0.26	0.02
Age range	0.244	0.08	0.29**	0.23	0.12	0.28	0.19	0.11	0.23
Cognitive abilities (Raven)				0.02	0.04	0.05	0.02	0.04	0.05
SES				-0.11	0.08	-0.13	-0.14	0.08	-0.17
DG proposals							0.24	0.06	0.35***
MT performance (sec)							0.00	0.00	0.25*
DG x MT (interaction)							0.00	0.00	**-0.19***
R^2		0.084			0.10			0.28	
F for change in R^2		4.19*			0.91			**7.23*****	
Durbin-Watson	1.73								

Note: DG proposals and MT performance were centred at their means.
*p < .05. **p < .01. ***p < .001.
Age range (6, 8, 10 years); Raven (Raven's Coloured Progressive Matrices); SES = Socio-Economic Status; DG = dictator game; MT = marshmallow task.

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performance (DV). The model showed no significant interaction effect of UG-MT performance on DG scores (Beta = -.129, t = 1.24, ns).

3.5. Inequality aversion (UG): receivers

In support of the idea and of previous findings showing that aversion to inequality increases with age, independent chi-square tests were carried evaluating the association between the frequency of acceptance of each type of proposal (hyperfair, fair and unfair) and age group. The results showed a significant linear by linear association between acceptance of *hyperfair* UG proposals and age group ($\chi^2_{(1)} = 5.7$, $p < .05$) as well as between acceptance of *unfair* UG proposals and age ($\chi^2_{(1)} = 4.7$, $p < .05$; Fig. 3) suggesting, for hyperfair and unfair proposals, a tendency to accept less with age increase. This was supported by the Mann-Whitney *U* test showing significant differences in both UG *hyperfair* and *unfair* proposal refusal between age groups 6 and 10 (*hyperfair:* $U_{(1)} = 383$, $Z = 2.33$, $p = 0.02$; *unfair:* $U_{(1)} = 376$, $Z = 2.12$, $p = 0.03$), indicating that children aged 6 years accepted hyperfair and unfair proposals significantly more than 10-year olds. No significant differences were observed in the frequency of acceptances of UG proposals between age groups 6–8-years and 8–10 years.

Binomial analyses carried out for each age group further showed that acceptance of *hyperfair* proposals was significant for age groups 6 and 8, but not for the 10-year olds. As expected, acceptance of fair proposals was significant for all age groups, whereas refusal of *unfair* proposals was significant only for the 10-year olds (for descriptive statistics, see Table 9).

4. Discussion

The present work was aimed at investigating decision-making processes in children aged 6, 8 and 10 years, highlighting the role played by prospective thinking on the relationship between altruism and fairness. For this purpose, we used three different tasks: the dictator game measuring altruism; the ultimatum game, in

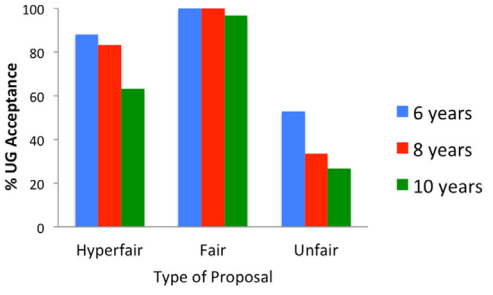

Fig. 3. Acceptance (%) of hyperfair, fair and unfair Ultimatum (UG) proposals, when the children played as receivers, for each age group (6, 8, 10 years).

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Table 9. Binomial analysis of children's *responses* to proposals in the Ultimatum Game by type of proposal (hyperfair, fair, unfair) and age group (6, 8, 10 years).

		UG proposal								
		Unfair			Fair			Hyperfair		
Age group (yrs)	Response type	N	%	p	N	%	p	N	%	p
6	Accept	18	47		34	100	0.00	30	88	0.00
	Refuse	16	53	0.86	0	-		4	12	
8	Accept	10	33	0.10	30	100	0.00	25	83	0.00
	Refuse	20	67		0	-		5	17	
10	Accept	8	27		29	97		19	63	0.20
	Refuse	22	73	0.02	1	3	0.00	11	37	

which the children played as both proposers and receivers, measuring fairness and inequality aversion respectively; and the marshmallow task measuring inter-temporal choice through a delay of gratification paradigm. Some of our data were confirmatory of current literature, whereas others highlighted the fairly unexplored role of the temporal component in decision-making processes characterising prospective thinking.

With respect to DG and UG tasks, our findings revealed that children's proposals were greater during the ultimatum than the dictator game independently of age and gender, generally whole marking a strategic approach to the ultimatum game quite early in age, already at 6 years. However, the positive association found between age and ultimatum scores, but not between age and performance at the dictator game, as well as the observed predicting effect of age on UG – but not DG – proposals further suggests that, while children's generosity is quite established in the youngest age group, fairness keeps developing with age.

Stabilization of children's altruistic behaviour by 6 years is quite consolidated. For example, testing altruism in pre-schoolers and school-age children, Benenson et al. (2007) observed that 9-year-old children donated significantly more than did 4-year-old children, but not with respect to 6-year-old children who, nevertheless, also displayed altruistic behaviour, backing the fundamental nature of altruism (see also, Gummerum et al., 2010; Blake and Rand, 2010). With respect to whether fairness increases with age in the primary school period, there is no definite agreement as yet, although evidence seems to favour the idea of fairness increasing with age. Experimental data suggests that we were not born with an inclination to reciprocity, although very young children show preference for egalitarian divisions and their behaviour appears to be affected by equal sharing already in infancy. Some work on early sharing, in fact, suggests that toddlers between the first and

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second year of life are not so willing to share (Brownell et al., 2009), but also do display a preference for equal sharing already at 15 months (Schmidt and Sommerville, 2011; Geraci and Surian, 2011; see also Olson and Spelke, 2008) presenting, around 3 years of age, a certain sensitivity to direct reciprocity (Levitt et al., 1985). However, when spontaneously allocating resources, 3- to 4-year-olds are generally found to be selfish in their distributions, whereas at 5 to 6 years of age, children show a greater sense of equality and fairness (Fehr et al., 2008; Lane and Coon, 1972; Rochat et al., 2009; for review, see Tomasello and Vaish, 2013). Testing for fairness and inequality aversion, Fehr and colleagues (2008), for example, showed that, while self-interest prevails in 3-year-olds, at 7–8 years children consistently prefer fair allocations. Similarly, Blake and McAuliffe (2011) found that already from 6–8 years, children show a tendency to be fair, increasing egalitarian allocations with age (see also, Shaw and Olson, 2012; Ongley and Malti, 2014). These data are in line with Castelli et al. (2013) showing that, when asked to judge the equity of a series of goods allocation, children displayed a more egoistic and egocentric perspective around 7 years and a more "fair" perspective, opening around 9 years (see also Sally and Hill, 2006; Leman et al., 2009; Bruni and Pelligra, 2010). Congruently with these findings, the results of the present research suggest egalitarian behaviour already in young children, although increased UG proposals with age indicates a refinement of this proclivity or "strategy" with age.

A proper game strategy in a reciprocal gambling game stems from the establishment of various cognitive competencies, including understanding other's intentions (e.g., Sally and Hill, 2006; Güroğlu et al., 2009, 2011; see also Schug et al., 2016), cognitive control (e.g., Rothbart and Bates, 2006; Posner and Rothbart, 2007) and, as we suggest, the ability to think prospectively. With respect to this latter, thinking in temporal terms appears to emerge in late childhood, when an awareness of ourselves as individuals in time is reached (e.g., Piaget, 1960; Melaer, 1973). This capacity represents a basis enabling children to perform on specific tasks that require prospective thinking and the age at which it emerges is congruent with the notion of children passing from a stage where they focus attention on concrete aspects of life pertaining to the present to a representation of things that can be projected in the future (Piaget, 1954). Our results on the marshmallow task (e.g., Mischel, 1958; Mischel and Baker, 1975; Duckworth and Seligman, 2005) support this concept, showing a significant increased ability to delay gratification with age, and particularly at 10 years (see also Sutter et al., 2015; Marchetti et al., 2014). To better delineate the role played by prospective thinking in the developmental trajectory of fairness in late childhood, we further tested the moderating effect of MT performance on the relationship between DG and UG proposals. Our data showed that, as children's ability to delay gratification improves with age, the correlation between fairness and altruism becomes

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increasingly weaker, confirming the moderating role of the children's ability to delay gratification in the relationship between fairness and altruism. This result was preserved when controlling for age, gender, cognitive abilities, and socio economic background and suggests that fairness and the capacity to delay gratification share specific features, which contribute to the differential developmental trend observed between fairness and altruism in late childhood. Our data indicate that one of such features is prospective thinking. Our data indicate that one of such features is prospective thinking.

Of course the ability to delay gratification does not only rely on the capacity to think prospectively, but it represents a complex self-regulatory process involving different cognitive components (Mischel et al., 1989), such as the ability to self-control understood as the capacity to inhibit immediate impulses for the sake of temporarily distant gains (for review, see Duckworth and Kern, 2011). Self-control as related to the notion of effortful control (Kochanska et al., 2000; Rothbart et al., 2003; Eisenberg and Spinrad, 2004; Rothbart and Rueda, 2005; Rothbart and Bates, 2006) is associated with developmental changes in executive attention found already during the third year of life (Gerardi-Caulton, 2000). However, the capacity to inhibit immediate impulses for future gains was shown to strengthen around 8–10 years (e.g., Posner and Rothbart, 2007). The surfacing of this cognitive leap is highlighted, in the present study, by our correlation analysis showing association between age, cognitive abilities and performance on the MT task. Notably, these factors also positively correlated with UG proposals, particularly at 10 years, suggesting that both the ability to delay gratification and fairness progress with cognitive growth and also implying, in this respect, an increased ability to self-control. Critically, DG proposals did not correlate with any of these variables – except for UG proposals as already discussed.

It needs to be noted that the relationship observed between the ability to delay gratification and fairness describes an intersection and not an overlap since, opposite to delay of gratification, with fairness the future outcome may benefit someone else and not oneself. The idea that being fair in the present may account for future behavioural benefits advantaging someone else is in line with the concept of inequality aversion, or altruistic punishment (Fehr and Gächter, 2002), which aligns with the thinking that teaching another a lesson in refusing an unfair proposal now will prompt more fairness in the future. This attitude develops with age, as observed in Fehr et al. (2008), who showed that egalitarianism, in terms of inequality aversion, strongly develops over children aged three to eight years. In the present study, when playing at the UG as responders, the youngest children accepted any proposals, independently of fairness and gradually become more susceptible to fairness at the older age groups. These findings are in line with Sutter et al.'s (2010) observation on nearly 900 children and adolescents aged eight to seventeen years, according to which true propensity to inequality aversion is

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seen in the youngest children, thus becoming gradually less central when making allocation choices with age increase. Interestingly, with respect to our findings, 10-year olds, not only refused unfair offers more than children aged 6 years, but also hyperfair proposals, in line with findings in Castelli et al. (2013). This latter result reinforces the idea that older children not only played the UG in consideration of fairness, understood in terms of equality/fair thinking, but also in light of a strategic game planning. In fact, by accepting hyperfair offers, one may feel the obligation to return "the favour". By refusing, no such repayment would be expected in the future when playing as proponents.

4.1. Concluding remarks

The data of this study support previous findings showing that the constructs of altruism and fairness develop in a similar fashion to about 8 years, to then significantly diverge, suggesting – at around 10 years of age – the emergence of developmental factors affecting their relationship. Our data ascribe at least part of the differences in performance between altruistic and fair behaviour to the implementation of the ability to think prospectively, as outlined by the relational trend observed between altruism, fairness and performance on the intertemporal choice task. This would allow children to become more strategic when making decisions in bargaining. With altruism, on the other hand, prospective thinking would play a very limited role since behaviour is mostly focused on present responses. In fact, in the case of altruism, benefit can be considered as the act of giving pleasure to the other person (Joubert, 2000), thus receiving immediate disinterested reward: "Whatever I have given, that I still possess" (Seneca, *De Beneficiis, VI, 3*).

Finally, we shall remark that the effects in the present study were observed within anonymous relationships where the contextual effect and social variables were not significantly influential on the behaviour. In line with previous works (e.g. Bicchieri, 2006; Castelli et al., 2014), by having children playing the games with an anonymous partner (both as proposers and responders) we intended to control for social contextual elements that are known to affect bargaining behaviour. These include physical appearance: attractive people receive higher offers (Solnick and Schweitzer, 1999); the proclivity to make prosocial decisions, which is related to in-group preferences (Fehr et al., 2008; Takezawa et al., 2006; Gummerum et al., 2008; Leman et al., 2009); parochialism, i.e. favouring the members of one's own social group (Fehr et al., 2008), just to cite a few.

Of course there are limits to this approach associated with a reduced ecological validity. Conceivably, though, by excluding socio-relational variables, it was possible to unveil a most unspoiled developmental trajectory associated with decision-making in children. As a matter of fact, even in consideration of these

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limitations, the present results can be regarded as externally valid, as also supported by the main effects of the tested variables mirroring previous results on the development of altruism, fairness and the ability to delay gratification. Future research may thus profitably build on our results assessing the influence of different types of socio-relational variables.

Declarations

Author contribution statement

Elisabetta Lombardi: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Cinzia Di Dio, Davide Massaro, Antonella Marchetti: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Ilaria Castelli: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

References

Baron, R.M., Kenny, D.A., 1986. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. J. Pers. Soc. Psychol. 51 (6), 1173.

Belacchi, C., Scalisi, T.G., Cannoni, E., Cornoldi, C., 2008. Manuale CPM. Coloured progressive matrices. Standardizzazione italiana. Giunti O.S, Firenze.

Benenson, J.F., Pascoe, J., Radmore, N., 2007. Children's altruistic behavior in the dictator game. Evol. Hum. Behav. 28 (3), 168–175.

http://dx.doi.org/10.1016/j.heliyon.2017.e00323

Berns, G.S., Laibson, D., Loewenstein, G., 2007. Intertemporal choice–toward an integrative framework. Trends Cogn. Sci. 11 (11), 482–488.

Berti, A.E., Bombi, A.S., 1981. The development of the concept of money and its value: A longitudinal study. Child Dev. 52, 1179–1182.

Bicchieri, C., 2006. The Grammar of Society: The Nature and Dynamics of Social Norms. Cambridge University Press, Cambridge.

Blake, P.R., McAuliffe, K., 2011. "I had so much it didn't seem fair": Eight-year-olds reject two forms of inequity. Cognition 120 (2), 215–224.

Blake, P.R., Rand, D.G., 2010. Currency value moderates equity preference among young children. Evol. Hum. Behav. 31 (3), 210–218.

Bolton, G.E., Ockenfels, A., 2000. ERC: A theory of equity, reciprocity, and competition. Am. Econ. Rev. 90 (1), 166–193.

Bosacki, S., Astington, J.W., 1999. Theory of mind in preadolescence: Relations between social understanding and social competence. Soc. Dev. 8 (2), 237–255.

Brownell, C.A., Svetlova, M., Nichols, S., 2009. To share or not to share: When do toddlers respond to another's needs? Infancy 14 (1), 117–130.

Bruni, L., Pelligra, V., 2010. The economic child: developmental aspects of economic behavior. Int. Rev. Econ. 57 (3), 255–257.

Caputi, M., Lecce, S., Pagnin, A., Banerjee, R., 2012. Longitudinal effects of theory of mind on later peer relations: the role of prosocial behavior. Dev. Psychol. 48 (1), 257.

Casey, B.J., Somerville, L.H., Gotlib, I.H., Ayduk, O., Franklin, N.T., Askren, M. K., Glover, G., 2011. Behavioral and neural correlates of delay of gratification 40 years later. Proc. Natl. Acad. Sci. 108 (36), 14998–15003.

Castelli, I., Massaro, D., Sanfey, A.G., Marchetti, A., 2010. Fairness and intentionality in children's decision-making. Int. Rev. Econ. 57 (3), 269–288.

Castelli, I., Massaro, D., Sanfey, A.G., Marchetti, A., 2013. "What is fair for you?" Judgments and decisions about fairness and Theory of Mind. Eur. J. Dev. Psychol. 11 (1), 49–62.

Castelli, I., Massaro, D., Bicchieri, C., Chavez, A., Marchetti, A., 2014. Fairness norms and theory of mind in an ultimatum game: judgments, offers, and decisions in school-aged children. PLoS One 9 (8) e105024.

Cowell, J.M., Samek, A., List, J., Decety, J., 2015. The curious relation between theory of mind and sharing in preschool age children. PLoS One 10 (2) e0117947.

 http://dx.doi.org/10.1016/j.heliyon.2017.e00323

Currie, C., Molcho, M., Boyce, W., Holstein, B., Torsheim, T., Richter, M., 2008. Researching health inequalities in adolescents: The development of the health behaviour in school-aged children (HBSC) family affluence scale. Soc. Sci. Med. 66 (6), 1429–1436.

Duckworth, A.L., Kern, M.L., 2011. A meta-analysis of the convergent validity of self-control measures. J. Res. Pers. 45 (3), 259–268.

Duckworth, A.L., Seligman, M.E., 2005. Self-discipline outdoes IQ in predicting academic performance of adolescents. Psychol. Sci. 16 (12), 939–944.

Eigsti, I.M., Zayas, V., Mischel, W., Shoda, Y., Ayduk, O., Dadlani, M.B., Davidson, M.C., Lawrence Aber, J., Casey, B.J., 2006. Predicting cognitive control from preschool to late adolescence and young adulthood. Psychol. Sci. 17 (6), 478–484.

Eisenberg, N., Spinrad, T.L., 2004. Emotion-related regulation: Sharpening the definition. Child Dev. 75 (2), 334–339.

Fehr, E., Schmidt, K.M., 1999. A theory of fairness, competition, and cooperation. Q. J. Econ. 114 (3), 817–868.

Fehr, E., Gächter, S., 2002. Altruistic punishment in humans. Nature 415 (6868), 137–140.

Fehr, E., Bernhard, H., Rockenbach, B., 2008. Egalitarianism in young children. Nature 454 (7208), 1079–1083.

Furnham, A., 2008. The Economic Socialisation of Young People. Social Affairs Unit, London.

Geraci, A., Surian, L., 2011. The developmental roots of fairness: Infants' reactions to equal and unequal distributions of resources. Dev. Sci. 14 (5), 1012–1020.

Gerardi-Caulton, G., 2000. Sensitivity to spatial conflict and the development of self-regulation in children 24-36 months of age. Dev. Sci. 3 (4), 397–404.

Gummerum, M., Keller, M., Takezawa, M., Mata, J., 2008. To give or not to give: children's and adolescents' sharing and moral negotiations in economic decision situations. Child Dev. 79 (3), 562–576.

Gummerum, M., Hanoch, Y., Keller, M., Parsons, K., Hummel, A., 2010. Preschoolers' allocations in the dictator game: The role of moral emotions. J. Econ. Psychol. 31 (1), 25–34.

 http://dx.doi.org/10.1016/j.heliyon.2017.e00323

Güroğlu, B., van den Bos, W., Crone, E.A., 2009. Fairness considerations: increasing understanding of intentionality during adolescence. J. Exp. Child Psychol. 104 (4), 398–409.

Güroğlu, B., van den Bos, W., van Dijk, E., Rombouts, S.A., Crone, E.A., 2011. Dissociable brain networks involved in development of fairness considerations: understanding intentionality behind unfairness. Neuroimage 57 (2), 634–641.

Güth, W., Kocher, M.G., 2014. More than thirty years of ultimatum bargaining experiments: Motives, variations: and a survey of the recent literature. J. Econ. Behav. Organ. 108, 396–409.

Güth, W., Schmittberger, R., Schwarze, B., 1982. An experimental analysis of ultimatum bargaining. J. Econ. Behav. Organ. 3 (4), 367–388.

Harbaugh, W.T., Krause, K., 2000. Children's altruism in public good and dictator experiments. Econ. Inq. 38 (1), 95–109.

Harbaugh, W.T., Krause, K., Liday, S.J., 2003. Bargaining by children. University of Oregon Economics Working Paper, 2002–2004.

Hepach, R., Vaish, A., Tomasello, M., 2012b. Young children are intrinsically motivated to see others helped. Psychol. Sci. 23 (9), 967–972.

House, B.R., Silk, J.B., Henrich, J., Barrett, H.C., Scelza, B.A., Boyette, A.H., Laurence, S., 2013. Ontogeny of prosocial behavior across diverse societies. Proc. Natl. Acad. Sci. 110 (36), 14586–14591.

Jensen, K., Call, J., Tomasello, M., 2007. Chimpanzees are rational maximizers in an ultimatum game. Science 318 (5847), 107–109.

Joubert, S., 2000. Paul as benefactor: reciprocity, strategy and theological reflection in Paul's collection (124). Mohr Siebeck.

Kahneman, D., Knetsch, J.L., Thaler, R.H., 1986. Fairness and the assumptions of economics. J. Bus. 59 (4), S285–S300.

Kochanska, G., Murray, K.T., Harlan, E.T., 2000. Effortful control in early childhood: continuity and change, antecedents, and implications for social development. Deve. Psychol. 36 (2), 220.

Kohlberg, L., 1975. The cognitive-developmental approach to moral education. The Phi Delta Kappan 56 (10), 670–677.

Kohlberg, L., 1981. The philosophy of moral development moral stages and the idea of justice. Harper & Row, New York.

Lane, I.M., Coon, R.C., 1972. Reward allocation in preschool children. Child Dev. 43 (4), 1382–1389.

 http://dx.doi.org/10.1016/j.heliyon.2017.e00323

Leman, P.J., Keller, M., Takezawa, M., Gummerum, M., 2009. Children's and adolescents' decisions about sharing money with others. Soc. Dev. 18 (3), 711–727.

Levitt, M.J., Weber, R.A., Clark, M.C., McDonnell, P., 1985. Reciprocity of exchange in toddler sharing behavior. Devel. Psychol. 21 (1), 122.

Marchetti, A., Castelli, I., 2012. Come decidono i bambini. Psicoeconomia evolutiva. Cortina, Milano.

Marchetti, A., Castelli, I., Sanfey, A., 2008. Teoria della Mente e decisione in ambito economico: un contributo empirico. In: Antonietti, A., Balconi, M. (Eds.), Mente ed economia. Come psicologia e neuroscienze spiegano il comportamento economico. Il Mulino, Bologna.

Marchetti, A., Castelli, I., Sanvito, L., Massaro, D., 2014. Is a bird in the hand worth two in the future? Intertemporal choice, attachment and theory of mind in school-aged children. Front. Psychol. 5, 483.

Marchetti, A., Castelli, I., Massaro, D., 2009b. Negoziazione e adozione: fenomeni meramente intrapersonali? Giornale Italiano di Psicologia 2, 483–487.

Marchetti, A., Castelli, I., Sanvito, L., 2009a. La presa di decisione: dall'eta adulta agli studi sullo sviluppo. In: Nicolini Paol, N.P. (Ed.), L'interazione tra pari nei processi di apprendimento. Casa Editrice Junior, Bergamo, pp. 259–278.

Melaer, J.D., 1973. Children's conception of death. J. Genet. Psychol. 360, 122–123.

Melis, A.P., Hare, B., Tomasello, M., 2006. Chimpanzees recruit the best collaborators. Science 311 (5765), 1297–1300.

Mischel, W., 1958. Preference for delayed reinforcement: An experimental study of a cultural observation. J. Abnorm. Soc. Psychol. 56 (1), 57.

Mischel, W., Baker, N., 1975. Cognitive appraisals and transformations in delay behavior. J. Pers. Soc. Psychol. 31 (2), 254.

Mischel, W., Ebbesen, E.B., Raskoff Zeiss, A., 1972. Cognitive and attentional mechanisms in delay of gratification. J. Pers. Soc. Psychol. 21 (2), 204.

Mischel, W., Shoda, Y., Peake, P.K., 1988. The nature of adolescent competencies predicted by preschool delay of gratification. J. Pers. Soc. Psychol. 54 (4), 687.

Mischel, W., Shoda, Y., Rodriguez, M.L., 1989. Delay of gratification in children. Science 244 (4907), 933–938.

Natterson, J.M., Knudson Jr, A.G., 1960. Observations concerning fear of death in fatally ill children and their mothers. Psychosom. Med. 22 (6), 456–465.

 http://dx.doi.org/10.1016/j.heliyon.2017.e00323

Olson, K.R., Spelke, E.S., 2008. Foundations of cooperation in young children. Cognition 108 (1), 222–231.

Ongley, S.F., Malti, T., 2014. The role of moral emotions in the development of children's sharing behavior. Dev. Psychol. 50 (4), 1148–1159.

Paglieri, F., Addessi, E., Sbaffi, A., Tasselli, M.I., Delfino, A., 2015. Is it patience or motivation? On motivational confounds in intertemporal choice tasks. J. Exp. Anal. Behav. 103 (1), 196–217.

Piaget, J., 1932. The moral development of the child. Kegan Paul, London.

Piaget, J., 1954. Language and thought from a genetic perspective. Acta Psychol. 10, 51–60.

Piaget, J., 1960. The child's concept of the world. Littlesfield Adams, Patterson.

Posner, M.I., Rothbart, M.K., 2007. Research on attention networks as a model for the integration of psychological science. Annu. Rev. Psychol. 58, 1–23.

Rabin, M., 1993. Incorporating fairness into game theory and economics. Am. Econ. Rev. 83 (5), 1281–1302.

Rabin, M., 1998. Psychology and economics. J. Econ. Lit. 36 (1), 11–46.

Raven, J.C., 1947. Progressive Matrices. Sets I and II. Lewis, London.

Rochat, P., Dias, M.D., Liping, G., Broesch, T., Passos-Ferreira, C., Winning, A., Berg, B., 2009. Fairness in distributive justice by 3-and 5-year-olds across seven cultures. J. Cross-Cult. Psychol. 40 (3), 416–442.

Rothbart, M.K., Ellis, L.K., Rosario Rueda, M., Posner, M.I., 2003. Developing mechanisms of temperamental effortful control. J. Personal. 71 (6), 1113–1144.

Rothbart, M.K., Rueda, M.R., 2005. The development of effortful control. Developing individuality in the human brain: A tribute to Michael I. Posner, , pp. 167–188.

Rothbart, M.K., Bates, J.E., 2006. Temperament. In: Damon, W., Lerner, R., Eisenberg, N. (Eds.), Handbook of child psychology (Vol. 3). Social, emotional, and personality development (6th ed., pp. 99-166). Wiley, New York.

Sally, D., Hill, E., 2006. The development of interpersonal strategy: Autism, theory-of-mind, cooperation and fairness. J. Econ. Psychol. 27 (1), 73–97.

Schmidt, M.F., Sommerville, J.A., 2011. Fairness expectations and altruistic sharing in 15-month-old human infants. PloS One 6 (10) e23223.

 http://dx.doi.org/10.1016/j.heliyon.2017.e00323

Schug, J., Takagishi, H., Benech, C., Okada, H., 2016. The development of theory of mind and positive and negative reciprocity in preschool children. Front. Psychol. 7, 888.

Shaw, A., Olson, K.R., 2012. Children discard a resource to avoid inequity. J. Exp. Psychol. Gen. 141 (2), 382.

Solnick, S.J., Schweitzer, M.E., 1999. The Influence of Physical Attractiveness and Gender on Ultimatum Game Decisions. Organ. Behav. Hum. Decis. Process. 79 (3), 199–215.

Sonuga-Barke, E.J.S., Webley, P., 1993. Children saving. ErlBaum, Hove.

Sutter, M., Feri, F., Kocher, M.G., Martinsson, P., Nordblom, K., Rützler, D., 2010. Social preferences in childhood and adolescence: a large-scale experiment. IZA Discussion, Paper No., 5016.

Sutter, M., Angerer, S., Rützler, D., Lergetporer, P., 2015. The Effect of Language on Economic Behavior: Experimental Evidence from Children's Intertemporal Choices. IZA Discussion Paper No. 9383.

Takagishi, H., Koizumi, M., Fujii, T., Schug, J., Kameshima, S., Yamagishi, T., 2014. The role of cognitive and emotional perspective taking in economic decision making in the ultimatum game. PloS One 9 (9) e108462.

Takezawa, M., Gummerum, M., Keller, M., 2006. A stage for the rational tail of the emotional dog: roles of moral reasoning in group decision making. J. Econ. Psychol. 27, 117–139.

Tomasello, M., Vaish, A., 2013. Origins of human cooperation and morality. Annu. Rev. Psychol. 64, 231–255.

Turiel, E., Smetana, J.G., Killen, M., 2014. Social contexts in social cognitive development. Handbook of moral behavior and development 2, 307–332.

Van't Wout, M., Kahn, R.S., Sanfey, A.G., Aleman, A., 2006. Affective state and decisionmaking in the ultimatum game. Exp. Brain Res. 169 (4), 564–568.

Warneken, F., Tomasello, M., 2006. Altruistic helping in human infants and young chimpanzees. Science 311 (5765), 1301–1303.

Warneken, F., Tomasello, M., 2008. Extrinsic rewards undermine altruistic tendencies in 20-month-olds. Dev. Psychol. 44 (6), 1785–1788.

Warneken, F., Tomasello, M., 2009a. Varieties of altruism in children and chimpanzees. Trends Cogn. Sci. 13 (9), 397–402.

Warneken, F., Tomasello, M., 2009b. The roots of human altruism. Br. J. Psychol. 100 (3), 455–471.

 http://dx.doi.org/10.1016/j.heliyon.2017.e00323

Warneken, F., Tomasello, M., 2013. Parental presence and encouragement do not influence helping in young children. Infancy 18 (3), 345–368.

Webley, P., Lea, S.E.G., 1993. Towards a more realistic psychology of economic socialization. J. Econ. Psychol. 14, 461–472.

Webley, P., 2005. Children's understanding of Economics. In: Barrett, M., Buchanan-Barrow, E. (Eds.), Children's understanding of Society. Psychology Press, Hove.

 http://dx.doi.org/10.1016/j.heliyon.2017.e00323