

“What is fair for you?” Judgments and decisions about fairness and Theory of Mind

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Theory of Mind (ToM) is involved in decision making in strategic games with adults, while its results with children are still controversial, probably because the literature to date has not directly assessed children's concept of fairness. The goal of this research is to investigate what constitutes fairness across different age groups (children aged seven, eight and nine years) by assessing both their judgements and their decisions concerning the offers made by a social partner and then to relate this to ToM understanding by using second-order false-belief tasks. Results show that, across age groups, the concept of fairness evolves from divisions in one's advantage towards those of equality; although ToM is not related to the concept of fairness, it plays a role in the strategic behaviour that orients children to accept more equal divisions and to reject hyperfair divisions.

Keywords: Fairness; Judgement; Decision; Theory of Mind.

The aim of this study was to evaluate the possible links between the Theory of Mind (ToM), which is operationalized as second-order false-belief understanding, and two aspects of the construct of fairness: the formulation of a judgment on the fairness of a division of goods and the behaviour in a situation in which a decision concerning fairness has to be taken. More specifically, in the first case (Study 1), we explore the link between ToM and the assessment of what

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the child believes to be a fair way of subdividing candies between two puppets; in the second case (Study 2), we investigate the relationship between ToM and a child's proclivity to accept or reject a proposed division, knowing that in the latter case no child will take anything.

Over the past decades, these two topics have, largely independently, led to many investigations that have shown the main mode of development of the two skills. ToM is considered a multi-faceted skill that changes throughout life and is involved in the management of many socio-affective and relational exchanges (Antonietti, Liverta-Sempio, & Marchetti, 2006; Baglio et al., 2012; Castelli et al., 2010; Castelli et al., 2011; Massaro & Castelli, 2009; Perner & Wimmer, 1985; Wellman, Cross, & Watson, 2001; Wimmer & Perner, 1983). Strategies for decision making, first theorized within the economic model of Expected Utility (that is, decisions are rational and exclusively aimed at maximizing profits), are also now considered an extremely complex phenomenon with multiple implications in individuals' everyday lives.

The interaction of these two processes in adults has been demonstrated by recent research in Neuroeconomics. Firstly, there is a growing body of evidence, using standard behavioural paradigms as well as new brain imaging techniques such as functional Magnetic Resonance Imaging (fMRI), that shows decision making in social contexts critically involves the ability to reason about mental states of the self and of others (Rilling, Sanfey, Aronson, Nystrom, & Cohen, 2004). Secondly, some studies have focused on the role of mentalization on decision making in strategic games, showing that the meta-representation of the mental states of both players have an effect on behaviour (Hoffman, McCabe, & Smith, 2000; Marchetti, Castelli, Harlé, & Sanfey, 2011).

Well-specified models for the investigation of social exchange have been provided by Game Theory, a subfield of economics. Bargaining games, such as the Dictator Game (DG) and the Ultimatum Game (UG) are widely used to examine responses to equality and inequality. In the DG, one player (the proposer) decides how much of an endowment to share with the second player (the responder). Allocations measure pure altruism, as the proposer sacrifices personal gain to share the endowment with his or her partner. The UG focuses on bargaining in a strategic context, shedding light on the role of fairness in such interactive process and on its outcome. In fact, in this game the responder has the option of accepting or rejecting the offer: if it is accepted, the sum is divided as proposed; if it is rejected, neither player receives anything. Much of the decision behaviour actually observed in these tasks deviates, often quite substantially, from the predictions of the standard game theoretic model (Güth, Schmittberger, & Schwarze, 1982).

If people are motivated purely by self-interest, the responder should accept any offer; and, knowing this, the proposer will offer the smallest non-zero amount. However, Game Theory predictions are at odds with observed behaviour (Camerer, 2003) and, in most industrialized cultures, low offers of less than 20%

of the total amount are rejected about half of the time for various reasons, such as the proclivity to preserve their own reputation, the desire to punish the partner for his/her unfairness and so on. These results suggest that psychological approaches, such as insight into mentalization abilities, may help our understanding of these decisions.

While interactive decision making has been widely studied in adults, developmental psychology has only recently begun to pay attention to children's behaviour in social interactions with economic exchanges (Benenson, Pascoe, & Radmore, 2007; Castelli, Massaro, Sanfey, & Marchetti, 2010; Fehr, Bernhard, & Rockenbach, 2008; Geraci & Surian, 2001; Gummerum, Hanoch, & Keller, 2008; Gummerum, Hanoch, Keller, Parsons, & Hummel, 2010; Gummerum, Keller, Takezawa, & Mata, 2008; Güroglu, van den Bos, & Crone, 2009; Harbaugh, Krause, & Liday, 2003; Hoffmann & Tee, 2006; Leman, Keller, Takezawa, & Gummerum, 2009; Lucas, Wagner, & Chow, 2008; Marchetti & Castelli, 2012; Moore, 2009; Murnighan & Saxon, 1998; Sally & Hill, 2006; Sutter, 2007; Takagishi, Kameshima, Schug, Koizumi, & Yamagishi, 2010; Takezawa, Gummerum, & Keller, 2006), although the development of basic economic concepts in children and of their economic behaviour have been already investigated. A cognitive-developmental approach showed that children progressively build a more complex and sophisticated theoretical system of the economic world (Berti & Bombi, 1988). A socio-developmental approach, instead, focused on the actual economic behaviour of children and on economic socialization, showing that socio-educational factors (pocket money) make children become active economic agents (Sonuga-Barke & Webley, 1993).

A major point of the ongoing debate concerns fairness,¹ because attitudes towards fairness change through development. Unfair offers are accepted more frequently by young children than by older ones (Murnighan & Saxon, 1998; Harbaugh, Krause, & Liday, 2003; Sally & Hill, 2006) and more often by adolescents than by adults (Hoffmann & Tee, 2006), while older children are more other-oriented and altruistic than younger ones (Benenson, Pascoe, & Radmore, 2007; Fehr, Bernhard, & Rockenbach, 2008). According to Sutter (2007), children and adolescents have greater sensitivity to the outcome than to the proposer's intentions compared to adults, whereas Güroglu, van den Bos, and Crone (2009) discovered that sensitivity to intentions depends on the type of offer. Other factors play a role: high socio-economic status (SES) children are more altruistic (Benenson et al., 2007) and females are more generous than males

¹From a developmental perspective, the sensitivity to fairness is not the only component of decision-making behaviour: the proclivity towards altruism and cooperation has been studied in human and non-human primates, showing that they appear quite early in development (Warneken, Chen, & Tomasello, 2006; Melis, Hare, & Tomasello, 2006; Jensen, Call, & Tomasello, 2007; Jensen, Hare, Call, & Tomasello, 2006; Rakoczy, Warneken, & Tomasello, 2008).

(Murnighan & Saxon, 1998; Harbaugh et al., 2003), though this last result is still controversial.

Finally, the development of other abilities, such as moral reasoning and ToM, is connected to decision making. Good levels of moral reasoning in the preschool age are related to altruistic sharing (Gummerum, Hanoch, Keller, Parsons, & Hummel, 2010), and the proclivity to make prosocial decisions is linked to in-group preferences (Fehr, Bernhard, & Rockenbach, 2008; Moore, 2009; Takezawa, Gummerum, & Keller, 2006; Gummerum, Keller, Takezawa, & Mata, 2008; Leman, Keller, Takezawa, & Gummerum, 2009). As regards ToM, Castelli, Massaro, Sanfey, and Marchetti (2010) found that advanced ToM development (i.e., second-order false-belief reasoning) has an effect on the responder's decision in the UG, especially regarding the most unfair offers. A positive effect of ToM on decision making has also been documented on preschoolers by Takagishi, Kameshima, Schug, Koizumi, and Yamagishi (2010), whereas Lucas, Wagner, and Chow (2008) did not find such an effect.

Given these still-open findings, the aim of our first study is to assess judgements about fairness, namely to what degree children understand "sharing" as fair, and to whether fairness judgments correlate with false-belief understanding. We expected ToM to be involved, because sharing behaviour is intrinsically social and the literature points out ToM as a crucial tool to deal with social interactions. The aim of our second study is to examine the behaviour concerning fairness in the same age range, operationalized as the decision to accept or refuse an offer in an interactive game like the UG. In this second case, we expect a link between ToM and decision in light of the above-mentioned literature. The second study also aims to investigate the possible link between fairness judgement and behaviour. The most original aspect of this work is to evaluate the role of ToM both in fairness judgments and decisions.

FIRST STUDY

Method

Participants. Seventy-eight children aged seven to nine took part in the study. Of those, 27 were seven years old ($M = 87.00$ months, $SD = 3.16$ months; 10 boys, 15 girls), 30 were eight years old ($M = 100.14$ months, $SD = 3.87$ months; 9 boys, 20 girls) and 21 were nine years old ($M = 111.67$ months, $SD = 4.03$ months; 10 boys, 8 girls). All participants were Italian and belonged to the middle socioeconomic status based on the parents' education and socioeconomic levels. Children were neither referred to social services nor reported by teachers for learning and socio-relational difficulties.

Materials. Participants completed the following tasks individually in one session in a quiet room at their school.

Cognitive abilities. To ensure that the sample was homogenous in terms of cognitive abilities, Raven's Coloured Progressive Matrices (CPM, Raven, 1947) was submitted. Six children were excluded from the analyses due to a score lower than 25th percentile. In particular, two seven-year-old children, one eight-year-old child, and three nine-year-old children were dropped from the sample, for a total final number of participants equal to 72.

Receptive vocabulary. This ability was explored through the administration of the Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981); Italian standardization was used (Stella, Pizzoli, & Tressoldi, 2000). The PPVT-R was scored according to its official coding system; scores ranged between 0 and 175.

Fairness baseline (FairBL). We designed this novel task to assess how each child conceptualizes fairness. To begin this task, the experimenter checked to ensure that each participant was familiar with the concept of fairness through a brief exchange about the meaning of this term. Children's answers were audio-recorded and, in case of incorrect answers or of difficulties in answering those questions, the child received the definitions from an Italian dictionary (appropriate, convenient, just or appropriate in the circumstances). Only a few of the youngest children needed such help. Then, the child was presented with a scenario, acted out with puppets and real candies. In this scenario, a child went to the amusement park: he/she wanted to play a game to win some candies. Before playing, the child's mother told him/her "I will buy a ticket for the game only if you will share the candies that you will win with another boy/girl". So, the child played the game and won 10 pieces of candy—at this point, the experimenter placed 10 candies on the table. The participant was asked about the fairness of a number of possible divisions of candies between the winner of the game and the other boy or girl (the test question was: "Is the puppet fair?"). The division always started from the lowest number of candies given to the other child. The first division the child deemed "fair" was considered the baseline. The fairness baseline was defined as the least number of shared candies described as fair: for example, a score of "4" would represent when the participant described as fair a partner who kept six candies for him or herself and offered four candies to the participant. In order to verify the baseline, a final control was carried out. The child was presented with the division that followed immediately the one he/she had labelled as fair and was expected to label it, coherently, also as fair. No child contradicted the baseline he/she had previously given.

ToM task. A modified version of the second-order false-belief task called "Look Prediction" (FB2), which also includes the evaluation of first-order false-belief understanding (FB1), (Astington, Pelletier, & Homer, 2002; Livertat-Sempio, Marchetti, Castelli, Lecciso, & Pezzotta, 2005; Sullivan, Zaitchik, & Tager-Flusberg, 1994) was administered. The child is told a story (with drawings) about Maria and Gianni who are playing with a toy. Maria puts the toy in a wardrobe and leaves the room, and while she is away Gianni changes the location

of the toy, putting it under the bed. The story is stopped and the child is asked where Maria will look for the toy once back in the room (first-order false-belief question). The child is then asked to justify the response, and is further given two memory control questions to assess the understanding of the story. Then, the story is resumed, with Maria returning to the room. From the open door she sees Gianni as he is moving the toy under the bed, though Gianni does not see Maria. The child is then asked where Gianni thinks Maria will look for the toy once back in the room (second-order false-belief question). Again, the child must justify this response, and is asked two last memory control questions. Both for first- and second-order understanding, children who correctly answered to all questions (memory, test and justification questions) were scored 1, otherwise they were scored 0.

RESULTS

Table 1 shows the descriptive analyses (mean and standard deviation) for the variables: first- and second-order false-belief understanding, fairness baseline, Receptive Vocabulary and Raven’s Coloured Progressive Matrices.

The correlation analysis only shows a positive association between second-order false-belief understanding and receptive vocabulary ($r = .372, p < .001$). No correlations between the fairness baseline and ToM performances were found.

The Analysis of the Variance showed an age effect on fairness baseline ($F_{271} = 11.22, p < .001$): seven-year-old children set the baseline value for the concept of fairness at a higher level than nine-year-old children ($M = 6.08$ vs. $M = 5.06$). The chi-square test showed a positive association between age and second-order false-belief understanding ($\chi^2 = 8.29, df = 2, p < .05$). Consistent with the literature, nine-year-olds show a better performance in the second-order false-belief understanding than seven-year-olds.

These results show that the concept of sharing fairly gradually approaches with age a concept of fairness as a numerically identical sharing of goods, while

TABLE 1
Descriptive statistics of the tasks performances

Tasks(score range)	7-year-olds (N = 25)				8-year-olds (N = 29)				9-year-olds (N = 18)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
FB1 (0-1)	1.00	1.00	1.00	.00	1.00	1.00	1.00	.00	1.00	1.00	1.00	.00
FB2 (0-1)	.00	1.00	.68	.48	.00	1.00	.93	.26	.00	1.00	.94	.24
FairBL	5	9	6.08	0.95	5	6	5.45	0.51	4	6	5.06	.64
PPVT-R (0-175)	89	114	98.64	7.02	85	118	103.31	8.84	86	120	104.56	8.52
Raven	19	29	24.36	3.28	23	33	27.07	2.60	24	36	29	3.80

the younger children consider as fair a division that gives them more than the other child. Although these findings can be interpreted saying that, in the age groups considered, the development of mentalizing abilities is not associated with the emerging concept of fairness, however, some critical points must be considered. First, the test specifically designed to measure the baseline queries the child about the fair behaviour of the puppet. The question “Is the puppet fair?” may confuse the child as she/he is explicitly asked to judge a person instead of judging a behaviour. Furthermore, the choice of administering the task always going from the smallest to the largest division could have somehow oriented the determination of the baseline. Secondly, although the task has the advantage of focusing on the concept of the baseline, however, it makes incidental the relational dynamics and the consequent decisional strategies, unlike what happens in economic games such as the UG. This fact may have inadvertently caused the child to underestimate the mentalistic components in performing the task. With these considerations in mind, we decided to conduct a second study.

SECOND STUDY

Method

Participants. Eighty-seven children aged seven to nine took part in the study. Of those, 29 were seven years old ($M = 87.45$ months, $SD = 2.44$ months; 18 boys, 11 girls), 29 were eight years old ($M = 100.83$ months, $SD = 8.27$ months; 16 boys, 13 girls), and 29 were nine years old ($M = 115.97$ months, $SD = 3.74$ months; 16 boys, 13 girls). All participants were Italian and belonged to the middle socioeconomic status based on the parents’ education and socioeconomic levels. Children were neither referred to social services nor reported by teachers for learning and socio-relational difficulties. Two seven-year-olds were excluded from the sample because they had not completed all the tests, so that the final sample has 85 children.

Materials. Receptive vocabulary. This ability was explored, as in the first study, through the administration of the Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981, Italian standardization by Stella, Pizzoli, & Tressoldi, 2000).

ToM tasks. A standard first-order false-belief task called “The Unexpected Transfer” (FB1) (Wimmer & Perner, 1983; Wimmer & Perner, 1983, Siegal & Beattie, 1991), the second-order false-belief task called “Look Prediction” (FB2) (Astington, Pelletier, & Homer, 2002; Sullivan, Zaitchik, & Tager-Flusberg, 1994; Liverta-Sempio, Marchetti, Castelli, Lecciso, & Pezzotta, 2005) which includes two steps of verification of second-order false-belief, and the classic second-order false-belief task called “The ice cream task” (Perner & Wimmer, 1985) were posed. The first-order false-belief task was administered as the control of

children's basic meta-representation skills. Both for first- and second-order understanding, children who correctly answered all questions (memory, test and justification questions) were scored 1, otherwise they were scored 0. A total score, which is the sum of the three measures of second-order false-belief understanding, was computed, so that participants obtained a score ranging from 0 to 3.

Numerical competence. Numerical competence was tested through a task specifically designed for this study. Eighteen cards showing the divisions of candies, both identical and different, were shown to the children with a request to indicate whether the sweets were divided equally or unequally. The cards were presented randomly. All children, except for five who were dropped from analyses, showed that they could correctly differentiate between identical and different divisions as well as when the differences are equal to one candy.

Fairness baseline (FairBL). The task for the fairness baseline has been slightly modified from the previous version. The context of the task has been maintained, but the introduction to the concept of fairness and the formulation of the question were modified. The game was introduced by saying that it was about a fair or an unfair way to divide candies between two children. Then the child was asked what he considered to be a fair division of candies. The answers that referred to the equal distribution and/or to the satisfaction of both children were considered relevant; otherwise, the child was told that a division was fair when considered good/satisfactory by both children. At this point, each child was asked to judge whether nine proposals of divisions, presented randomly and between 9–1 and 1–9, were fair or unfair. The proposed divisions judged as fair were coded as 1, while those judged as unfair were coded as 0. Then, the answers were categorized with the intent to have fairness typologies with the following characteristics: those who consider fair only an equal division (5–5) and those adjacent to it (6–4 and 4–6); those who consider fair the equal division and all the divisions less favourable for her/him; those who consider fair the equal division and all the divisions more favourable for her/him; and those who do not fall into one of the abovementioned categories.

Ultimatum Game (UG). An adapted version of the Ultimatum Game was presented to the children. They were told that they would take part in a game in which a child could determine how to divide 10 candies with another child. The latter could decide whether to accept or reject the proposed division. If she/he accepted, the candies were divided as proposed; if she/he refused, neither child took anything. The children were told that they would always play the role of the one who can decide whether to accept or reject the offer of the division, and that each game would take place with a different child. The UG was played for real, giving a final amount of candies equal to the half of the accepted offers (the divisions were rounded up to the next integer if necessary). All the children took part in nine games, in which all offers between 9–1 (nine candies for her/him who proposes the division and one candy for her/him who receives the offer) and 1–9 (vice versa) were presented randomly. An overall score that includes the

TABLE 2
Descriptive statistics of the tasks performances

Tasks(score range)	7-year-olds (N = 26)				8-year-olds (N = 26)				9-year-olds (N = 28)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
PPVT-R (0-175)	65	120	96.08	15.78	81	129	109.92	12.97	74	127	105.68	12.36
FB1 (0-1)	0	1	.85	.37	0	1	.92	.27	0	1	.86	.36
FB2 (0-3)	0	3	1.35	.89	0	3	1.42	.80	0	3	1.64	.91
UG acc rate	1	9	5.27	2.59	1	8	4.00	2.11	1	7	3.68	2.00
UG unfair acc rate	0	3	1.19	1.27	0	3	.85	1.16	0	3	.57	.88
UG fair acc rate	1	3	2.15	.83	1	3	1.92	.74	1	3	1.93	.81
UG hyperfair acc rate	0	3	1.92	1.32	0	3	1.23	1.27	0	3	1.18	1.09
Equal Lower for me Higher for me Other Equal Lower for me Higher for me												
FairBL Typology	53.8%	7.7%	15.4%	23.1%	73.1%	7.7%	7.7%	11.5%	67.9%	10.7%	10.7%	10.7%

total number of acceptances was calculated. In addition, the specific score for three main categories of offers; i.e., hyperfair, fair and unfair, was computed. The three main categories are constituted as follows: hyperfair offers = 9–1, 8–2, 7–3; fair offers = 6–4, 5–5, 4–6; unfair offers = 3–7, 2–8, 1–9.

RESULTS

Table 2 shows the descriptive analyses (mean and standard deviation) for the variables: first- and second-order false-belief understanding, Receptive Vocabulary and Ultimatum Game; it also shows frequencies for fairness baseline typologies.

The correlation analysis confirms a positive association between second-order false-belief understanding and receptive vocabulary ($r = .394$, $p < .001$). The Analysis of the Variance showed an age effect on the total number of acceptance in the UG ($F_{277} = 3.74$, $p < .05$): seven-year-old children accept on average more offers than children aged eight and nine ($M = 5.27$ vs. $M = 4.00$, $M = 3.68$). Considering each UG offer separately, the correlation analysis shows a moderate positive association between second-order false-belief understanding and offer 5–5 ($r = .260$, $p < .05$), and a moderate negative association between second-order false-belief understanding and offers 2–8 ($r = -.264$, $p < .01$) and 1–9 ($r = -.219$, $p < .05$). More specifically, children with high performance in the second-order false-belief task tend respectively to accept the fair offer 5–5, and to reject the hyperfair offers 2–8 and 1–9.

We recoded the total number of acceptances to the UG on the basis of the percentile distribution with the intent to have a new variable that divides the subjects of the sample into high and low acceptors. The chi-square test showed a positive association between this new variable and the fairness baseline typologies ($\chi^2 = 12.95$, $df = 3$, $p < .01$): those who tend to reject UG offers are more likely to consider that the only fair proposal of division is the one that provides an equal division of goods.

DISCUSSION

Our results offer a snapshot of children's judgements and behaviours about fairness at different ages. The principal finding of Study 1 was that older children have a concept of fairness that approaches the equal division of goods. Such a result has the potential to be an important component of investigations that seek to examine empirical vs. normative expectations in decision making (Bicchieri & Chavez, 2010). This tendency was confirmed by the results of Study 2, which showed that the percentage of children who considered fair the divisions equal or near 5–5 (4–6 and 6–4) increases with age. Study 2 also showed that, where the behaviour is concerned, the younger child acts more like the "homo oeconomicus" than the older one, accepting proportionally more

offers. This result shows how, already in this small age range, children change in solving the conflict between the proclivity to maximize the outcome and the need to preserve their reputation. Overall these evidences offer a complex view on the development of the construct of fairness in children. In fact, as for judgement, younger children establish the fairness baseline over equal division; as for the behaviour, they show a proclivity to also accept unfair offers in line with the predictions of classical economic theory.

With regard to ToM, the results of both studies confirm a strong correlation between second-order false-belief understanding and receptive vocabulary (Antonietti, Liverta-Sempio, & Marchetti, 2006). Considering the relationship between ToM and fairness, Study 1 does not highlight any significant link between false-belief understanding and fairness judgement, while Study 2 shows two significant associations between false-belief understanding and UG behaviour. The first evidence, showing a higher 5–5 acceptance rate with a high ToM score, underlines that the child's capacity to put her/himself in the other's shoes goes with the decision to mainly accept the perfectly equal division. The impact of first-order false-belief understanding cannot be evaluated because of the absence of variance at the ages considered. However, we think that second-order recursive thinking, namely "I think that you think that I think that this offer is fair for me", is crucial for a decision that cares also for its relational implications. The second evidence is a bit counterintuitive: in fact, children with high mentalization ability reject more hyperfair offers. This result could be explained in terms of defence of the other's reputation, cooperation and reciprocity. Further studies are needed to investigate the specific role of these constructs. Furthermore, although a parallel rejection of very unfair offers in subjects with high ToM performance could be expected, the over-mentioned "homo oeconomicus"-like behaviour can partially account for the absence of this result, especially in young children.

Finally, in order to jointly consider evidences about fairness judgement and behaviour, two final points need to be considered. Firstly, Study 2 showed that children with high rejection rates mainly consider fair the offer of equal division; therefore, the 5–5 offer represents the "psychological equilibrium point" for decision making involving fairness at this age. Secondly, we consider the discrepancy between judgement and behaviour in younger children: they expected more but accepted less than older ones. This fact reinforces the idea that a correct approach to fairness in childhood has to jointly explore the different aspects of this construct. Two of them—namely judgment and behaviour—have begun to be investigated by this study.

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