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Inequity Aversion, Reciprocity, and Appropriateness in the Ultimatum-Revenge Game

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Abstract

This article reports the results of a simple bargaining experiment on the ultimatum-revenge game. The game enables to differentiate between fairness that is stimulated by intentional based motives, distributional motives, and fairness considerations that mix both motives. The laboratory experiments indicate considerable heterogeneity of motives. A majority of subjects seem to combine both motives. However, the composition of the mix is subject to a transition, which can be formalized by the principle of appropriateness. In contrast to contemporary reciprocity models, this approach suggests that mildly unkind treatments are responded mildly unkindly, while strong unkindness leads to harsh reactions.

Keywords: distributional preferences, fairness, intentional based preferences, social welfare, ultimatum bargaining
JEL: *D63, D64*

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1. Introduction

In the last two decades, there has been substantial progress with respect to an economic theory of fairness. Considerable evidence indicates the importance of fairness for economic behavior. Subjects cooperate in social dilemma games, they contribute to voluntary public goods, and they are willing to sacrifice payoffs of their own in order to change those of others. It seems that people draw utility not only from their own payoffs, but also from the well-being of others (see, e.g., Fehr & Schmidt, 2006). Yet, there is an ongoing debate about the motives that trigger fairness (see, e.g., Bolton & Ockenfels, 2005). Among others, the contemporary literature indicates two major motives; first, distributional motives (e.g., Fehr & Schmidt, 1999, Bolton & Ockenfels, 2000) and, second, intention-based motives (e.g., Rabin, 1993, Dufwenberg & Kirchsteiger, 2004, Sobel, 2005, Falk & Fischbacher, 2006, Cox, Friedman & Gjerstad, 2007).[1]

This article reports experiments on a simple ultimatum bargaining game that allows me to differentiate players according to their types of fairness motives (i.e., distributional type players, intentional type players, and mixed type players). I will analyze whether players' choices indicate consistently one type of fairness motives across several distribution decisions. Notice that even models that nests distributional and intention-based preferences (e.g., Charness & Rabin, 2002) predict a consistent mix of both motives for players' choices. For those players whose choices violate consistency, one may ask

[1] There is a similar approach to intention-based preferences, guilt aversion (Batigalli & Dufwenberg, 2007), relying on the idea that subjects dislike letting down the opponents' expectations concerning responses. As this model leads to qualitatively similar predictions, I will not explicitly discuss guilt aversion hereafter.

whether there is a principle for the transition between motives for different tasks. I will offer such a simple principle formalizing the transition, the principle of appropriateness. This principle of appropriateness will identify tasks for which it is appropriate for the player to respond inequity averse (distributional motive) or reciprocal (intention-based motive), respectively. Individual differences in appropriateness will be captured by an individual taste parameter. I will show that for extreme values of the taste parameter, the principle of appropriateness nests the two predominant fairness motives. Purely inequity-averse players exhibit a zero-taste parameter and adhere to equality irrespectively of the distribution task, whereas purely reciprocal players hold a sufficiently large parameter so that they prefer a large inequality in payoffs. However, in contrast to intention-based and distributional preference models, subjects do not *per se* prefer extreme or equal payoff distributions.

I will denote the game that allows us to distinguish between fairness motives as the ultimatum-revenge game. The ultimatum-revenge game partly corresponds to the standard two-person ultimatum game. One person, called the proposer, receives an endowment P. The proposer has to offer the second person, called the responder, a share x of P. If the responder accepts the offer, the proposer receives the payoff $P - x$, while the responder earns the offer x. However, the game differs substantially from the standard ultimatum game if the responder rejects the offer x. Rejecting the offer, the responder earns κx for a exogenously fixed factor $0 \leq \kappa < 1$, but freely determines the payoff for the proposer, y, from an interval $y \in [0, P - \kappa x]$ (the "revenge"). Assuming pure material selfinterest, there are several subgame perfect equilibria of the ultimatum-revenge game, where the resulting payoffs for responder and proposer do not differ from that of the standard ultimatum game. The smallest positive x will be offered and never be rejected. If, however, responders reject offers, they reveal a taste for fairness. Rejecting offers, inequity averse responders choose equitable payoffs for the proposers (i.e., $y = \kappa x$). Reciprocal responders will choose proposers' payoffs from the lower bound of the interval (i.e., $y = 0$) rejecting unkind offers. Responders who choose y between the two points (i.e., $y \in (0, \kappa x)$) indicate a mix of both motives. The crucial question is whether responders choose y consistently when rejecting several offers. That is, if responders reject more than once, do all their responses, for instance, indicate inequity aversion? Distributional, intention-based and mixed models suggest so. However, for a certain taste parameters, the principle of appropriateness predicts a variation in y. For rejections of very unequal offers, it is appropriate to choose y that indicates reciprocity, while for only mildly unequal, but still unacceptable offers, appropriateness suggests to choose $y = \kappa x$.

There is a broad body of experimental literature on the relation between distributional preferences and intention-based preferences. For instance, the results of the mini-ultimatum game[2] experiments by Falk, Fehr and Fischbacher (2003) demonstrate the importance of both motives for fairness. When the proposer has the option to offer an equal distribution of earnings and an unequal one favoring herself, the responder rejects

[2] The mini-ultimatum game has two stages, where a constant sum is distributed between two persons. In the first stage, a proposer has to choose a particular distribution. In the second stage, the responder is asked to accept the payoff distribution. When she rejects it, both payoffs are zero.

significantly more often the latter one than when the proposer has to choose between the unequal and an even more unequal distribution of earnings (44.4% versus 8.9%). Of course, this result points to the importance of the intention-based motive. However, when the proposer has no option but to choose the unequal offer, still a substantial number of responders (18%) reject. As there is no intention for the proposer to favor herself, this observation suggests that inequity aversion triggers rejections. Other experiments (e.g., on the convex ultimatum game,[3] Andreoni, Castillo & Petrie, 2003, on the three-person ultimatum games,[4] Bereby-Meyer & Niederle, 2005, and on a three-person gift exchange game,[5] Thöni & Gächter, 2007) have shown that fairness can hardly be explained by inequity aversion and reciprocity alone.

The experimental results for the ultimatum-revenge game support the previous findings that fairness subsumes several motives. The results stem from a sizable number of responders' rejections that indicate inequity aversion. On the other hand, a substantial number of responders behave reciprocally. However, for the majority of responders, responses indicate a mix of both motives. And the combination changes between mildly

[3] The convex ultimatum game has the following structure: A proposer receives an endowment and has to offer the responder a share of the endowment. The responder either accepts the offer, keeping the offer for herself, while the proposer earns the endowment minus the offer, or she rejects the offer and determines the factor by which both payoffs are shrunk.

[4] The ultimatum game has the following structure: The proposer receives an endowment and has to offer the responder a share from the endowment. The responder either accepts the offer, keeping the offer for herself, while the proposer earns the endowment minus the offer, or the responder rejects the offer, which leads to a low-conflict payoff for herself and the proposer (standard ultimatum game) or for herself and a third party while the proposer receives nothing (three-person ultimatum game).

[5] The three-person gift exchange game has the following structure: Two persons receive unconditional gifts from the third person. Then, the two persons have to make effort decisions that cause costs to them but yield a payoff to the third person.

unequal offers and strongly unequal offers. For the majority of the responders showing intermediate responses, I can estimate a non-positive taste parameter supporting the principle of appropriateness.

The remaining article is organized as follows: Section two introduces the ultimatum-revenge game. Section three will develop the principle of appropriateness and discusses behavioral expectations for the ultimatum-revenge game. Section four analyzes the experimental data with respect to these predictions. Finally, section five concludes the article.

2. The ultimatum-revenge game

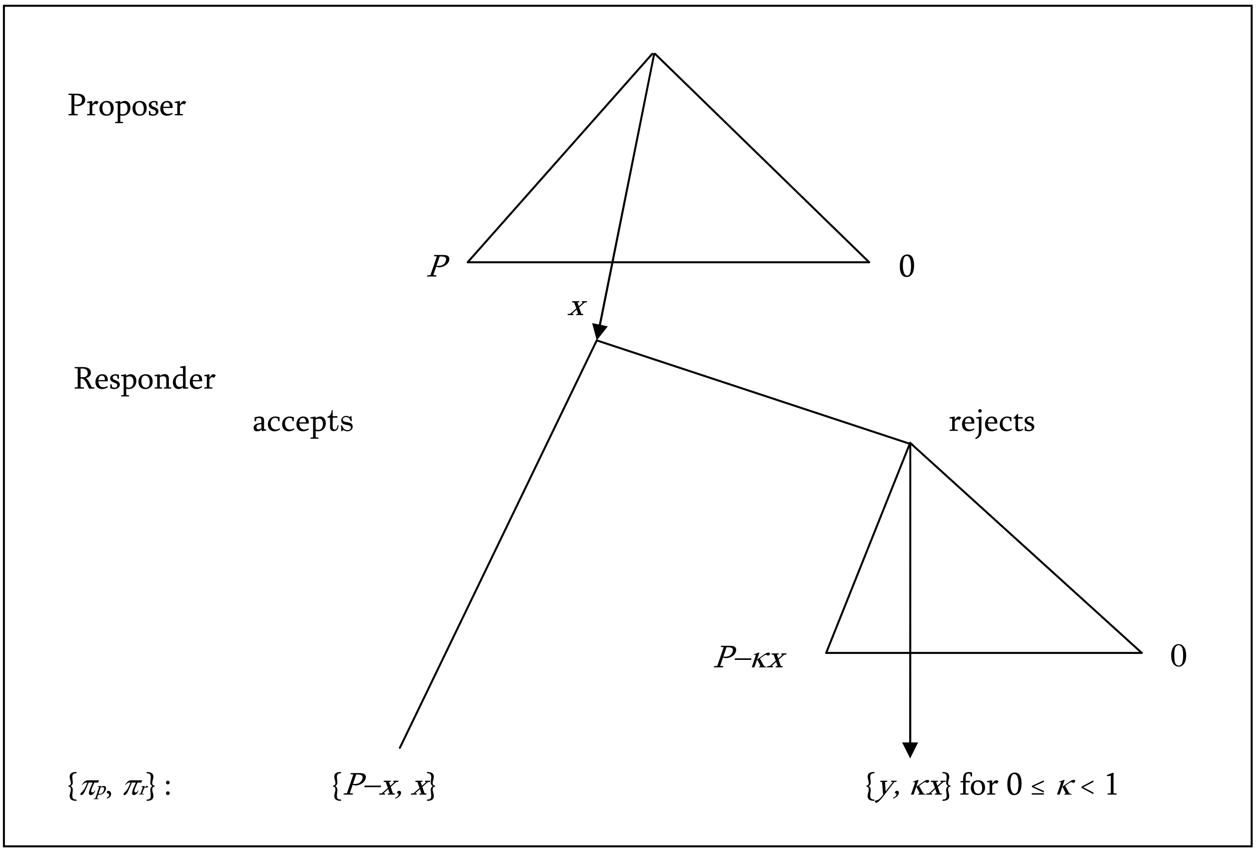
The ultimatum-revenge game is a simple bargaining game with two players. A proposer is endowed with some monetary pie of size P. The proposer has to offer x out of P to the responder. If the responder accepts the offer, the proposer keeps the remaining $P - x$, while the responder earns x. If the responder rejects the offer, the responder earns κx with a commonly known parameter $\kappa \in [0,1)$, while the responder can freely determine the earnings of the proposer (the "revenge"), denoted as y, from the interval $y \in [0, P - \kappa x]$. Therefore, the payoff functions for the proposer, π_{p}, and the responder, π_{r}, respectively, are

$$\pi_{\mathrm{p}} = \delta\,(P - x) + (1 - \delta)\, y$$

$$\pi_{\mathrm{r}} = \kappa x + \delta\,(1 - \kappa)\, x, \tag{1}$$

where $\delta = 1$ if the responder accepts the offer x, and $\delta = 0$ otherwise. Figure 1 illustrates the game tree of the ultimatum-revenge game. If the responder rejects the offer, his payoff is denoted as the conflict payment. Obviously, assuming both players to have pure selfish preferences yields subgame perfect Nash-equilibria, which are identical with respect to x and δ to the one in the standard ultimatum game. For any $x > 0$, it is not optimal to reject, while for $x = 0$, the responder is indifferent between accepting and rejecting the offer. Since for the first case, the corresponding conflict payoff is smaller than the offer, responders will accept any positive offer. Anticipating this, proposers choose the smallest possible offer x' leading to subgame perfect equilibria $x = x'$, $\delta = 1$, and $0 \leq y \leq P - \kappa x'$.[6]

Figure 1: *Game tree of the ultimatum-revenge game*



[6] I assume that proposers prefer one of the x' equilibria (yielding a sure payoff of $P - x'$) over one of the

Henceforth, I will focus almost exclusively on the behavior of the responder. The responder's decision is non-strategic in the sense that the responder does not take any further possible actions of other players into account; the game terminates after his decision. By contrast, the proposer's decision combines both, own fairness considerations as well as the belief about the fairness considerations of the responder. Therefore, only responder's decision in the ultimatum-revenge game allows me to observe behavior that is not contaminated by strategic reasoning.

Restricting the y set to $y \equiv 0$ and setting the parameterisation $\kappa = 0$ yields the standard two-person ultimatum game (Güth, Schmittberger & Schwarze, 1982). However, rejections in the standard ultimatum game may show inequity aversion – responders favor an equal split {0, 0} compared to a more unequal distribution of the pie – but may also exhibit a hostile answer to an unkind offer. The "unrestricted" ultimatum-revenge game imposes no marginal costs for responders to alter proposers' payoffs providing responders the opportunity to differentiate their disapproval of an unacceptable offer.[7] The results obtained for responders' decisions in the ultimatum-revenge game extend the results of previous experiments that estimate interdependent preferences by using decisions in dictator games[8] (e.g., Andreoni & Miller, 2002, Fisman, Kariv & Markovits, 2007) by the – potential – influence of reciprocity for the responder's behavior, as well as previous

equilibria $x = 0$, $\delta = \{0,1\}$, $0 \leq y \leq P$ (yielding an uncertain payoff).

[7] In the real world, for instance, workers instead of quitting the job, slow down their effort, or refuse to work overtime.

experimental evidence on other modified ultimatum games.[9] Those studies have focussed predominantly on the robustness of the prediction based on inequity aversion (Kagel & Wolfe, 2001, Andreoni, Castillo & Petrie, 2003). They found a sizable number of responders showing behavior consistent with inequity aversion. Yet again, there are also substantial numbers of subjects whose behavior is inconsistent with inequity aversion, but indicates reciprocity. The current study continues this line of research in the way that responders' decisions in the ultimatum-revenge game allow me to analyze their motives in greater detail and to test whether the mix of motives differs over several offers. For this purpose, I apply the strategy vector method for responders (Selten, 1967). This means that responders have to decide for all possible (integer) offers before they are informed about the actual offer. Then, the offer and the corresponding responder decision determine the payoffs.[10]

3. The principle of appropriateness

The following section introduces the principle of appropriateness. This principle will allow me to formalize a gradual transition between the distributional motive and the intention-based motive in a simple model of fairness preferences. I will avoid inessential elaboration and specification of intention based, or distributional preferences. Therefore, I

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[8] The dictator game simplifies the strategic interaction between players such that responders cannot reject the offer proposed by the dictator, who keeps the pie minus the offer. Hence, there is no response in the dictator game.

[9] For instance, see the experiments on the convex ultimatum game (e.g., see Suleiman, 1996, Charness & Rabin, 2002).

[10] Schotter, Weigelt and Wilson (1994), Cason and Mui (1998), Brandts and Charness (2000) and Güth, Huck and Müller (2001) do not find significant differences in behavior among the strategy and direct response method.

will not test, for instance, which specification of distributional preferences fit experimental data better (which has been done elsewhere, e.g., Engelmann & Strobel, 2004). Rather, I will characterize all models by first order and second order derivatives of a motivation function,[11] according to which subjects try to optimize their behavior.

Two general claims will be captured by the motivational function. First, and commonly in economics, it is assumed that *more money is preferred to less money*. Second, and departing from the perspective of narrowly self-interested players, it is assumed that *people care for the payoffs of others*. Thus, a motivation function v_i of player i is subject to two independent variables, i's payoff, π_i and some term referring to the payoff of the reference player's payoff (or the sum of reference players' payoffs, if there are more than one),[12] denoted as z. With respect to the first claim, all preference models share the following assumption:

$$\frac{\partial v_i(\pi_i, z)}{\partial \pi_i} \geq 0 \quad \text{and} \quad \frac{\partial^2 v_i(\pi_i, z)}{\partial \pi_i^2} \leq 0 \,. \tag{2}$$

In a first step, I will formulate the second claim as distributional preferences. According to distributional preferences, subjects draw – in addition to the utility they gain from their own monetary payoff – disutility from inequality between payoffs. Subjects are inequity

[11] All models formalize evidence that is mainly collected in n-person laboratory games, where a player interacts anonymously, and, if she plays the game several times, she never plays the game with any particular subject more than once. Undoubtedly, other factors like political or religious belief, education or age influence behavior, but are not formalized in the models. Therefore, in accordance with Bolton and Ockenfels (2000), I prefer to speak about "motivation functions" rather than utility functions, since the scope of objectives formulated in these functions are focused on this very narrow and abstract setting.

[12] Determining the relevant reference group in the real world appears to be a difficult task. Concerning the scope of the motivation function in the experiment, the reference players are more obvious, namely all interaction partners. Yet, in some experiments, this task is still not trivial (see, e.g., Thöni & Gächter, 2007).

averse with respect to payoff differences. Inequity aversion can be formulated either directly as the absolute difference between payoffs (Fehr & Schmidt, 1999) or indirectly as the individual share of the total sum of payoffs (Bolton & Ockenfels, 2000). In the following, I will apply only the indirect way.[13] Therefore, let z measure the difference in relative shares of payoffs between player i and the reference players, $z := \pi_i / \sum_j \pi_j - 1/n$.

Inequity aversion suggests for the motivation function v_i the following:

$$\frac{\partial v_i(\pi_i, z)}{\partial z} = 0 \quad \text{and} \quad \frac{\partial^2 v_i(\pi_i, z)}{\partial z^2} < 0 \quad \text{if} \quad z = z_0, \tag{3}$$

where $z_0 = 0$. Equation (3) states that fixing player i's payoff, there is a local maximum of the motivation function given the equal distribution of payoffs among players. Suppose there are only two players and i's payoff remains constant at some $\tilde{\pi}_i$; i chooses between z' and z'', where $z' = 0$, but $z'' \neq 0$. Then, i prefers the first alternative since $v_i(\tilde{\pi}_i, z')$ exceeds $v_i(\tilde{\pi}_i, z'')$.

A simple modification of our motivation function v_i will allow us to incorporate intention based motives in the model: let $z_0 \in \{-1/n, 0, (n-1)/n\}$. The value $z_0 = (n-1)/n$ ($z_0 = -1/n$) characterizes the case that i's relative share of profit equals one (zero), so that she earns everything (nothing) in the first (second) case. How does this relate to intention-based preferences? According to intention-based preference models (e.g., Dufwenberg & Kirchsteiger, 2004, Falk & Fischbacher, 2006, Cox, Friedman & Gjerstad, 2007), subjects

[13] The direct way requires $z := 1/n \sum_{j \neq i} |\pi_i - \pi_j|$. Elaborating the indirect way of inequity aversion does not mean that I consider this approach as being superior, but it simplifies notation considerably.

prefer to reciprocate; they like to respond kindly to perceived kindness and they prefer to reciprocate unkindly to perceived unkindness.[14]

For this purpose, a kindness term φ evaluates the perceived treatment – in the case of simultaneous moves the expected treatment – by another player (see, e.g., Falk & Fischbacher, 2006). Formally, let us assume a game with sequential moves where player i observes preceding moves. l_1, l_2, …, l_m denote all those end nodes of the game where i chooses her payoff maximizing best response strategy to any previous treatment (e.g., in the ultimatum-revenge game, the responder accepts the offer) and $\pi_i(l_1)$, …, $\pi_i(l_m)$ the corresponding payoff of i. Then $\varphi\colon l \mapsto \Re$ is a strictly increasing function such that $\varphi(l_s) > \varphi(l_t)$ if $\pi_i(l_s) > \pi_i(l_t)$, $\varphi(l_s) > 0$ if $\pi_i(l_s) > \prod$, $\varphi(l_s) < 0$ if $\pi_i(l_s) < \prod$, and $\varphi(l_s) = 0$ if $\pi_i(l_s) = \prod$, where $\prod := \sum_k \pi_i(l_k)/m$. Hence, responders in the ultimatum-revenge game perceive an offer (un)kindly if the offer is higher (lower) than the equal split of P. A similar rational applies for i's responses; player i responses (un)kindly, if the payoff for the other player is higher (lower) than the average payoff for the opponent. Overall, intention based preference models frame reciprocity as the product of perceived kindness and the kindness of the response. That is, fixing player i's payoff at $\tilde{\pi}_i$, if she has been treated unkindly, she increases the value of her motivation function by increasing the unkindness of her response, while the value decreases by increasing the kindness of her response. Likewise, if she has been treated kindly, she increases the value of her motivation

[14] The importance of reciprocity become evidently if experiments rule out intentions exogenously. Blount (1995) and Falk, Fehr and Fischbacher (2008) can show that behavior differs significantly between a game

function by increasing the kindness of her response and the value decreases by increasing the unkindness of her response. Therefore, referring to our motivation function characterized in equation (3), it follows that

$$z_0 = \begin{cases} (n-1)/n & \text{if } \varphi < 0, \\ -1/n & \text{if } \varphi > 0, \\ 0 & \text{otherwise.} \end{cases} \tag{4}$$

Recall that the marginal cost for responders to alter the proposers' payoff in the case of a rejection is zero. Responders directly reveal the z they prefer the most. On the other hand, offers can be directly interpreted with respect to φ. Therefore, I get extreme predictions concerning responder's decision on y if she rejects an offer. Summarizing the findings:

- for distributional preferences, the responder maximizes the value of the motivation function by $z = 0$ implying that $y = \kappa x$,
- for intention-based preferences, the responder maximizes the value of the motivation function by $z = (n\text{-}1)/n$ implying that $y = 0$ if $x < P/2$, and by $z = -1/n$ implying that $y = P - \kappa x$ if $x > P/2$.[15]

Finally, mixing both motives suggests a linear combination of the previous predictions. That is, $z_0 \in [-1/n, 0]$ if $\varphi > 0$, and $z_0 \in [0, (n-1)/n]$ if $\varphi < 0$, where in the first case $(nz_0 + 1)$ (in the second case $1 - nz_0/(n-1)$) characterizes the relative importance of the distributional motive and z_0 ($nz_0/(n-1)$) the relative importance of the intention-based motive for fairness.

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where computers randomly generate moves for opponents and the same game where opponents choose for themselves.

[15] No model predicts the rejection of an equal offer of $x = P/2$.

A fundamental problem occurs if responders change z for varying offers. I will interpret the fact that responders are inequity averse for some offers, while reciprocal for others, as follows: The principle of appropriateness orders potential offers such that it provides responders with the intuition when it is appropriate to respond inequity aversely and when to respond reciprocally.

However, when is it appropriate to respond inequity aversely or reciprocally? Previous experiments suggest this itself to be simply a matter of reciprocity; subjects tend to intensify the harshness of their responses the harsher they have been treated. For instance, several experiments on Stackelberg competition find an upward-sloping response function of following players (e.g., Huck, Müller & Normann, 2001, 2002). In contrast to theoretical predictions, players intensify competition only if the leading players have intensified their pricing. Applying this finding to the ultimatum-revenge game, one can expect z to be a monotone decreasing function on the perceived kindness of the reference player, $z : \varphi \mapsto \left(-1/n, (n-1)/n\right]$ such that $\partial z(\varphi)/\partial\varphi \leq 0$. Therefore, the principle of appropriateness relaxes reciprocity models such that it suggests a gradual change concerning the extremeness of responses for increasing (un)kindness. Calculating the kindness function φ for offers in the ultimatum-revenge game yields $\varphi = 0$ for x = $P/2$ and $\partial\varphi/\partial x > 0$. Thus I expect to find a non-positive relation between z and $x - P/2$. Of course, one can interpret "pure type" reciprocity and "pure type" inequity aversion as limit cases for the principle of appropriateness. That is, if we allow for individual differences concerning the absolute value of $\partial z(\varphi)/\partial\varphi$, a sufficiently large slope yields "pure type" reciprocity, while zero slope yields "pure type" inequity aversion.

Finally, recall that responders can choose y from the interval $[0,P-\kappa x]$ if rejecting an offer x. This raises the question how we interpret $y > P/2$ for offers $x < P/2$?[16] Those responses conflict with both intention-based preferences and distributional preferences. However, there is evidence that efficiency or social welfare considerations crucially influence behavior in distributional tasks (see, e.g., Charness & Rabin, 2002, Engelmann & Strobel, 2004). Responders' efficiency considerations could reduce their willingness to vanish payoffs for revenge. Hence, I will argue that any response $y > P/2$ for offers $x < P/2$ indicates responders' efficiency considerations.

4. Experimental results

The laboratory experiments were conducted at the EconLab at the University of Bonn, Germany, in October and November 2006.[17] Copies of the instructions were handed out to participants and read aloud thereafter.[18] Participants' questions concerning the experiments were then answered privately by the instructors. Finally, all participants had to answer an electronic questionnaire testing their understanding of the game and of the payoff structure.[19] Before participants answered the questionnaire, it was made clear that

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[16] Notice that the opposite case, $y < P/2$ for $x > P/2$, has hardly been observed in previous experiments.

[17] Experiments were computerized using zTree (Fischbacher, 2007). For the recruitment of subjects, I used ORSEE (Greiner, 2004).

[18] Translations of the original instructions are presented in Appendix A.

[19] Translations of the original questions are presented in Appendix B.

the only purpose of the questionnaire was to improve the understanding of the rules of the game. Wrong answers were privately explained and corrected before the experiment started. Each participant played one anonymous ultimatum-revenge game either in the role of the proposer or in the role of the responder. In the instructions, I referred to proposers as persons A and to responders as persons B. The pie size was set to $P = 12$ Euro. Offers could only be made in integers. Applying the strategy vector method, responders had to make a total of 13 acceptance/rejection decisions and, if they rejected offers, determine the payoff of proposers. In contrast to the standard procedure of the strategy vector method, responders were not provided with a choice menu, that is, a decision sheet that presents all potential offers in an ascending or descending order. Rather, potential offers were presented sequentially; the order of possible offers differed randomly for all responders. I introduced the random procedure in order to make each decision as realistic as possible and to avoid possible order effects. Therefore, offers were presented one after another without being able to change them once they were submitted. Thereafter, responders were asked to state which offer they considered as fair, and which offer they expected to receive. Then, an offer of one proposer was randomly assigned to a decision vector of one responder, and payoffs were realized according to the decisions made by the responder for this particular offer. Participants were informed about their payoffs. Finally, participants had to answer a short socio-demographic questionnaire, before picking up their payoffs in private. Participants were mostly undergraduate students from various fields of studies. Approximately one third of the students were economists or mathematicians, making it potentially easier for them to compute the subgame perfect

Nash equilibria.[20] In total, 306 subjects participated; half of all subjects were females. The median age was 23 years.

In order to test the robustness of fairness in the ultimatum-revenge game, I introduced two treatment conditions. For one condition, `high`, the commonly known parameter κ is set to $\kappa = 0.5$, while in the other condition, `low`, $\kappa = 0.25$. In total, 76 proposers and 76 responders participated in the `high` treatment, while 77 proposers and 77 responders participated in the `low` condition. The average length of the experiment was 30 minutes, including the instruction time and the time for paying off subjects. 84% of actual offers in the `high` condition (81% in the `low` condition) were accepted; average payoffs for proposers were 5.52 Euro in `high` and 5.43 Euro in `low` (standard deviations 1.90 and 2.61, respectively), average payoffs for responders were 5.24 Euro in `high` and 4.42 Euro in `low` (standard deviations 1.59 and 2.01, respectively). The average offer made in the `high` condition, 5.55, is significantly higher than the average offer made in the `low` condition, 4.81.[21] In line with findings in other ultimatum experiments (e.g., see Camerer, 2003), the result can be explained by the fact that for a given offer, the responder has a higher conflict payoff in the `high` condition than in the `low` condition. Proposers increase offers for increasing conflict payoffs.

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[20] Some authors have stressed the importance of education for fairness considerations in simple distribution games (Fehr, Naef & Schmidt, 2006). I control for this effect below.

[21] $p = 0.001$, Wilcoxon rank-sum test, two-sided. Notice that there is no significant difference between offers made by economists/mathematicians and other participants in both treatment conditions ($p > 0.05$, Wilcoxon rank-sum tests, two-sided).

The mean expected offers are 5.47 in the `high` condition and 5.26 in the `low` condition. There is no significant difference between expected offers and actual offers in both treatment conditions.[22] Moreover, there is no treatment effect with respect to expected offers and fair offers stated by responders.[23] However, mean expected offers are significant smaller than the stated fair offers, 6.02 and 5.88, respectively,[24] while there is no significant difference between stated fair offers by responders in the `low` and in the `high` condition.[25] Hence, there is a treatment effect for proposers' behavior, while the results for expectations and fair offers of responders are hardly influenced by conflict payoffs.

4.1 Rejections

For the analysis of rejection decisions, I will define an upper and a lower acceptance threshold for responder i, tr^u_i and tr^l_i, as following

$$tr^u_i := \max\{x \mid \delta_i(x) = 1\} \quad \text{and}$$

$$tr^l_i := \min\{x \mid \delta_i(x) = 1\}, \tag{5}$$

where $\delta_i(x)$ denotes the acceptance decision of responder i for a certain offer x. Note that inequity aversion and reciprocity predict regularity with respect to rejections, that is, $\delta_i(x) = 1 \ \forall \ x \in [tr^l_i, tr^u_i]$. In total, 32 out of 153 responders exhibit rejection decisions that

[22] $p > 0.05$, Wilcoxon rank-sum tests, two-sided.

[23] $p = 0.52$, Wilcoxon rank-sum test, two-sided. Again, testing expected offers and stated fair offers by economists/mathematicians and other participants reveals no significant differences in both treatment conditions ($p > 0.05$, Wilcoxon rank-sum tests, two-sided).

[24] $p < 0.001$, Wilcoxon rank-sum tests, one-sided.

[25] $p = 0.53$, Wilcoxon rank-sum test, two-sided.

violate regularity.[26] The further analysis also includes the data of responders violating rejection regularity. Responders are classified according to their acceptance thresholds; Table 1 reports the number of responders in each lower and upper acceptance class, $||tr^l_i||$ and $||tr^u_i||$, respectively.

Table 1: *Numbers of responders according to acceptance thresholds*

	$\|\| tr^l_i \|\|$								$\|\| tr^l_i \|\|$				sum
	0	1	2	3	4	5	6	7	9	10	11	12	
`high`	4	7	5	6	6	38	9	1	1	1	10	64	76
`low`	1	11	9	10	18	23	5	0	0	1	5	71	77

Responders with tr^u_i = 12 and either tr^l_i = 0 or tr^l_i = 1 behave in accordance to selfish individual utility maximization, since standard game theory predicts responders to accept any positive offer except x = 0 where responders are indifferent between accepting and rejecting. In total, only 10 responders do so.[27] Hence, comparison with typical results from other variations of the ultimatum game (e.g., see Andreoni, Castillo & Petrie, 2003), the

[26] Among these 32 responders are 8 economists/mathematicians. This proportion does not differ significantly from the proportion of economists/mathematicians in the population of experimental participants (p = 0.352, binomial test). These are more responders to behave irregularly than typically observed (see Camerer, 2003). However, there is a simple reason for this substantial number of violations. I can attribute most of them to the difficulty arising from the random order procedure of presenting possible offers. Responders submit their decision one after another without being able to change their decisions once they have submitted them. Of course, this procedure is less abstract than a decision sheet that presents potential offers in some kind of menu. Yet, this procedure is prone to error. If I relax the definition of rejection regularity and allow for one wrong decision at the most, the number of responders exhibiting irregular rejections reduces considerably to 9 subjects, which corresponds to approximately 6% of all responders (again, the proportion of economists/mathematicians, 2, among these 9 subjects does not differ significantly from the proportion of economists/mathematicians in the population of experimental participants, p = 0.728, binomial test).

[27] Particularly, 3 responders in the `high` and 7 in the `low` condition do so. The proportion of economists/mathematicians in the group of rational responders, 6, differs weak significantly from the proportion of economists/mathematicians in the overall population of responders (p = 0.098, binomial test).

ultimatum-revenge game yields much less selfish behavior by responders. The average tr^l_i is 4.08 for the `high` and 3.58 for the `low` condition; the mean tr^u_i is 11.80 for the `high` and 11.91 for the `low` condition.[28] With respect to the interaction between the lower and the upper threshold, one would expect a strongly negative correlation. That is, responders who have a small lower acceptance threshold indicating a high sensitivity for own material payoffs, are expected to exhibit also a large upper acceptance threshold indicating again a high sensitivity of own material payoffs. However, there is only a small, insignificant correlation between tr^l_i and tr^u_i of 0.05 for `high` and 0.13 for `low`.[29] Yet, there are significant correlations between the stated fair offers and the lower acceptance threshold, which are 0.29 for `high` and 0.27 for `low`,[30] while there are no significant correlations between the stated fair offer and the upper acceptance threshold, which are 0.098 for `high` and 0.023 for `low`.[31] Overall, there is a significant difference between tr^l_i in the `high` condition and tr^l_i in the `low` condition.[32] Responders are more likely to accept lower offers in the `low` condition than in the `high` condition.[33] However, for tr^u_i no significant difference between treatment conditions can be found.[34]

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[28] There are no significant differences between average lower and average upper acceptance threshold of economists/mathematicians and other participants in both treatment conditions ($p > 0.05$, Welch Two Sample tests, two-sided).

[29] $p = 0.691$ for `high` and $p = 0.26$ for `low`, Pearson's correlation test, two-sided. Testing these and all following correlations for economists/mathematicians separately lead to the same qualitative results as for all subjects using Pearson's correlation tests, two-sided.

[30] $p = 0.01$ for `high` and $p = 0.02$ for `low`, Pearson's correlation test, two-sided.

[31] $p = 0.40$ for `high` and $p = 0.84$ for `low`, Pearson's correlation test, two-sided.

[32] $p < 0.001$, Fisher's exact test.

[33] There is no significant difference between average lower and average upper acceptance thresholds of economists/mathematicians and other participants in both treatment conditions ($p > 0.05$, Welch Two Sample tests, two-sided).

[34] $p = 0.11$, Fisher's exact test.

To summarize the results for rejection behavior of responders, the ultimatum-revenge game yields less selfish behavior than other variations of the ultimatum game. Supporting earlier experimental results (e.g., Zwick & Chen, 1999), lower conflict payments in the `low` condition increase the average acceptance of smaller offers. Finally and quite astonishingly, there is only an insignificant correlation between higher and lower acceptance thresholds across responders.

4.2 Responses

In order to classify the responses of responders, I define for each rejected offer x and the corresponding response y the normalized distance to equity as

$$d(y) = \begin{cases} \dfrac{y-\kappa x}{\kappa x} & \text{if } y \leq \kappa x, \\ \dfrac{y-\kappa x}{P-2\kappa x} & \text{if } y > \kappa x, \end{cases} \tag{6}$$

where $d(y) \in [-1,1]$. $d(y) = -1$ characterizes unkind responses according to the previous definition, so that $d(y) = -1 \; \forall \; x < P/2$ where $\delta = 0$ corresponds to reciprocal responses of i to unkind offers. Likewise, following inequity aversion, $d(y) = 0 \; \forall \; x$ where $\delta = 0$ characterizes inequity averse responses of i. Finally, $d(y) = 1 \; \forall \; x > P/2$ where $\delta = 0$ indicates reciprocal responses of i. However, I have to stress an important difficulty. Obviously, choosing $y = 0$ for a rejected offer of $x = 0$ is an unkind as well as an equitable response. For this offer, I cannot differentiate between the two motives[35] and (6) is not defined. Therefore, I will exclude the decisions for $x = 0$ from further analysis. Finally, there are ten responders who behave selfishly. There is no valid response y observed for them, so that their mean distance to equity is not defined, which I denote with $\varnothing$. For remaining responders, I obtain a classification of responders according to their average distance of their responses to equity. The numbers of responders within each response class, $||d(y)||$, are reported is Table 2.

Table 2: *Numbers of responders according to mean* $d(y)$

	$\|\| d(y) \|\|$						sum
	-1	(-1,0)	0	(0,1)	1	∅	
high	14	33	11	14	0	4	76
low	26	17	9	17	0	8	77

The data show a large heterogeneity in responders' motives. In both treatment conditions, only a small minority of responders behaves selfishly. Some responses reveal inequity aversion, some reciprocity,[36] while for a considerable number of responders in both treatment conditions the average $d(y)$ indicates a mix of both motives.[37] Furthermore, some responders exhibit an average $d(y)$ larger than zero, suggesting some efficiency considerations.[38] Overall, the mean distance is –0.35 for all subjects in the high condition and –0.42 in the low condition. Thus one could say that the average responder mixes both motives. The distributional motive appears to be slightly more important (approximately sixty percent) than the intention based motive (approximately forty percent). However,

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[35] See the discussion for the standard ultimatum game in the previous section.

[36] One can think of reciprocal responders choosing $y = 0$ for some $x < P/2$ and $y = P - \kappa x$ for some $x > P/2$ yielding an average $d(y) \in (-1,1)$. However, no responder does so.

[37] The effect of responses to the rejected offer $x > P/2$ for the classification of responders is almost negligible due to the insufficient number of observations (6 responders), so that I will not present separate classifications according to cases $x \leq P/2$ and $x > P/2$.

the reciprocity becomes more important in the `low` condition (that is, if conflict payoffs of responders decrease).

Furthermore, I find on average a positive relation between the offer and the mean $d(y)$ for responses smaller than the equal split. As shown in Figure 2, for very low offers, responses tend to be unkind, while rejected offers close to the equal split are responded more equally; again, decreasing the conflict payment shifts average responses in the `low` condition to the lower bound of $d(y)$ compared with the `high` condition.

The experimental findings cannot identify a dominant motive for responders' behavior. Rather, there is a large heterogeneity among responders' motives; inequity aversion, reciprocity, and even efficiency considerations matter. The average results (Figure 2) suggest a transition between fairness motives: for very small offers, responders seems to be motivated by intentional based preferences, while for higher, but nonetheless unacceptable offers, distributional preferences motivate responses. In the consecutive section, I will analyze whether one finds this result even on the level of individual responders.

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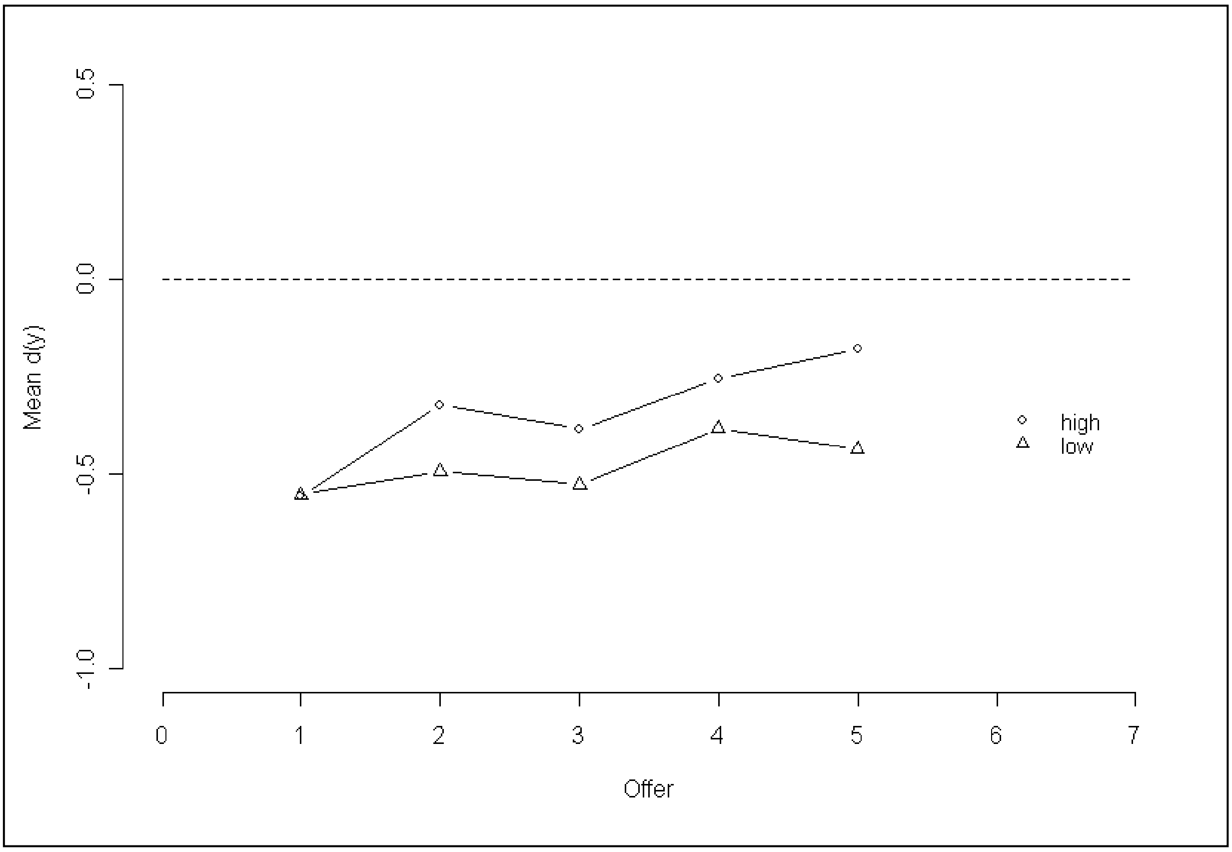
[38] Notice that for both treatment conditions the majorities of responders with irregular rejections, 11 responders in the `high` and 7 responders in the `low` condition, are classified in the class (0,1). This is due to the fact that most of the responses for obviously mistakenly rejected offers are such that $y > \kappa x$.

Figure 2: *Mean distance from equity*



4.3 Individual taste parameters

For the test of the principle of appropriateness on the level of each individual responder, I will capitalize on the fact that I observe – for the majority of responders – several y. These observations enable me to estimate for each responder the relation between the offer x and the responder's relative share of the conflict payment, z. Recall that I hypothesize a non-positive relation between x and z such that

$$\kappa x/(\kappa x + y) - 1/2 = \beta_i (x - P/2), \tag{8}$$

where the individual taste parameter β_i is non-positive. There are extreme cases for appropriateness: for pure inequity-averse responders, I will find $z = 0 \; \forall \; \delta = 0$ leading to β_i = 0; for pure reciprocal responders, I will find $z = 1/2 \; \forall \; \delta = 0$ and $x < P/2$, and $z = \kappa x/P$–

$1/2 \; \forall \; \delta = 0$ and $x > P/2$. This means that the corresponding taste parameter is negative and its absolute value so large that they choose $y = 0$ whenever they reject unkind offers and $y = P - \kappa x$ whenever they reject kind offers. I will define for these responders $\partial z / \partial x \equiv -\infty$.[39] From the 141 subjects whose $tr^1_i > 1$, the results show for 106 subjects consistent estimations of the taste parameter (among them are 40 pure reciprocal and 20 pure inequity adverse responders). Particularly, for subjects whose $z \in (-\infty, 0)$, the mean drift is –0.047 in the `high` condition and –0.043 in the `low` condition.[40] Consequently, decreasing the offer by one Euro increases on average the responder's most preferable share according to the definition of the left hand side of (8) by approximately 4.5% compared to an offer of the equal split. This means that a responder who rejects five Euros chooses on average $y = 2.09$ in the `high` condition ($y = 1.04$ in the `low` condition) which corresponds to $z = 0.54$, whereas a responder who rejects one Euro chooses on average $y = 0.19$ ($y = 0.09$) which corresponds with $z = 0.72$.

Summarizing the experimental evidence, there is a majority of responders whose behavior can be explained in the framework of the principle of appropriateness. Of course, the fit of this approach is partly attributed to responders whose choices persistently indicate the intentional based motive or the distributional motive, since appropriateness nests those two approaches. However, this model can integrate additional observations; 46 subjects in

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[39] The estimation for the taste parameters of all other responders will again rely only on observed y corresponding to $x > 0$, since (8) is not defined for $y = 0$ and, more importantly, the setup of the game excludes choices for responders that yield $z > 0$.

[40] The difference between the mean parameters where $z \in (-\infty, 0)$ differ insignificantly across treatment conditions ($p = 0.79$, Wilcoxon rank-sum test, two-sided).

the experiment gradually alter responses consistently with the principle of appropriateness. When rejecting less unkind offers, they choose for proposers approximately the same amount as they receive, while they choose zero payoffs for proposers responding to very unkind offers. Nevertheless, there are other motives for fairness like social welfare or efficiency considerations as 36 responders behave inconsistently with the principle of appropriateness.

5. Conclusion

Along previous studies, this paper finds that fairness subsumes a large variety of motives (e.g., Charness & Rabin, 2002, Falk, Fehr & Fischbacher, 2003). The experimental results for the ultimatum-revenge game demonstrate that a single motive for fairness falls short of characterizing the behavior of responders sufficiently. The classification of subjects with respect to their mean response shows that there are responders who decide in accordance with inequity aversion, others decide in accordance with reciprocity, and some even indicate some efficiency considerations. Yet, for a majority of subjects, choices suggest a mix of the intention-based motive and distributional motive.

The individual data for a considerable number of responders show a gradual transition between both motives when rejecting several offers. That is, when treated mildly unkindly, they like to respond mildly unkindly, while strong unkindness leads to harsh reactions. I formalize this observation in the principle of appropriateness which predicts a non-positive relation between the perceived unkindness of the other person (i.e., the difference between the equal split of P and the offer in the ultimatum-response game) and the relative share of the own conflict payoff (i.e., z). Overall, the behavior of 118 out of 153 responders fit the predictions (12 selfish responders and 106 responders with a reciprocal, inequity averse or mixed taste parameters). For the remaining 36 responders, other motives like social welfare or efficiency may have influenced the decisions. In this sense, the principle of appropriateness is another sufficiently simple approach that hopefully grasps an important feature of fairness. Yet, I consider this principle as promising in the sense that it integrates a large body of pre-existing, alternative motives for fairness.

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Appendix: A. Instructions[41]

Thank you for participating in our experiment! In this experiment, you will make decisions with which you can earn money. How much you will earn depends on your decisions and the decisions of other participants. Please read these instructions very carefully. We kindly ask you to refrain from any public announcements and attempts to communicate directly with other participants during the experiment. If you violate this rule, we have to exclude you from this experiment. If you have any questions, please contact one of the persons running the experiment, he or she will come to your place and clarify your questions.

The decision task

In this experiment, you and another person will interact only once. Except for us, the experimenters, no participant is able to identify the other participant. At the beginning of the experiment, one of the two persons will be randomly selected as person *A*, the other person as person *B*. Person *A* receives an amount of 12 euros from the experimenter. Out of these 12 euros, she offers a proposal to person *B*. The proposal can be any amount between 0 and 12 euros. However, the proposal must be an amount in whole euros. If person *B* accepts the proposal, she earns the proposal. Person *A* earns the rest of the 12 euros (12 – proposal). If *B* rejects the proposal, she earns the half of the proposal[42] and

[41] This is the translation of the German instructions for the `high` condition. Differences in the `low` condition are marked by footnotes.
[42] "a quarter of the proposal".

decides on the amount person *A* will earn. This can be any amount from the remaining rest (between 0 and 12 – proposal/2).[43]

Example: Person *A* proposes 5 euros. If person *B* accepts the proposal, person *A* earns 7 euros (12 – 5). If person *B* rejects the proposal, person *B* earns 2.50 euros (proposal/2).[44] Then, person *B* determines the earnings of person *A*, choosing an amount between 0 and 9.50 (12 – 2.50) euros.[45]

The setup of the experiment

Before we start with the experiment, you will receive an electronic questionnaire which you have to fill in completely. The questionnaire helps you to understand the rules of the experiment. After all participants have completed the questionnaire correctly, you will be randomly selected as person *A* or person *B*. Then, person *A* has to decide on the proposal she will offer to person *B*. The proposal must be an amount in whole euros. At the same time, person *B* has to decide whether to accept or to reject for all possible proposals (0 euros, 1 euro,..., 12 euros), and, if rejecting an offer, which amount person *A* will earn. The possible proposals will be shown to person *B* in a random order. Please note that you cannot change your decision once you have confirmed it. Thereafter, we will ask person *B* which proposal she considers as fair and which proposal she expects to receive from person *A*. When each person *B* has decided on all possible proposals, we will select randomly and anonymously for each person *A* a person *B*. Payoffs for person *A* and

[43] "(between 0 and 12 – proposal/4)."
[44] "1.25 euros (proposal/4)."
[45] "0 and 10.75 (12 – 1.25) euros."

person B are determined by the proposal of person A and person B's decision, which she determined for the particular proposal beforehand. This means, that each decision of person B is relevant for the determination of the payoffs. At the end of the experiment, we will inform you of your payoff and ask you to answer a short socio-demographic questionnaire (your age, sex,...). Then you will receive your payoff privately; no other participant can see what you have earned.

Appendix: B. Questionnaire[46]

Please mark the correct answers for the following questions. They will help you to understand the rules of the experiment. Please note that there could be more than one correct answer, so that you have to mark in those cases more than one answer.

Question 1: Suppose person *A* offers 6 euros. Person *B* rejects. How much does person *B* earn? a. 1 euro b. 3 euros c. 6 euros[47]

Question 2: In the situation described in question (1), from which interval does person *B* choose person *A*'s payoff? a. 0 to 12 euros b. 0 to 6 euros c. 0 to 9 euros[48]

Question 3: Suppose person *A* offers 11 euros. Person *B* accepts. How much does person *A* earn? a. 1 euro b. 5.50 euros c. 11 euros

Question 4: Suppose person *B* receives a proposal of 0 euros and rejects the proposal. Which statement is correct? a. Person *B* earns 0 euros. b. Person *B* earns 0.50 euros. c. Person B chooses person *A*'s earnings from the interval 0 to 6 euros. d. Person *B* chooses person *A*'s earnings from the interval 0 to 12 euros.

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[46] This is the translation of the German questionnaire for the `high` condition. Differences in the `low` condition are marked by footnotes.

[47] "a. 0.50 euro b. 1.50 euros c. 6 euros"

[48] "a. 0 to 12 euros b. 0 to 6 euros c. 0 to 10.5 euros"