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Unraveling Fairness in Simple Games? The Role of Empathy and Theory of Mind*

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Abstract

Economists have been theorizing that other-regarding preferences influence decision making. Yet, what are the corresponding psychological mechanisms that inform these preferences in laboratory games? Empathy and Theory of Mind (ToM) are dispositions considered to be essential in social interaction. We investigate the connection between an individual's preference type and her disposition to engage in empathy and ToM in neutrally framed Dictator and Ultimatum Game. For that purpose, cognitive and emotional psychometric scales are applied to infer the dispositions of each subject. We find that a disposition for empathy does not influence the behavior in the games. ToM positively correlates with offers in the Dictator Game. Integral to ToM are beliefs about others. Both, other-regarding and selfish types, show a strong correlation between what they belief others do and their own action. These results indicate that expectations about the prevalent social norm might be central in informing behavior in one-shot games.

Key words: Altruism, Inequality, Empathy, Theory of Mind, Behavioral Economics

JEL Classification: C91, C72, D01, D03, D64

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1 Introduction

What are the underlying mechanisms that inform our preferences in social interaction? A large amount of evidence across the social sciences indicates that a substantial share of people is motivated by other-regarding considerations. Economists use simple games to sort decision-makers into different *types* according to their other-regarding preferences.[1] Psychologists and neuroscientists on the other hand point out that an individual's *disposition* to engage in empathy and Theory of Mind (ToM) centrally informs other-regarding behavior. Both, preference types and dispositions, are regarded as stable characteristics of an individual.[2] However, the connection between these two concepts has not yet been analyzed. Is an individual's preference type as revealed in simple economic games informed by the disposition to engage in empathy and ToM?

The assumption that there are different types of people who vary in fairness preferences has become an important issue in economic analysis. At its center are models that account for other-regarding preferences.[3] For instance Fehr and Schmidt (1999), assume that there is a heterogeneous population consisting of two preference types, other-regarding and selfish. Yet, the validity of these measures has been questioned as it is unclear what the behavioral motives are that underlie the different preference types found in laboratory experiments and how these might relate to questions relevant to economic policy (Levitt and List 2007).

Looking inside the black box of social preferences, one component that is likely to inform these is empathy, the disposition to share feelings of others. In economics, Adam Smith already noted the role of empathy:

> "Empathy is the source of our fellow-feeling for the misery of others, that it is by changing places in fancy with the sufferer, [it is] that we come either to conceive or to be affected by what he feels" (Smith 1759, p.10).

Taking a very similar line of argument, the perception-action model of empathy by Preston and de Waal (2002) proposes that it is sufficient to observe or imagine someone else in an emotional state to trigger an empathic response. It is generally agreed upon that empathic feeling precedes many, but certainly not all, acts of pro-social behavior and that an empathic response is already present shortly after birth, indicating the innateness of empathy (Eisenberg and Fabes 1992, Hoffman

[1] See for instance Andreoni and Miller (2002), Blanco et al. (2008), Fisman et al. (2007) and Iriberri and Rey-Biel (2009).

[2] People exhibit rather stable differences in pro-social tendencies and and associated dispositions across the life span, see for instance Caspi et al. (2003).

[3] See Fehr and Schmidt (2006) for an overview.

2000, Preston and de Waal 2002).[4] Dispositional differences in empathy were found to reflect differences in pro-social behavior in such domains as volunteering and donating (Davis et al. 1999). Moreover, Batson et al. (1981) postulate empathy as the exclusive source of genuine altruism.[5] Does then an increased disposition to be empathic inform other-regarding behavior in games?

While empathy constitutes an affective mechanism when engaging with others, ToM is the complementary cognitive side. It is the capacity to understand others' intentions, desires, and beliefs, and enables humans to attribute mental states and probable actions to others (Premack and Woodruff 1978).[6] Of particular relevance for this study is the conception that ToM facilitates the formation of probable beliefs in a given context, which brings it close to the kind of strategic reasoning that is also employed in economics (Singer and Fehr 2005). In a competitive setting, being able to deduce what the other is likely to do, an agent can best respond and maximize her payoff. Hence, ToM can inform types that pursue their self-interest in a laboratory context (Davies and Stone 2003). However, ToM is also regarded as an evolved capacity that allows us to engage in complex joint activities such as building a shelter together, or collaborating scientifically (Tomasello et al. 2005). Shared expectations of cooperation can for instance arise from social norms (Bicchieri 2006, Fehr and Gintis 2007). In the context of a laboratory experiment, if an individual forms beliefs what the other expects from her, an other-regarding type might be inclined to anticipate these expectations and follow them suit.

We investigate the role of the dispositions to engage in empathy (to share another person's feeling) and in ToM (to infer intentions and probable actions of another person) as they relate to other-regarding and selfish types. Measures for ToM and empathy are generated by using two psychometric tests, the *Interdependent Reactivity Index* (Davis 1980) and the *Multifaceted Empathy Test* (Dziobek et al. 2007). Following an early experiment on fairness by Forsythe et al. (1994), we employ two simple, neutrally framed games: the Dictator Game (Kahneman et al. 1986) to assess the altruistic inclination and principle type in a non-strategic setting and the Ultimatum Game (Güth et al. 1982) to investigate the behavior of other-regarding and selfish types in strategic interaction. Integral to ToM are beliefs about others.

[4]Singer et al. (2004) demonstrated the functioning of empathy in an experiment using fMRI. Participants initially experienced a painful stimulus after which they watched a loved one being exposed to the same stimulus. Brain areas that were activated when receiving pain were also activated when the participant was only an observer.

[5]Altruism is here defined as the ultimate goal of increasing another person's welfare.

[6]Theory of Mind has also been referred to as mentalizing, cognitive perspective-taking, and mind-reading (Singer 2008). For an overview on current research see Adolphs (2009).

Investigating the validity of the two ToM measures of the psychometric tests as applied to the games, we elicited in an incentive-compatible manner what subjects believed a randomly matched subject is likely to do. Higher ToM scores are expected to correlate with higher accuracy of beliefs.

The psychometric tests show high internal validity, and behavior in the games corresponds to that observed in other studies. We find that the disposition to engage in empathy is not correlated with any behavior in the games. However, an individual's disposition to engage in ToM is correlated with other-regarding behavior in the Dictator but not in the Ultimatum Game. Surprisingly, the accuracy of beliefs is not related to the values obtained for ToM in both psychometric tests. Instead, both other-regarding and selfish types, show a strong correlation between what they belief others do and their own action. These results indicate that expectations about the prevalent social norm might be central in informing behavior in one-shot games.

The paper is organized as follows. The experimental approach and methods are described in the next section. Section 3 gives an overview on the validity of the psychometric tests and compares the ToM scores to the elicited beliefs. This is followed by an analysis of the experimental tasks and their relation to the psychometric measures and beliefs. Section 4 of this paper discusses the results.

2 Experimental Design, Hypotheses, and Protocol

2.1 Experimental Design

In order to assess an individual's disposition for empathy and ToM we use two psychometric tests, allowing for cross-validation. Both tests are unique in that they measure both empathy and ToM in the same test (Dziobek et al. 2007). The Interpersonal Reactivity Index (IRI)[7] is a classic test applied in psychology that has been extensively investigated and validated.

The test has four dimensions: 'empathic concern', which measures the tendency to experience feelings of warmth, compassion, and concern for others undergoing negative experiences; 'perspective taking' as a measure for ToM which reflects a tendency to adopt the perspective of another person; 'personal distress', which indicates to what degree respondents experience feelings of discomfort and anxiety when witnessing a negative experience of another person; 'fantasy', which indicates to what degree respondents identify strongly with fictitious characters in, for

[7]The German translation of the IRI, the Saarbrücker Persönlichkeits-Fragebogen, was used in the experiment (Paulus 2007).

instance, movies or books (Davis 1980). With regards to eliciting measures for empathy and ToM only the first two scales (empathic concern and perspective taking) are of interest here.

Self-reporting tests are criticized on the grounds that they are prone to be confounded by people's tendency to answer in a socially desirable manner. Therefore, as a second measure, the Multifaceted Empathy Test (MET) by Dziobek et al. (2007) was employed. Participants were presented with 40 realistic photographs of faces expressing positive or negative emotions as stimuli. Three types of questions reflecting three subscales were asked for each picture, resulting in 120 answers per participant. The first subscale, emotion recognition, assesses the cognitive ability to infer the mental state of the depicted person. Emotions recognition is considered as a subcomponent of the higher-level construct of ToM. Participants were asked with respect to each presented picture "What does this person feel?" and had to select one out of four possible answers. Only one answer was correct. Each correct answer gave one point. The second subscale directly addresses empathy. Participants answered the question "How much do you feel with this person?" for each of the 40 photographs. The third scale measures empathy indirectly with the question "How aroused are you by the picture?". Direct and indirect empathy are measured with a 9-point scale ranging from "not at all" to "a lot". For the final empathy measure, a compound of the two empathy scales was used.

In order to test the relevance of empathy and ToM in motivating and guiding preference types, we employed two simple games, the Dictator Game (DG) and the Ultimatum Game (UG). The DG has been used as a simple measure to indicate preferences for fairness (e.g. Andreoni and Miller 2002). A proposer decides how much of an initial endowment to give to a receiver who does not have the opportunity to respond. In the UG, a limited amount of strategic interaction is introduced. A proposer has to share an initial endowment with a responder who can accept or reject the offer. If the responder rejects, both will get nothing. The subgame perfect Nash equilibrium is reached via backward induction. A sophisticated, money-maximizing proposer performs two steps. First, the proposer considers the responder's options and likely course of action. Second, the proposer chooses the best option accordingly, which is to offer the smallest possible share of the initial endowment.

To scrutinize whether the measures of ToM in the psychometric tests indicate a disposition to correctly attribute mental states and probable actions to others, we compare the scores to the accuracy of subjects beliefs: How well the subject anticipated what others would offer in the DG and UG and what others would ask

for as the minimum acceptance level in the UG.[8]

2.2 Hypotheses

According to the perception-action model, simply imagining someone in a certain emotional state results in an automatic representation of that state in the observer (Preston and de Waal 2002). With regards to fair behavior in the DG, subjects who can imagine what it might feel to receive an offer of 0 or alternatively a fair offer might be inclined to go with the latter. A similar argument can be made for the UG. It has been noted that emotions are central to the UG in motivating rejection (see Henrich et al. 2001, Sanfey et al. 2003). Being able to imagine ex-ante these negative emotions or the positive emotions of receiving a fair offer might increase the propensity to act pro-socially.

> *Hypothesis 1: The disposition to engage in empathy positively correlates with offers in the respective game.*

The measures of ToM in the psychometric tests indicate a disposition to correctly attribute mental states and probable actions to others. Closely related to our research is that of Sally and Hill (2006) and Takagishi et al. (2009), who tested ToM in the UG with children and juveniles. Those subjects with a higher level of ToM were found to make higher UG offers.[9] We investigate whether this holds as well for adults in the DG and UG. In particular the empirical results stand in sharp contradiction to theoretical considerations in which individuals with a high level of ToM can be also selfish types which by definition offer little in the DG.

One can make theoretical predictions about the behavior of selfish types in the UG: Forming an expectation of what others might accept, selfish types in their pursuit to maximize their payoffs will minimize the difference between what they expect others to accept and their own offers.

> *Hypothesis 2: Selfish types minimize the difference between offers in UG and what they believe is the minimum acceptance level.*

[8]This approach makes it possible to address the frequently made assumption in applications of incomplete information that the probability distribution over states of nature within a certain population are commonly known (Nyarko and Schotter 2002).

[9]The level of ToM was assessed using a second-order false belief task which utilizes the Birthday Puppy story. This task asks, whether the mother of a boy - who has been snooping around the basement behind her back - believes that he is unaware of his surprise birthday gift, a puppy (Sullivan et al. 1994).

2.3 Experimental Protocol

The games were played via the strategy vector method (Selten 1967), i.e. each participant actively played the role of the proposer in the DG and both the role of proposer and responder in the UG. In both games the proposer was endowed with 90 currency units and could split these into intervals of 10. Participants were not able to offer simply an equal split which is frequently the median offer. If people had a strong preference for fairness, they had to decide whether to give the other player a little less or a little more than themselves. Participants were informed that they were matched for each role with a different, randomly allocated player. At the end of the experiment one role and one game would be picked randomly, which was then used to calculate the payoffs. To control for potential order effects, the psychometric test and games were conducted in counterbalanced order.

The next task was the incentive compatible elicitation of beliefs using a Quadratic Scoring Rule (QSR).[10] People were carefully instructed on the procedure in order to ensure full understanding of the payoff mechanism (see Artinger et al. 2010). Each participant had to go through three learning episodes with control questions that became increasingly more difficult. This made it possible to investigate the degree to which the subject understood the task, and in consequence how action affected payoff. Overall, 96 percent of people were able to correctly answer the most demanding question. People were asked about their first-order beliefs for one randomly matched partner in all three decisions that were made in the games and were paid according to the QSR.[11] As a fourth element in the experiment, participants' risk attitude was elicited using the Holt and Laury (2002) risk elicitation task. Questions with regards to the demographic background of each participant finalized the experiment.

The experiment was conducted in the laboratory of the Max-Planck Institute for Economics in Jena (Germany) in March 2009 using z-Tree (Fischbacher 2007) and Orsee (Greiner 2004). A total of 120 subjects in four sessions participated in the experiment. Four subjects were excluded from the data analysis as they were non-native German speakers and seemed to have considerable difficulties in answering the MET questions appropriately. The psychometric test necessitates that people have an accurate command of the language in which it is given, due to the specific adjectives describing the different emotional states. Overall, 73 percent of subjects were female and 27 percent were male, all of whom were students from a range of different disciplines, having studied on average four semesters. The experiment lasted for about two hours. Earnings per participants ranged from 7 euros to 26

[10] For details see Murphy and Winkler (1970).

[11] See the instructions in appendix C for details.

euros with a mean of 14 euros.

3 Results

3.1 Validity and consistency of the data

The behavior in the games broadly reflects what has been observed elsewhere (for comparison see table 7 in appendix A).[12] The mean offer increases from 25 percent in the DG to 40 percent in the UG. The modal offers in both games are equally high, 44 percent. The mean of the minimum acceptance level is 26 percent, the mode 33 percent.

The reliability of applied ToM and empathy constructs is assessed through Cronbach's alpha coefficients. We find both for the MET (direct empathy: 0.95; indirect empathy: 0.96) and IRI (ToM: 0.73; Empathy: 0.80) high values of internal consistency which correspond to the values found by Davis (1980) and Dziobek et al. (2007).

Comparing the two psychometric tests with each other in table 1, we find that the empathy scores are highly correlated. However, the correlation coefficient between the ToM scores of the two tests is 0.23 ($p = .02$) which is slightly lower than the correlation between IRI empathy and MET-ToM with 0.24 ($p = .01$). Thus, there is only mixed evidence for the validity of the ToM measure across psychometric tests. A possible explanation is that in particular the MET's but also the IRI's primary aim is to measure empathy.

	IRI - Empathy	*IRI - ToM*
MET - Direct empathy	.59(.00)	.26(.01)
MET - Indirect empathy	.54(.00)	.30(.00)
MET - ToM	.24(.01)	.23(.02)

Table 1: Correlation between MET and IRI scales (p-values in brackets)

Another point that should be noted is of methodological interest: Does the disposition to engage in ToM positively correlate with the accuracy of beliefs? Accuracy of beliefs was measured for each of the subjects in how well they were able to predict the behavior of each of the other participants. Thereby, each subject was paired with each of the other subjects, resulting in 119 QSR scores for each subject. The mean value of these scores provides the accuracy of beliefs for each subject. This

[12] See Camerer (2003) for an overview.

results in scores for every belief elicitation task in the experiment (DG Offer, UG Offer, and UG minimum acceptance level) and an overall elicitation score that simply aggregates over the three individual scores. As can be seen from table 2, the ToM and accuracy of belief measures are different and not significantly correlated in each elicitation task and overall.

	IRI - ToM	*MET - ToM*
Accuracy of Beliefs DG	.06(.51)	−.03(.77)
Accuracy of Beliefs UG proposer	−.05(.57)	−.05(.63)
Accuracy of Beliefs UG responder	−.08(.42)	−.04(.67)
Accuracy of Beliefs mean overall	−.03(.72)	−.06(.55)

Table 2: Correlation between accuracy of beliefs and the ToM scales of MET and IRI (p-values in brackets)

3.2 Behavior in DG and UG and the relation to empathy and ToM

Does the disposition to engage in empathy positively correlate with offers in the games (Hypothesis 1)? Table 3 shows the correlations between offers in the games and the empathy measures in the psychometric tests.[13] We find no significant positive correlation between the empathy measures of the psychometric tests and offers in the DG or in the UG.[14] It is of note that the MET scores have much lower correlations and p-values than the IRI score. This finding suggests that measures from the photobased test (MET) are less related to the behavior in the neutrally framed games than the IRI scores. This can be explained by the different nature of these two tests. Whereas the IRI is a rather abstract test for empathy and ToM, the MET elicits the scores of an individual's disposition via photo-based stimuli. As the games are also more abstract in nature, the IRI seems to have a better fit.

	DG offers	*UG offers*
IRI - Empathy	.12(.19)	.10(.28)
MET - Direct Empathy	−.08(.42)	−.08(.40)
MET - Indirect Empathy	−.06(.53)	−.06(.56)

Table 3: Correlation between offers in the DG as well as UG and the psychometric scales. (p-values in brackets)

[13] For plots see figure 2 in Appendix A.

[14] Correlating empathy score with a number of indexes accounting for altruism (for instance UG - DG; Beliefs in the DG - DG) did not uncover any relation.

Is there a positive correlation between the disposition to engage in ToM and offers in the two games? Table 4 indicates a positive correlation between ToM as measured by the IRI and offers in the DG, but surprisingly no relationship to offers in the UG. The literature points out that ToM can be used twofold, to maximize one's own payoff but also to gauge what others might expect. Selfish types who seek to maximize their individual payoffs should use the disposition strategically, whereas other-regarding types will likely use increased ToM to match what the receiving subject might expect. Hence, in the DG subjects use the disposition to engage in ToM, which indicates its importance for other-regarding behavior in non-strategic settings.

	DG offer	*UG offer*
IRI - ToM	.20(.04)	.08(.41)
MET - ToM	−.10(.29)	.03(.73)

Table 4: Correlation between ToM measures and offers in the games both for the entire population and separately for other-regarding and selfish types (p-values in brackets)

The question remains how closely people's reported beliefs are related to their action. Do selfish types use the disposition to engage in ToM in order to act strategically, i.e. to minimize the difference between offers in the UG and what they believe would be minimally accepted, thereby maximizing their payoffs (Hypothesis 2)?

In order to test this, we divided our sample into other-regarding and selfish types according to a mean split of DG offers. Figure 1 shows for other-regarding and selfish types the frequencies of what a subject offers in the UG minus what the individual believes would be minimally accepted. Positive difference (the right part of the graph) indicate that subjects offer more than they think is necessary to be accepted. A distribution skewed to the right would imply that subjects are more generous. On the other hand a distribution skewed to the left would be a sign of stinginess. Comparing the offers of fair and selfish types, the Mann-Whitney-U-test yields a p-value of $p = .05$.[15] This indicates that selfish players are more likely to strategically utilize their beliefs about what others accept in the UG.[16]

[15]Comparing the two distributions the Kolmogorov-Smirnov test shows $p = .07$ and $p = .05$ taking ties into account.

[16]This result is not driven by different risk preferences of the two types. Testing that risk preferences across the two populations have the same mean, the Mann-Whitney-U-test with $p = .22$ indicates that the null hypothesis cannot be rejected. Similarly, testing the distributions of the two populations of selfish and fair types the Kolmogorov-Smirnov test with $p = .88$ indicates that

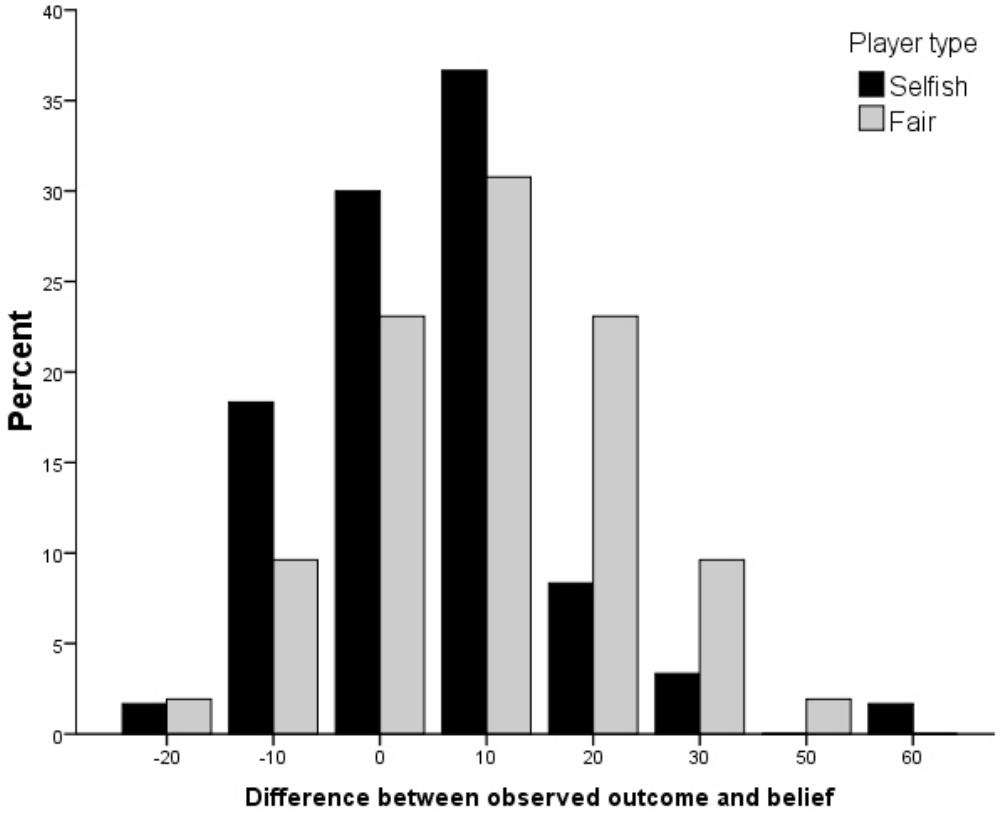

Figure 1: Difference between offers in the UG and beliefs about the minimum acceptance

This result raises the question whether for selfish types the ToM measure negatively correlates with the difference between offers in the UG and what would be minimally accepted. As can be seen in table 5, we do not find a significant negative correlation between the ToM measures and the difference between UG offers and what is believed will be minimally accepted. Likewise there is no relationship between ToM and the difference of UG offers minus the mean minimum acceptance level of the whole sample. It indicates that selfish types with a higher disposition to engage in ToM do not make offers closer to the minimum acceptance level than selfish types with a lower ToM.

	Offer - Belief about acceptance	Offer - Mean sample acceptance
IRI - ToM	−.02(.89)	−.03(.82)
MET - ToM	.02(.85)	.04(.76)

Table 5: Correlation between ToM and the minimization of the difference between offers and acceptance for the selfish types (p-values in brackets)

the null cannot be rejected.

To investigate a potential relationship between the beliefs and behavior of a subject, correlations were computed for subjects' offers and minimum acceptance level on the one hand and respective beliefs on the other. As can be seen in table 6, first-order beliefs correlate very highly with offers and the minimum acceptance level for both games.

	DG offers	*UG offers*	*UG min. acceptance*
First-order beliefs	.33 (.00)	.52 (.00)	.70 (.00)

Table 6: Correlation between action in the games and the beliefs what a randomly matched opponent would do (p-values in brackets).

This strong correlation of beliefs and action may reflect social norms whereby subjects assume that they are acting in a fashion in which others also would act. In a related analysis, Dawes and Mulford (1996) noted that this type of behavior can be perfectly rational on the grounds that people in a one-shot scenario cannot make any inference as to how differently others are acting. A further analysis at this point is difficult, given that the endogeneity problem prevents for instance a meaningful Tobit regression.[17]

4 Discussion

Economists have recently become interested in the proposal that there are types of people who vary in their preferences for fairness, as observed in neutrally framed laboratory experiments. Psychologists and neuroscientists find that an individual's disposition to engage in empathy and ToM centrally informs decision making in social interaction and hence other-regarding behavior. Both, types and dispositions, are assumed to be inherent and constant in a decision maker.

Analyzing the relationship between psychometric tests and the behavioral data from the games, we find that dispositional empathy does not inform behavior in this context. If we consider the empathy-altruism hypothesis our finding clearly questions altruism, or relatedly, warm-glow as explanations for other-regarding behavior in Dictator and Ultimatum Games (e.g. Batson et al. 1981, Andreoni 1990, Levine 1998). For ToM we find a positive correlation to the offers in the DG. Yet, at the

[17] We tried to construct an instrumental variables regression with gender, height, semester, working hours and field of study as instruments for DG giving, beliefs about the minimum acceptance level and risk aversion. Unfortunately, none of the available instruments show any significance (see appendix B for the regression results).

same time ToM as measured by the psychometric tests is not related to behavior in the UG. Moreover, there is no correlation between ToM and accuracy of beliefs.

These results raise the question in how far psychometric tests and observed behavior in games are related to each other. Previous studies have found a positive correlation between ToM and offers in the UG for children and juveniles (Sally and Hill 2006, Takagishi et al. 2009). The psychometric test in these studies were specifically matched to the cohort investigated. This points to how specific measures of pro-social behavior can be either coming from laboratory games or psychometric tests. How well do games capture situations of our everyday life? Empathy and ToM have been found to relate to differences in pro-social behavior. For instance, it has been shown that across a five year span in a population of young adults pro-social dispositions are stable and that these are related to ratings of empathy (Eisenberg et al. 2002). At the same time insights of models on other-regarding preferences have been widely applied to issues outside the laboratory.[18] This rises the question about the external validity of measurements of pro-social behavior from neutrally framed laboratory games. It becomes important to ensure that essential elements from an environment are adequately captured before one draws any strong conclusions from laboratory data.

Focusing on behavioral data, i.e. observed actions in the games and elicited beliefs, we find that selfish types seek to minimize the difference between what they offer in the UG and expect others to accept. This finding is congruent with the opportunistic interpretation of human motives, which is often also assumed to underlie traditional economic theory. At the same time, selfish types expect that others are behaving in a similar way to themselves. Interestingly, fair types also assume that others would be acting fairly in the game. This behavior is in line with the conception of social norms, which rest on shared expectations (Bicchieri 2006, Fehr and Gintis 2007, Levitt and List 2007), or a norm of generalized reciprocity (Putnam 2001). The finding can also be linked to models like Konow (2000) or Matthey and Regner (2007) which are based on the theory of cognitive dissonance (Festinger 1957), where subjects suffer if their behavior differs from what they expect about themselves. However, the causality might also be reverse and people assume that others act in a similar fashion to themselves, indicating a false consensus effect (Ross et al. 1977). Unfortunately, we are not able to distinguish between different theories.

Is the use of the strategy-vector method a source for potentially confounding results? Subjects have to make decisions in each role of the two games and are

[18] See for an overview Levitt and List (2007).

asked about their beliefs about the actions of others for each role. [19] However, in the context of the Public Goods game (PG), it has been found that belief elicitation has no effect on preferences that are gathered via the strategy-vector method (Fischbacher and Gächter 2010). A further possible explanation of these strong correlations is that subjects are trying to justify their preceding actions. However, we think that this is unlikely given the belief elicitation task was incentive compatible, with payoffs increasing when predictions improved. In addition, participants went through an elaborate learning period to properly understand the functioning of the payoff mechanism.

The presence of the strong, positive, correlation between actions and beliefs and that ToM is positively correlated at least in the DG with offers, points to that there are social norms underlying the behavior observed here. However, a central prerequisite of the functioning of social norms are expectations of shared beliefs. Looking at the beliefs in the present study we find them to have a considerable variance. In addition, people have a tendency to assume that others are similar to themselves, whereas this does not hold. Evidence form the PG indicates that beliefs about others behavior is a central driving force across games (Fischbacher and Gächter 2010). For PG it has been found that people adapt their behavior in iterate interactions, yet, once the game is restarted with new group members, subjects return to their original offers from the first round. Thus, is there potentially a certain inertia in subject's beliefs, i.e. do they maintain their beliefs despite evidence that others might act differently? What is a functional explanation for this behavior?

Pro-social behavior displayed in the context explored does not seem to be motivated by genuine altruism. Instead, internalized norms inside and outside the laboratory might be one of the guiding principles that help us to avoid the pitfalls of a solitary, poor, nasty, brutish, and short life that we would be living in if only pure self interest would reign (Hobbes 1651).

[19] Even though there is only one decision maker in the DG, subjects do not know in advance if they are the sender or receiver.

Appendices

A Additional Data

	DG offers	*UG offers*	*UG min. acceptance*
Mean	.25	.40	.26
Median	.22	.44	.33
Mode	.44	.44	.33

Table 7: Normalized offers and acceptance levels in the three games

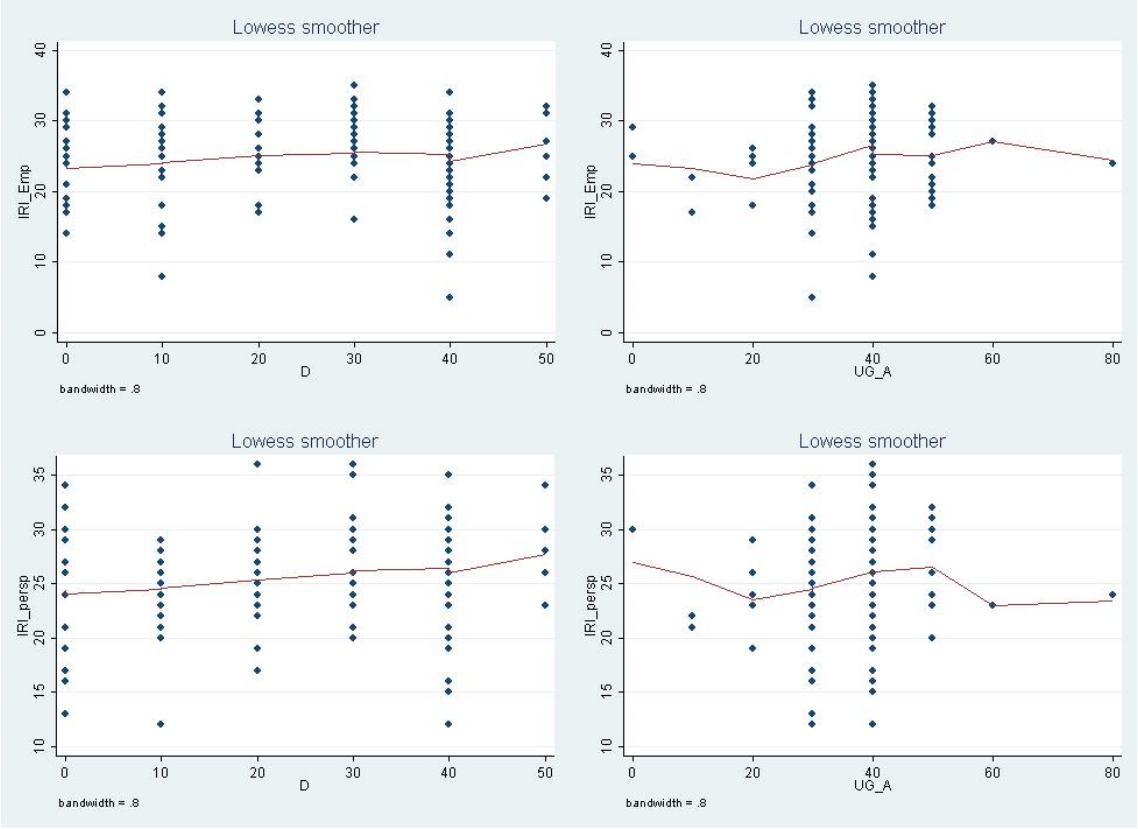

Figure 2: Locally weighted regressions of empathy and ToM on DG giving and UG offers

B Instrumental Variables Regression

Number of obs	=	116
F (13, 106)	=	1.10
Prob > F	=	0.3660
R-squared	=	0.1232
Adj R-squared	=	0.0114
Root MSE	=	15.8248

DG Giving	Coef.	Std. Err.	t	P>|t|	95% Conf.	Interval
IRI empathy	−0.06	0.32	−0.20	0.84	−0.70	0.57
IRI ToM	0.41	0.35	1.20	0.23	−0.27	1.10
Gender	2.53	5.02	0.50	0.62	−7.42	12.48
Semester	1.18	0.62	1.90	0.06	−0.05	2.41
Housing	2.59	2.27	1.14	0.26	−1.91	7.09
Height	−0.21	0.23	−0.91	0.37	−0.66	0.25
Social Science	1.15	4.94	0.23	0.82	−8.65	10.95
Natural Science	−0.48	5.17	−0.09	0.93	−10.73	9.77
Humanities	−0.90	5.71	−0.16	0.88	−12.23	10.44
Law	0.04	6.39	0.01	1.00	−12.63	12.71
Economics	−2.06	6.05	−0.34	0.74	−14.07	9.95
Medicine	−5.23	7.79	−0.67	0.50	−20.68	10.21
Working hours	1.18	2.50	0.47	0.64	−3.78	6.14
Constant	38.77	42.23	0.92	0.36	−45.00	122.55

Table 8: First-stage regression DG giving

Number of obs	=	116
F (13, 106)	=	0.65
Prob > F	=	0.807
R-squared	=	0.076
Adj R-squared	=	-0.041
Root MSE	=	11.466

Belief UG Acceptance	Coef.	Std. Err.	t	P>|t|	95% Conf.	Interval
IRI empathy	0.43	0.23	1.84	0.07	−0.03	0.89
IRI ToM	−0.27	0.25	−1.07	0.29	−0.77	0.23
Gender	−2.14	3.63	−0.60	0.56	−9.35	5.07
Semester	−0.29	0.45	−0.64	0.52	−1.18	0.60
Housing	1.14	1.64	0.69	0.50	−2.12	4.40
Height	0.14	0.17	0.85	0.40	−0.19	0.47
Social Science	2.39	3.58	0.67	0.51	−4.71	9.49
Natural Science	0.70	3.74	0.19	0.85	−6.73	8.13
Humanities	0.75	4.14	0.18	0.86	−7.46	8.96
Law	−0.23	4.63	−0.05	0.96	−9.40	8.95
Economics	1.21	4.39	0.28	0.78	−7.49	9.91
Medicine	−1.09	5.64	−0.19	0.85	−12.28	10.10
Working hours	−0.50	1.81	−0.27	0.78	−4.09	3.10
Constant	1.09	30.60	0.04	0.97	−59.61	61.78

Table 9: First-stage regression belief about UG acceptance level

Number of obs	=	116
F (13, 106)	=	1.04
Prob > F	=	0.421
R-squared	=	0.117
Adj R-squared	=	0.004
Root MSE	=	1.41

Risk aversion	Coef.	Std. Err.	t	P>|t|	95% Conf.	Interval
IRI empathy	0.01	0.03	0.47	0.64	−0.04	0.07
IRI ToM	−0.02	0.03	−0.71	0.48	−0.08	0.04
Gender	0.01	0.45	0.03	0.98	−0.87	0.90
Semester	0.02	0.06	0.42	0.67	−0.09	0.13
Housing	0.27	0.20	1.36	0.18	−0.13	0.68
Height	−0.20	0.02	−0.95	0.35	−0.06	0.02
Social Science	−0.37	0.44	−0.84	0.40	−1.24	0.50
Natural Science	−0.13	0.46	−0.29	0.77	−1.05	0.78
Humanities	0.21	0.51	0.41	0.69	−0.80	1.22
Law	−0.75	0.57	−1.32	0.19	−1.88	0.38
Economics	−0.65	0.54	−1.20	0.23	−1.72	0.42
Medicine	0.90	0.69	1.29	0.20	−0.48	2.27
Working hours	−0.04	0.22	−0.18	0.86	−0.48	0.40
Constant	9.42	3.76	2.50	0.01	1.96	16.89

Table 10: First-stage regression risk aversion

Number of obs	=	116
Wald chi2 (5)	=	2.69
Prob > chi2	=	0.747
R-squared	=	0.177
Root MSE	=	9.306

UG Offer	Coef.	Std. Err.	z	P>|z|	95% Conf.	Interval
DG Giving	0.19	0.23	0.81	0.42	−0.27	0.64
Belief UG Acceptance	0.38	0.41	0.93	0.35	−0.42	1.18
Risk Aversion	−0.44	2.03	−0.22	0.83	−4.42	3.54
IRI Empathy	0.02	0.23	0.08	0.94	−0.44	0.47
IRI ToM	0.08	0.24	0.35	0.73	−0.39	0.56
Constant	21.73	19.08	1.14	0.26	−15.68	59.13

Table 11: Instrumental variables (2SLS) regression

C Instructions

Thank you for coming! You are now about to take part in an experiment on decision making. With taking part in the experiment and reading the following instructions carefully you can earn a considerable amount of money depending both on your own decisions and on the decisions of others.

These instructions and the decisions to be made are solely for your private information. During the experiment you are not allowed to communicate in the laboratory nor with someone outside the laboratory. Please switch off your mobile phone. Any violation of these rules will lead to exclusion from the experiment and all payments. If you have any questions regarding the rules or the course of this experiment, please raise your hand. An experimenter will assist you privately.

The experiment consists of one computerized questionnaire and three separate sections with varying decision tasks. Answering carefully all the items in the questionnaire will earn you four (4) Euros. In each of the three separate sections, one randomly chosen decision determines your earnings from the section. Your overall income from the experiment will be based on the sum of earnings from the three separate sections and the questionnaire. It is in your best interest to make a careful decision in all possible situations. Neither during nor after the experiment will you or any other participant be informed about the true identity of a person with whom you are interacting. Your earnings will be paid privately in cash at the end of the experiment.

During the experiment all decisions and transfers are made in Experimental Currency Units (ECUs). Your total income will be calculated in ECUs and at the end of the experiment converted to Euros at the following rate:

10 ECUs = 1.5 Euro.

The experiment begins with the questionnaire. You have one decision to be taken per computer screen. Please bear in mind that after the introductory stage of two computer screens you have up to 15 seconds to make your decision in each screen. The remaining time is displayed on your screen in the upper right hand corner.

First Section

The first section consists of two decision tasks in which your earnings depend both on your own decisions and one randomly chosen participant. There are two types of individuals: Type A and type B. You will act in both roles. To calculate your earnings from the section only one decision will be randomly chosen. The random decision is determined by the computer at the end of the experiment.

First Decision Task

There are two types of individuals: Type A and type B. Person A decides how to divide a pie of 90 ECUs between him/herself and person B. Person B is passive in this situation. The division is possible in intervals of 10 currency units. Person A can accordingly allocate 0, 10, 20, 30, 40, 50, 60, 70, 80, or 90 ECUs to person B.

Example: Should the person A allocate 30 ECUs to person B, person A earns (90 - 30 =) 60 ECUs.

Second Decision Task

Person A decides how to divide a pie of 90 ECUs between him/herself and person B. Type B person may now either accept or decline the proposed division. Should the person B accept the division, earn both persons ECUs in compliance with the proposed division. Should the person B decline the offered allocation, earn both persons nothing. To determine the final allocation from the second decision task indicates person B the minimum amount of ECUs that he/she is willing to accept. Both the division and the indication of acceptance are possible in intervals of 10 currency units.

You are asked to make your decision in both roles: as a person A and B. Your payoff relevant decision will be randomly determined by the computer at the end of the experiment.

Example: Person A decides to offer 30 ECUs to person B and thereby keep 60 ECUs for him/herself. Person B indicates the minimum amount of ECUs he/she

is willing to accept. Should the amount be smaller or equal to 30 ECUs, receives person B 30 ECUs and person A 60 ECUs. Should the acceptable amount be greater than 30 ECUs, both person receive 0 ECUs from the decision task.

Second Section

The second section consists of three decision tasks that are described below. In this section your earnings depend both on your own decisions and on the decisions of others. At the end of the experiment computer will randomly determine one of the three tasks that will be solely used to assign your earnings from the second section.

There were three situations in which 90 ECUs were at stake:

1. Person A allocates ECUs between him/herself and person B, B is passive;
2. Person A allocates ECUS between him/herself and person B, B is active;
3. Person B indicates the smallest amount that he/she is willing to accept.

All decisions were to be made in intervals of 10 ECUs.

In the following three decision tasks your earnings will be determined by the accuracy of your probability assessment. Your task is to indicate the likelihood that a randomly chosen person has chosen one of the ten possibilities. Please note that the sum of your probability assessments needs to equal 100 per cent.

Your earnings will be calculated on the basis of the following figure 3. A more detailed explanation will follow.

The payoff consequences of your choice will be explained through an example: Assume a situation in which person A decides how to allocate a pie of 90 ECUs between him/herself and a person B. Person B is passive.

First column in the table contains the probability that you want to assign for a certain possible division. Should you for instance assess that all the 10 possible divisions (from 0 ECUs to 90 ECUs) are equally likely to occur, your decision is to set 10 per cent probability to all possible events.

Second column in the table indicates your earnings from a correct prediction given your probability assessment. Think of the example in which all possible events were assessed to be equally likely and received a probability estimate of 10 per cent. You have inevitably made a correct prediction which earns you 10.90 ECUs.

You have to bear the costs from incorrect probability assessments (third column). In this example you have set 10 per cent probability also for all the events that did

Your probability assesment	Your earnings from a correct prediction	Your cost from an incorrect prediction
100%	20,00 ECU	10,00 ECU
95%	19,98 ECU	9,03 ECU
90%	19,90 ECU	8,10 ECU
85%	19,78 ECU	7,23 ECU
80%	19,60 ECU	6,40 ECU
75%	19,38 ECU	5,63 ECU
70%	19,10 ECU	4,90 ECU
65%	18,78 ECU	4,23 ECU
60%	18,40 ECU	3,60 ECU
55%	17,98 ECU	3,03 ECU

Your probability assesment	Your earnings from a correct prediction	Your cost from an incorrect prediction
50%	17,50 ECU	2,50 ECU
45%	16,98 ECU	2,03 ECU
40%	16,40 ECU	1,60 ECU
35%	15,78 ECU	1,23 ECU
30%	15,10 ECU	0,90 ECU
25%	14,38 ECU	0,63 ECU
20%	13,60 ECU	0,40 ECU
15%	12,78 ECU	0,23 ECU
10%	11,90 ECU	0,10 ECU
5%	10,98 ECU	0,03 ECU
0%	10,00 ECU	0,00 ECU

Figure 3: Earningstable

not occur. These incorrect predictions are all associated with a deduction 0.10 ECUs as can be read from the third column in the table.

That is, your total earnings from the task are 10.90 ECU - 0.10 ECU - 0.10 ECU - 0.10 ECU - 0.10 ECU - 0.10 ECU - 0.10 ECU - 0.10 ECU - 0.10 ECU - 0.10 ECU = 11.90 ECU – 9 * 0.10 ECU = 11.00 ECU.

Another example: Assume that you have made following probability assessments: 20% for 0 ECUS, 40% for 10 ECUs, 10% for 20 ECUs and 15% for 30 and 40 ECUs. The randomly chosen person A decides to allocate 10 ECUs to person B. Your probability assessment for that event was 20%. Your earnings from the decision task will be calculated as following: 13.60 ECUs (20% for a correct prediction) - 1.60 ECUs (40% for an incorrect prediction) - 0.10 (10% for an incorrect prediction) - 2 * 0.23 ECUs (two times 15% for an incorrect prediction) = 11.44 ECUs.

Pay attention to the fact that under the given payoff scheme the worst possible monetary outcome happens when you set 100 per cent probability for an event that does not occur. Your earnings in such case would be 0 ECUs. On the contrary, should you set 100 per cent probability for an event that occurs, your earnings would be the highest possible (20 ECUs).

Please note that you are not bound to make your probability assessments in intervals of 5 per cent. This limitation is only for an illustration. That is, you can

for instance set a probability of 97% for a certain event. You will receive a complete payoff table once we begin the experiment.

Training Period

Please answer the following control questions. These will give you the opportunity to get familiar with the payoff. At the same time it is ensured that you understood the instructions. Please indicate your answers in the relevant field. To proceed click 'continue'. Once all questions will be answered correctly we will start with the actual experiment.

Please answer following questions with the help of the table 12. You are expecting with a probability of 55% that your partner will decide to give you 30 ECU. Your partner decides to actually give you 30 ECU. How many ECU will you receive for this correct prediction?

After four trials the solution (17.98 ECU) and following table 13 are presented:

Please answer following questions with the help of the above table 12: You are expecting with a probability of 50% that your partner will decide to give you 30 ECU, with a probability of 30% 20 ECU, and with a probability of 20% that he will decide to give you 10 ECU. Your partner decides to actually give you 40 ECU. How high are your costs (in ECU) for this incorrect assessment?

After four trials the solution ($2.50 + 0.90 + 0.40 = 3.80$) and following table 14 is presented:

Please answer following questions with the help of the above table 12: You are expecting with a probability of 50% that your partner will decide to give you 30 ECU, with a probability of 30% that he will give you 40 ECU, with a probability of 10% that he will give you 20 ECU, and with a probability of 5% that he will give you 10 ECU respectively 50 ECU . Your partner decides to actually give you 30 ECU. How high is your payoff (in ECU)?

After four trials the solution ($17.50 - 0.90 - 0.10 - 0.03 - 0.03 = 17.50 - 0.90 - 0.10 - 2 * 0.03 = 16.44$) and following table 15 is presented:

Stated probability (in percent)	Choice of partner correctly predicted (in ECU)	Costs for giving probabilities to not chosen actions (in ECU)
100	20.00	10.00
95	19.98	9.03
90	19.90	8.10
85	19.78	7.23
80	19.60	6.40
75	19.38	5.63
70	19.10	4.90
65	18.78	4.23
60	18.40	3.60
55	17.98	3.03
50	17.50	2.50
45	16.98	2.03
40	16.40	1.60
35	15.78	1.23
30	15.10	0.90
25	14.38	0.63
20	13.60	0.40
15	12.78	0.23
10	11.90	0.10
5	10.98	0.03
0	10.00	0.00

Table 12: The alternative representation of QSR

Third Section

In the following decision task your earnings depend only on your own decisions and a random procedure. Your task is to decide between option A and B in ten different situations. At the end of the third section the computer will roll a dice twice (numbers on the dice are between 1 and 10). The first roll determines one of the ten situations and the second roll your earnings from the situation dependent on your choice. In all ten situations there two options available: option A and option B. Both options may earn you a certain amount of ECUs. Look at the situation one - equal to a situation in which the first dice roll turns out to be 1 - displayed in figure 4. Now Option A pays you 20.00 ECUs if the second throw of the ten

Stated probability (in percent)	Choice of partner correctly predicted (in ECU)	Costs for giving probabilities to not chosen actions (in ECU)
100	20.00	10.00
95	19.98	9.03
90	19.90	8.10
85	19.78	7.23
80	19.60	6.40
75	19.38	5.63
70	19.10	4.90
65	18.78	4.23
60	18.40	3.60
55	**17.98**	3.03
50	17.50	2.50
45	16.98	2.03
40	16.40	1.60
35	15.78	1.23
30	15.10	0.90
25	14.38	0.63
20	13.60	0.40
15	12.78	0.23
10	11.90	0.10
5	10.98	0.03
0	10.00	0.00

Table 13: The alternative representation of QSR

sided die is 1, and it pays 16.00 ECUs if the throw is 2-10. Option B yields 38.50 ECUs if the throw of the die is 1, and it pays 1 ECU if the throw is 2-10. The other situations are similar, except that as you move down the table, the chances of the higher payoff for each option increase.

	Option A		**Option B**		**Your decision**
	Number of the dice	Earnings	Number of the dice	Earnings	Option A or Option B
1.	1	20.00 ECU	1	38.50 ECU	
	2 - 10	16.00 ECU	2 - 10	1.00 ECU	

Figure 4: Situation 1

Stated probability (in percent)	Choice of partner correctly predicted (in ECU)	Costs for giving probabilities to not chosen actions (in ECU)
100	20.00	10.00
95	19.98	9.03
90	19.90	8.10
85	19.78	7.23
80	19.60	6.40
75	19.38	5.63
70	19.10	4.90
65	18.78	4.23
60	18.40	3.60
55	17.98	3.03
50	17.50	**2.50**
45	16.98	2.03
40	16.40	1.60
35	15.78	1.23
30	15.10	**0.90**
25	14.38	0.63
20	13.60	**0.40**
15	12.78	0.23
10	11.90	0.10
5	10.98	0.03
0	10.00	0.00

Table 14: The alternative representation of QSR

Example (in case the first throw shows number one):
Assume that the result form the second throw is number one. Should you have chosen option A, your earnings is 20.00 ECUs. Should the second throw be 2, 3, 4, 5, 6, 7, 8, 9 or 10, your earnings are 16 ECUs. Should you have chosen option B, you earnings would be 38.59 ECUs. Should the result form the second throw, however, be 2, 3, 4, 5, 6, 7, 8, 9 or 10 and your decision option B, your earnings would be 1 ECU.

As indicated above, computer will roll a dice twice. The first throw determines one of the ten situations the second throw your earnings from the situation depending on your own decision.

Stated probability (in percent)	Choice of partner correctly predicted (in ECU)	Costs for giving probabilities to not chosen actions (in ECU)
100	20.00	10.00
95	19.98	9.03
90	19.90	8.10
85	19.78	7.23
80	19.60	6.40
75	19.38	5.63
70	19.10	4.90
65	18.78	4.23
60	18.40	3.60
55	17.98	3.03
50	**17.50**	2.50
45	16.98	2.03
40	16.40	1.60
35	15.78	1.23
30	15.10	**0.90**
25	14.38	0.63
20	13.60	0.40
15	12.78	0.23
10	11.90	**0.10**
5	10.98	**0.03**
0	10.00	0.00

Table 15: The alternative representation of QSR

Please answer the following questions concerning some personal details. We will prepare your payment simultaneously. After finishing the questionnaire your final payment will be displayed on your computer screen. You will find out the payoff relevant situations that the computer has chosen in each of three sections.

Thank you for your participation!

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