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Research report

# Emotions and cooperation in economic games

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**Abstract**

In this paper, we examine decisions to cooperate in economic games. We investigate which payoffs give players the greatest pleasure and whether the pleasure they feel about payoffs predicts their decisions to cooperate. To do this, we modify the ultimatum and dictator games by asking players to consider a fixed set of offers and report their preferences over all offers. Players also report the pleasure they imagine feeling from each possible payoff. Results show that players differ in the extent to which they derive pleasure from fairness or greediness. They also differ in the extent to which their choices depend on what we call "strategic" and "non-strategic" pleasure. Strategic pleasure is the expected pleasure of offers, whereas non-strategic pleasure is the pleasure of accepted payoffs. Players whose pleasure primarily depends on larger payoffs tend to make fair offers in the ultimatum game and selfish offers in the dictator game. They maximize strategic pleasure in the ultimatum game and non-strategic pleasure in the dictator game. Players who derive greater pleasure from fairness tend to act fairly in both games. These players maximize non-strategic pleasure. Brain imaging studies should address the question of whether the observed differences in pleasure and preference are systematically linked to differences in neurological activation.


*Theme:* Neural basis of behavior
*Topic:* Motivation and emotion

*Keywords:* Ultimatum game; Dictator game; Emotions; Affect; Cooperation

## 1. Introduction

Why do people cooperate? Is it a learned skill that is acquired from social and cultural expectations? Most communities have norms that both encourage and enforce cooperation. Or is cooperation largely genetic? Animals, as well as people, engage in cooperation. Bees collect pollen for the entire hive, birds warn other birds of nearby predators, and meerkats will guard a common nest. Presumably for both environmental and genetic reasons, we value and enforce cooperation. It has evolutionary benefits for the survival of a species [12]. Therefore, it is interesting to speculate about human and animal behavior when the enforcement of cooperation is impossible. Do people continue to help one another, even when violations cannot be detected?

Economists generally give a bleak answer to this question. From their perspective, human nature is driven by self-interest and opportunism. People "free ride" whenever they can get away with it. Fortunately for us, economic predictions are often inaccurate, and real-world behavior is less grim. People often cooperate, collaborate, offer assistance, and lend a hand, even when both parties have no history and no expectation of future interaction. Tipping, for example, is fairly common, even with patrons who are visiting distant establishments and will never return again [21]. What drives cooperation in these cases?

## 2. Economic games

Economic games provide one avenue for studying cooperation and the factors that encourage it. Over the last several decades, economic games have become a central tool for exploring behavior, in part because of the simplicity

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of the normative solutions and, in part, because of a desire to understand what people really do. Consider the ultimatum game. In the most common form, people are paired off and assigned to the role of proposer or responder at random. The proposer is given a sum of money, often $10, and is told to divide it between himself and the responder. The responder can either accept the offer, and the money is divided accordingly, or reject it, and both players receive nothing. The normative solution for the ultimatum game is for the proposer to offer a token amount (such as 1¢) and for the responder to accept that amount because "something is better than nothing".

Güth, Schmittberger, and Schwarze [17] were the first to test this prediction, and, in the process, they demonstrated two fascinating results. First, proposers tended to give responders far more than economic theory predicted. In fact, the most common offer among the proposers was an even split. Second, the responders were unwilling to accept offers than left them with approximately 20% or less. That is, the vast majority of responders refused to take money in order to punish greedy proposers.

Hundreds of studies followed. Researchers varied the number of games played, the anonymity of players, the size of the stakes, and the populations of players. They found that proposers offered slightly less in repeated games than in one shot games [6,23,32]. Anonymous proposers were slightly greedier than proposers who interacted with responders [18]. Raising the stakes from $10 to $100 had relatively little effect on proposers' offers or responders' rejection rates [19]. Finally, players behaved in similar ways across a wide range of cultures. Of course, there were some exceptions. Players made and accepted offers of less than 20% in Boliva and Peru, and players made offers of up to 70% in Papua New Guinea (see [9] for a review). Yet despite these exceptions, the findings of Güth, et al. were remarkably robust.

Cooperation is certainly not limited to laboratory settings. Many people voluntarily assist others. Firms, for example, set up health care and retirement programs for their employees. Governments often establish welfare programs for the sick, disabled, and poor. Churches provide help to the less fortunate members of their communities. Such behavior may, indeed, be self-serving. Firms can hire better employees when they increase the perks, and governments may reduce future costs of crime and/or health care. But not all cooperative behavior can be written off as self-serving. Some people, for example, make large and anonymous donations to charitable causes, simply to improve the lives of others.

The enforcement of cooperative norms can also be found in the real world. Some people forego tangible benefits to punish those who treat them unfairly (e.g., [11]). Consumers avoid buying goods from firms they perceive as unfair. Some will even pay higher prices or drive longer distances to punish those firms. Workers forego wages when they decide to strike, and management foregoes profit when they refuse to bargain. In short, both cooperation and punishment are real economic anomalies [10,36].

## 3. Explanations for cooperation

What theories can explain these anomalies? Two hypotheses have been proposed, each of which embodies a different view of human nature. The first asserts that people have a taste for fairness [16]. They prefer to operate in a world where they can treat others fairly and be treated fairly. From this perspective, proposers would act fairly and responders would reject unfair offers to punish those who refuse to cooperate.

Formal accounts of this hypothesis have taken a variety of forms. Some theorists replace payoffs (or personal utilities) with social utilities. People care about their own payoffs, as well as their payoffs relative to the other player [5,14,24]. Others assert that players' choices depend on assumptions about the likely actions of others. Rabin [31] proposed the idea of a fairness equilibrium in which individuals are motivated to help those who help them and to hurt those who hurt them. If responders view low offers as attempts to hurt them, they will retaliate by rejecting low offers—even at a cost to themselves. Empirical support comes from Ruffle [33] who showed that when the size of the overall stake was determined by the responder's performance on a quiz, proposers rewarded responders who performed better.

The second hypothesis is based on a more sophisticated form of selfishness. Players are assumed to cooperate because they are aware of the "irrationality" of other players. That is, they realize that unfair offers may be rejected, so they maximize their expected payoffs and, in the process, appear to be acting fairly [37]. This strategic explanation has largely focused on the behavior of proposers, leaving unanswered the question of why responders reject positive offers.

Which hypothesis best describes the data? To test the relative merits of the hypotheses, researchers have devised new games. In one case, players divided chips rather than money, with each chip worth a different amount to each player. When chips were worth more to the proposer than the responder and both players were aware of it, proposers tended to offer equal monetary splits. However, when proposers, but not responders, were aware of the differential value of the chips, proposers tended to divide chips equally, thereby favoring themselves [13,20,29]. These studies suggest that proposers may be more concerned with the *appearance* of fairness than with actual fairness.

Other tests between the hypotheses have relied on other games, such as the dictator game. This game is similar to the ultimatum game, except it removes incentives for strategic behavior. If players still act fairly, they must have a taste for fairness. Two players are randomly assigned the role of the dictator or the recipient. The dictator is given a sum of money with the charge of dividing it between himself and the recipient. The recipient must accept the offer, so dictators have no

concern about rejection.[1] Results from dictator games show a mixture of fairness and selfishness. Some dictators offer 0%, others offer 50%, and the rest fall somewhere in between [15].

## 4. Emotions in economic games

Emotions are important predictors of cooperation, and recent work has begun to explore the emotions of players in the ultimatum game. Pillutla and Murnighan [30] measured the feelings of responders when confronted with unfair offers in order to predict their tendency to reject. Feelings of anger were positively correlated with the tendency to reject. Other researchers showed that when responders were treated unfairly, they felt not only anger, but sadness, irritation, and contempt [7]. In a recent and novel study, Sanfey et al. [34] used functional magnetic resonance imaging to monitor the brain activity of responders while playing ultimatum games. Those who showed greater activation in the bilateral anterior insula, a part of the brain associated with negative emotions, were more likely to reject unfair offers. Those who showed greater activation in the dorsolateral prefrontal cortex, an area linked to problem solving and cognitive conflict, were more likely to accept unfair offers.

The interest in emotions has extended to individual decisions, as well as economic games. Numerous theories have been developed to account for the effects of emotions on individual choice [2,3,25,26]. Mellers, Schwartz, and Ritov [28] proposed that individuals select options that maximize their expected pleasure. In this paper, we continue our efforts to explain choices with emotions in economic games and focus primarily on proposers and dictators. We assume that preferences are based on tradeoffs between the expected pleasure of offers (a form of strategic pleasure) and the pleasure of accepted payoffs (a form of non-strategic pleasure). To test this idea, we will modify the ultimatum and dictator games.

## 5. Measuring pleasure, beliefs, and preferences in economic games

Consider an ultimatum game with stakes of $10. Proposers can make any offer they wish in units of $1. Proposers are also asked to imagine the pleasure they would feel with each possible payoff (i.e., $0, $1, $2). They rank order their preferences over offers, and finally, they draw inferences about the emotions and actions of the other player. The combination of pleasure judgments and preference orderings allows us to test the fairness explanation versus the sophisticatedly strategic explanation.

Suppose that the pleasure of an offer depends on tradeoffs between fairness and greediness. Furthermore, suppose that preferences over offers are based on tradeoffs between strategic and non-strategic pleasure. Strategic pleasure, which varies with beliefs about the other player's actions, is the expected pleasure of an offer (either accepted or rejected). Non-strategic pleasure is the imagined pleasure of an accepted offer.

What would we expect from proposers with a taste for fairness? These players would derive greater pleasure from fair offers than greedy offers, regardless of the game. Furthermore, these players would not behave strategically. Instead, their preferences would be based on their direct feelings about accepted offers. This pattern is illustrated in Fig. 1 in which the rank order of pleasure judgments (solid line) and the rank order of preferences (dashed line) are presented against the proposer's payoffs. The greatest pleasure comes from fair offers of $5. Pleasure and preference decline as inequalities grow.

What would we expect from sophisticatedly selfish proposers? For both games, these players would derive greater pleasure from larger payoffs than from fair payoffs, as shown in Fig. 2. Preferences in the ultimatum game would be predictable from strategic pleasure or the expected pleasure of offers. For a wide range of beliefs about responders' rejections, predicted preferences based on the expected pleasure of offers would resemble the dashed line in Fig. 2.[2] Preferences in the dictator game would be predictable from the non-strategic pleasure or the pleasure of accepted offers. Since those feelings are largely selfish, preferences would follow the same pattern.

## 6. Tradeoffs in pleasure and preferences

Figs. 1 and 2 are extreme stylized patterns; we would not expect players in either the ultimatum or the dictator games to have feelings or preferences with precisely those shapes. Instead, we suggest that the pleasure of a payoff is a tradeoff between fairness and selfishness as follows:

$$P_{ij} = w_{Fi} * F_j + (1 - w_{Fi}) * S_j, \quad (1)$$

where $P_{ij}$ is the rank order of person $i$'s pleasure with payoff $j$, $w_{Fi}$ is a relative weight of fairness, $F_j$ is the rank order of payoff $j$ based on pure fairness, and $S_j$ is the rank order of payoff $j$ based on pure selfishness.

Fig. 3 shows three patterns that could arise from Eq. (1). When the weight of fairness is zero ($w_F = 0$), the pleasure of payoffs increases directly with outcomes. When the weight of fairness is one ($w_F = 1$), an equal payoff provides the greatest pleasure. When pleasure is a combination of these tendencies (e.g., $w_F = 0.5$), equal payoffs provide the

[1] Since receivers have no veto power in the dictator game, the dictators' offers are technically decisions (rather than formal games).

[2] There are other reasons why proposers with selfish feelings would act fairly. We cannot rule out the possibility that they behave fairly based on moral or ethical grounds, rather than the strategic pleasure of offers.

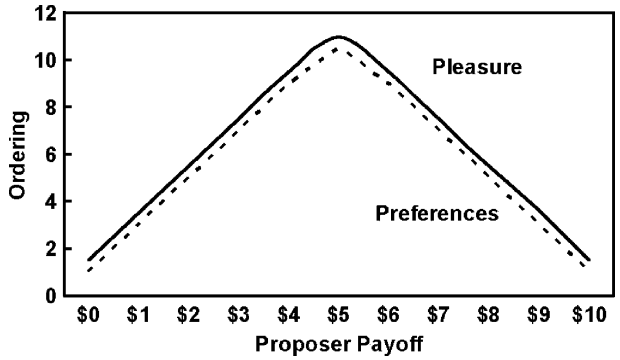


Fig. 1. Hypothetical patterns of preferences (dashed line) and pleasure (solid line) shown against proposer payoffs for proposers with a taste for fairness.

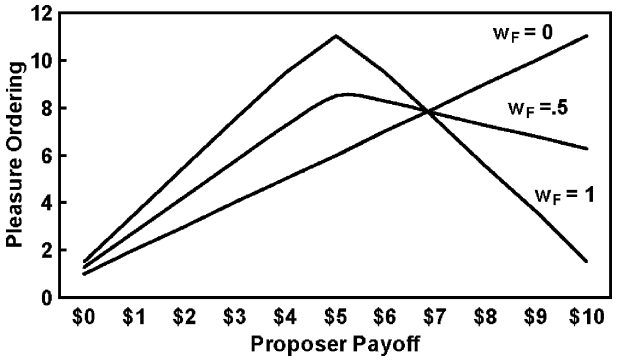


Fig. 3. Predicted pleasure orderings if pleasure is a tradeoff between fairness and selfishness. The three curves show pleasure orders with different weights for fairness.

greatest pleasure, followed by unequal payoffs that benefit the decision maker. The asymmetry often found in fairness judgments can arise from a tradeoff between a desire to be fair and a desire to be greedy.

Like pleasure judgments, preferences or choices over offers are tradeoffs between strategic pleasure (the expected pleasure of offers) and non-strategic pleasure (the pleasure of accepted offers). This tradeoff is expressed as:

$$C_{ij} = w_{Pi} * P_{ij} + (1 - w_{Pi}) * \mathrm{EP}_{ij}, \quad (2)$$

where $C_{ij}$ is the choice order of offer $j$ for proposer $i$, $w_{Pi}$ is the relative weight of pleasure (for proposer $i$), $P_{ij}$ is the rank order of pleasure for payoff $j$, and $\mathrm{EP}_{ij}$ is the rank order of expected pleasure for offer j, and is:

$$\mathrm{EP}_{ij} = s_{ij} * P_{ij} + \left(1 - s_{ij}\right) * \mathrm{PR}_i, \quad (3)$$

where $s_{ij}$ is proposer $i$'s subjective belief (measured as a probability from 0 to 1) that a responder will accept offer j and $\mathrm{PR}_i$ is displeasure if proposer $i$'s offer is rejected. In the dictator game, players have no reason to be strategic. The subjective belief that a receiver will accept any offer is 1.0, so choices would be a direct function of the pleasure of accepted offers (i.e., $\mathrm{EP}_{ij} = P_{ij}$ in Eq. (3), and $C_{ij} = P_{ij}$ in Eq. (2)).

This framework allows players to differ in their tradeoffs regarding (1) what gives them pleasure and (2) how pleasure influences their choices. For example, a player could derive pleasure from being fair or being selfish, and that same player's preferences could depend on the pleasure of payoffs (i.e., non-strategic feelings) or the expected pleasure of offers (i.e., strategic emotions that are sensitive to beliefs about the other player's actions). As we shall see, there is a correlation between the source of pleasure and the way in which pleasure influences choice. We will now describe the results of two experiments, an ultimatum game and a dictator game, that test this framework for predicting pleasure and preference in economic games.

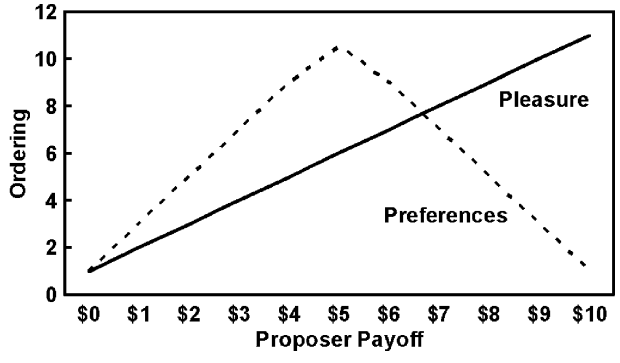


Fig. 2. Hypothetical patterns of preferences (dashed line) and pleasure (solid line) shown against proposer payoffs for proposers who are sophisticatedly selfish.

## 7. Experiment 1: ultimatum game

Pairs of participants played the ultimatum game with stakes of $10. Proposers reported their preferences over an entire set of offers, judged the pleasure they would feel if each offer was accepted (and rejected), rated the pleasure they imagined the responder would feel, and estimated the probability the responder would accept each offer. We asked responders to answer a similar set of questions, but these results will not be presented here.

### 7.1. Method

#### 7.1.1. Stimulus materials and procedure

Each participant was randomly assigned to the role of proposer or responder and given a packet of materials. Instructions for proposers stated that the participant had been randomly paired with another participant (person X), and that he or she should allocate $10 between himself or herself and the other participant. There were 11 potential offers (in dollar units) ranging from $10 to $0. Proposers were told that responders could accept or reject the offer. If X accepted, the $10 would be divided accordingly, and if X rejected, both parties would receive nothing.

As mentioned above, proposers completed four tasks. First, they rated their feelings of pleasure about each possible payoff, as well as the disagreement point of $0/$0. Responses were on a scale from −8 to 8, where −8

represented feeling extremely unhappy, 8 represented feeling extremely happy, and 0 represented feeling neither happy nor unhappy. Next, they were asked to predict how X would feel about the same payoffs. Then, proposers ranked their preferences over offers from 1 to 11, with 1 being the actual offer made to X. Finally, they estimated the probability that X would accept each offer in percentages that ranged from 0% to 100%, with 0% labeled as absolutely unacceptable and 100% labeled as absolutely acceptable.[3]

When finished, participants gave their packets to the experimenter. The experimenter randomly paired a proposer with a responder, although neither person knew the identity of the other. Money was paid as per the instructions. After receiving their payments, participants indicated how they felt about the payoff they received on the same happiness scale used earlier.

#### 7.1.2. Participants

Eighty undergraduate business students from the University of California at Berkeley were recruited from introductory marketing, organizational behavior, and managerial decision making classes. Researchers informed the students at the beginning of class that they had the opportunity to earn up to $10 in a decision making task that would last approximately 10 to 15 min. and would occur immediately after the class.

### 7.2. Results

#### 7.2.1. Offers, rejections, and beliefs about rejections

Frequencies of "most preferred" offers are presented in Fig. 4. Accepted and rejected offers appear in black and white, respectively. The modal offer was $5, and the average offer was $4.60. Only 3 of the 40 offers were rejected. These results are generally consistent with past research.

Fig. 4 shows that the most preferred offers of proposers were fair offers. To investigate whether proposers preferred fair offers across the entire set of allocations, we computed the correlation between each proposer's observed preference order and the ordering based on strict fairness. Correlations ranged from 0.13 to 1.0, with a median value of 0.65. Although some proposers became more self-serving after the initial offer, the vast majority tended to prefer fair offers across the entire set.

We now turn briefly to the responders. The black bars in Fig. 5 show rates of rejection, plotted against offers. Ninety-two percent of responders rejected offers of $0, and the majority said they would reject offers of $1 or $2. Perhaps more surprising is the fact that many responders rejected offers that benefited themselves, a pattern recently reported by Bahry and Wilson [1]. As many as 29% of responders said they would reject an offer that gave them $10.

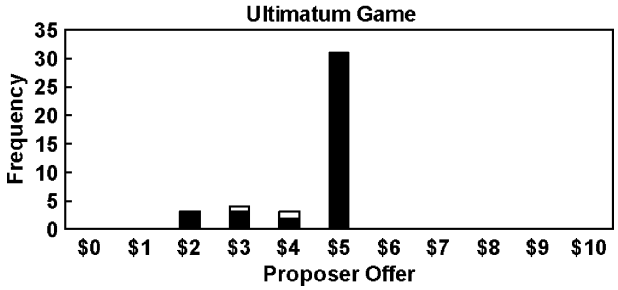


Fig. 4. Frequencies of proposer offers in the ultimatum game. Black bars show accepted offers and white bars show rejected offers.

Responders were also inclined to maintain at least some degree of equality.

The gray bars in Fig. 5 show proposers' beliefs about responders' rates of rejection. Proposers believed that responders were more likely than not to reject all offers less than $5. Beliefs followed the same pattern as actual rejection rates and the correlation between subjective and objective rejection rates was 0.94.[4] There was, however, a tendency on the part of proposers to think that rejections were more likely than they actually were. Proposers overestimated actual rejection rates by an average of 18% [$t(10) = 5.63$].

#### 7.2.2. The pleasure of outcomes

To distinguish between the fairness and strategic explanations of the fair offers, we now turn to the judgments of pleasure. To what extent did proposers derive pleasure from acting fairly? We converted each proposer's pleasure judgments into rankings and correlated those ranks with the ordering based on strict fairness. The source of pleasure varied considerably across proposers. Fig. 6 presents frequencies of individual correlations. The distribution is positively skewed and ranges from 0 to 0.64, with a median value of only 0.11.[5] That is, the majority of proposers derived relatively little pleasure from fair payoffs.

Although the correlations in Fig. 6 vary along a continuum, we divided them into three groups of proposers to highlight the individual differences. One group included proposers for whom the correlations between pleasure and fairness were 0.0 (black bar). The second included those for which the correlations ranged from 0.1 to 0.4 (gray bars), and the third included proposers with statistically significant correlations of 0.5 or greater (white bars). Approximately 25% of proposers derived no pleasure from fairness, 65% derived some pleasure from fairness, and 10% derived significant pleasure from fairness.

We now show median pleasure and preference orders of proposers whose fell into the two most extreme groups in the next two figures. Fig. 7 displays proposers who derived no pleasure from fairness. Pleasure ranks are solid blank

[3] In other studies, we have varied the order in which players performed the tasks. We have measured preferences that have both preceded and followed pleasure ratings. We find no significant effects of order.

[4] All significance tests were conducted at a 0.05 alpha level.

[5] Responders' correlations between fairness and pleasure are virtually identical to those of the proposers.

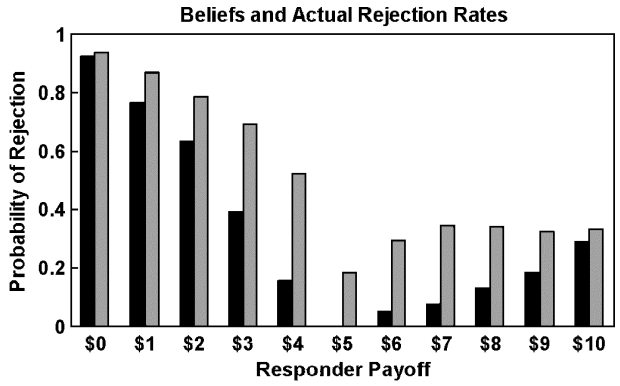


Fig. 5. Rejection rates shown against responder payoffs. Black bars are actual rejection rates, and gray bars are average proposer beliefs about rejection.

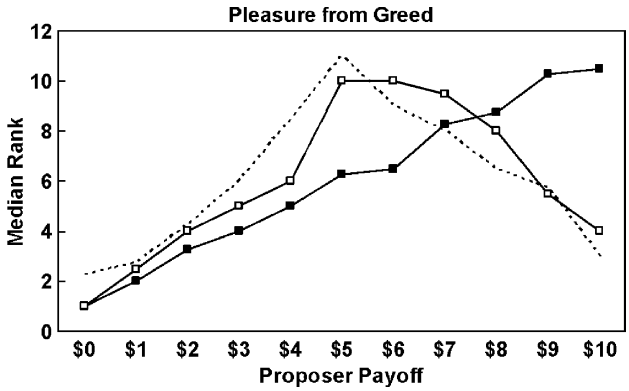


Fig. 7. Median ranks of pleasure (solid black points), preference (white points), and expected pleasure (dashed line) for proposers who derived pleasure from greed (i.e., those shown in Fig. 6 with the black bar).

points and preference ranks are open points. The most pleasurable offer has the largest payoff. The most preferred payoff is $5, followed by $6, $7, $8, $4, and so on. Preference orders differ from pleasure orders.

To examine whether preferences resemble the ordering based on strategic pleasure or the expected pleasure of offers, we computed the ranking based on the expected pleasure of offers for each proposer. The rank of the median order is shown in Fig. 7 as a dashed line. If proposers maximized expected pleasure, their most preferred payoff would be $5, followed by $6, and so on. Preferences generally follow the predictions based on expected pleasure. Furthermore, individual correlations between observed preferences and predictions based on the expected pleasure of offers ranged from −0.1 to 1.0, with a median value of 0.8. In sum, these proposers, whose pleasure comes from larger payoffs, tend to make choices that are consistent with the expected pleasure of offers. They appear to act fairly for strategic reasons.

Fig. 8 shows the median ranks of pleasure and preference for proposers who derived the most pleasure from fair offers. Once again, pleasure ranks are solid black points, preference ranks are open points, and predicted ranks based on expected pleasure are a dashed line. Pleasure ranks and preference ranks are remarkably similar. These proposers may have a taste for fairness and base their choices on the pleasure they experience when they behave fairly. Individual correlations between preference and non-strategic pleasure ranged from 0.5 to 0.9 with a median of 0.7. Alternatively, these proposers might be sophisticatedly selfish because their preferences also resemble the predicted order based on expected pleasure (i.e., the dashed line). Correlations between preference and strategic pleasure (ranks based on expected pleasure) ranged from 0.1 to 0.9 with a median of 0.5. Although preferences were better predicted by the pleasure of payoffs, both explanations remain viable.

### 7.2.3. Summary

Most proposers made fair offers in the ultimatum game, but the reasons behind those fair offers appeared to vary. The majority of proposers (90%) either derived no pleasure or only slight pleasure from fair offers. Their preferences over offers were consistent with the expected pleasure of offers. For these players, cooperation was strategic. However, about 10% of the proposers derived greater pleasure from fair payoffs than from larger payoffs. These players

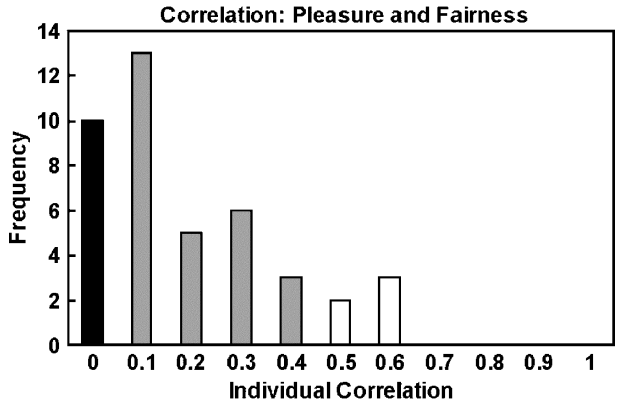


Fig. 6. Frequencies of correlations between each proposer's pleasure ordering in the ultimatum game and the order based on strict fairness. Different colored bars represent three groups of proposers.

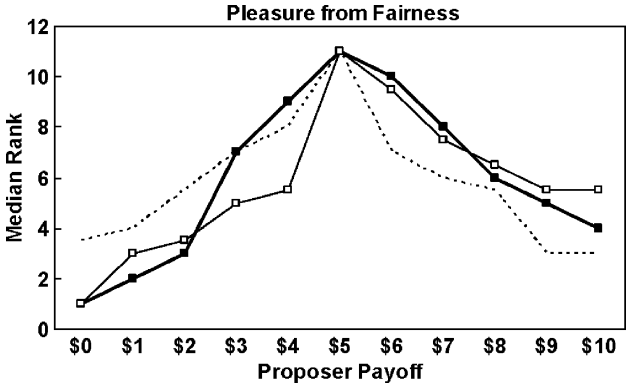


Fig. 8. Median ranks of pleasure (solid black points), preference (white points), and expected pleasure (dashed line) for proposers who derived more pleasure from fairness than from greed (i.e., those shown in Fig. 6 with the white bars).

had preferences that were consistent with both the pleasure of payoffs and the expected pleasure of offers. The cooperation these players displayed may have been due to a taste for fairness or from sophisticated selfishness. To find out which explanation is better, one needs to examine preferences and pleasure in the dictator game. Experiment 2 does exactly that.

## 8. Experiment 2: dictator game

This experiment was similar to the ultimatum game, except that recipients had no opportunity to reject offers, so there was no reason for dictators to behave strategically.

### 8.1. Method

#### 8.1.1. Stimulus materials and procedure

Participants were randomly assigned to the role of dictator or recipient and given a packet. Dictator packets informed participants that they had been randomly paired with another participant (person X), and that they were to allocate $10 between themselves and X. Once again, there were 11 possible allocations. Money would be allocated according to the dictator's decision. Both players then completed four tasks. Dictators judged the pleasure they imagined feeling with each outcome, as well as the allocation $0/$0. Then they predicted how X would feel about the same allocations. Third, they ranked their preferences for the allocations from 1 to 11, with 1 being the actual offer made to X. Finally, they were told to imagine what X would do if he or she had the opportunity to reject an allocation (and if they did so, both would receive $0) and estimate the probability that X would accept each allocation with a percentage from 0 to 100 (with 0 = Absolutely Unacceptable and 100 = Absolutely Acceptable). Recipients completed a similar set of tasks, though we focus only on dictators here.

Once all packets were completed, the experimenters randomly paired players to determine the payoffs. Neither player knew the identity of the other. Money was paid as per the instructions. After receiving their earnings, all players indicated how they felt about their payoff on the same happiness scale used in previous sections.

#### 8.1.2. Participants

Eighty-six undergraduate business students served as participants.

### 8.2. Results

#### 8.2.1. Offers

The distribution of offers in the dictator game can be seen in Fig. 9. Compared to the ultimatum game, offers are lower and more variable. The distribution is bimodal, with peaks at $5 and $10, and other offers falling inbetween. The

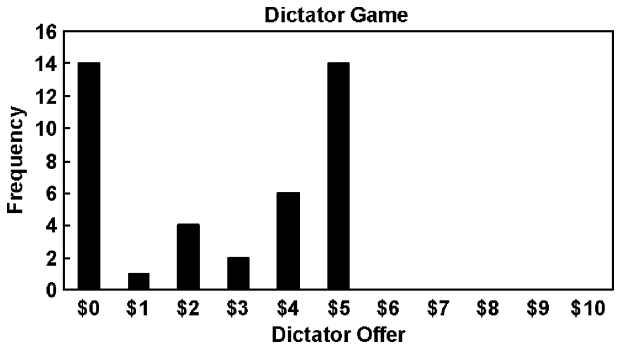


Fig. 9. Frequencies of dictator offers in the dictator game.

average offer was $2.64, significantly lower than the average offer of $4.60 in the ultimatum game [$t(82) = 5.44$]. Proposers were less cooperative without the fear of retaliation.

To examine preferences over the entire set of offers, we computed the correlation between each dictator's preference order and the order based on strict fairness. Correlations ranged from 0 to 1.0, with a median of 0.22, much lower than those in the ultimatum game with a median of 0.64.

Next, we examined the extent to which dictators derived pleasure from fairness. For each dictator, we converted pleasure judgments to ranks and then computed the correlation between pleasure rankings and the rank order based on strict fairness. Fig. 10 shows the distribution of correlations. Values range from 0 to 1.0, with a median of 0.04, similar to the median of 0.11 found in the ultimatum game. The vast majority of players derived relatively little pleasure from fairness.

We divided the distribution into three groups of dictators based on the magnitudes of their correlations between pleasure and fairness. Those groups appear in Fig. 10, shown with black, gray, and white bars. Approximately 55% of dictators derived no pleasure from fairness, 30% derived some pleasure from fairness, and 15% felt significant pleasure from fairness. We now examine pleasure and preference orders for the two most extreme groups.

Fig. 11 shows median pleasure ranks with solid black points and median preference ranks with open points for those who derived no pleasure from fairness. Both preferences and pleasure increased monotonically with payoffs. These dictators enjoyed larger payoffs, and their preferences were consistent with their feelings of pleasure. Individual correlations between preference and pleasure ranged from −0.1 to 1.0, with a median value of 0.9.

Fig. 12 shows median pleasure ranks with solid black points and median preference ranks with open points for those with significant pleasure from fair offers. Both preferences and pleasure peak at equality. These dictators tended to make fair offers, even when they had no strategic reason to do so. Individual correlations between preference and pleasure ranged from 0.5 to 1, with a median of 0.8. Results demonstrate that some dictators have a taste for fairness and suggest that some proposers in the ultimatum

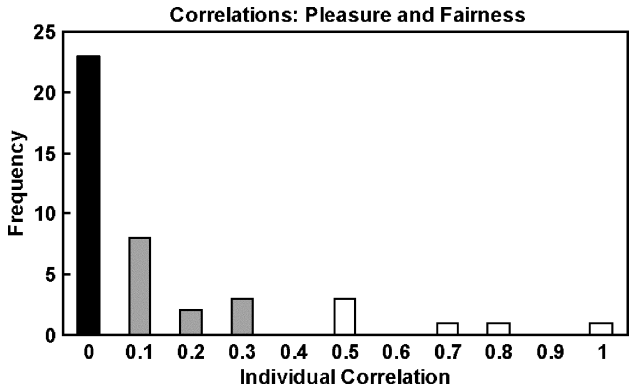


Fig. 10. Frequencies of correlations between each dictator's pleasure ordering in the dictator game and the order based on strict fairness. Different colored bars represent three groups of dictators.

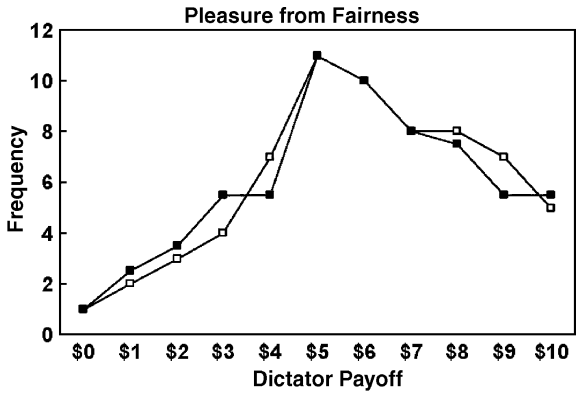


Fig. 12. Median ranks of pleasure (solid black points) and preference (white points) for dictators who derived more pleasure from fairness than from greed (i.e., those shown in Fig. 10 with the white bars).

game with fair preference and pleasure ranks (Fig. 8) may also have had a taste for fairness.

*8.2.2. Summary*

Average offers in the dictator game ($2.64) were less generous than those in the ultimatum game ($4.60). The majority of dictators (85%) derived either no pleasure or relatively little pleasure from fair payoffs. Their enjoyment came primarily from larger payoffs, and their preferences over payoffs maximized their most positive feelings. However, some dictators (15%) derived greater pleasure from fair payoffs than from large payoffs. They also had fair preferences, despite the lack of incentives. For virtually all dictators, preferences were a direct function of pleasure. However, there were pronounced individual differences in what provided dictators with pleasure.

## 9. General discussion

The intent of this research was to broaden our understanding of how emotions associated with possible payoffs predict cooperative behavior. We proposed a framework in which pleasure is viewed as a tradeoff between self-interest and fairness. Preferences over offers are also viewed as a tradeoff between the direct pleasure of payoffs (non-strategic feelings) and the expected pleasure of offers (strategic feelings that take into account beliefs about the other player's actions). We found individual differences in both pleasure and preference. Players differed in terms of what gave them pleasure and how pleasure influenced their choices.

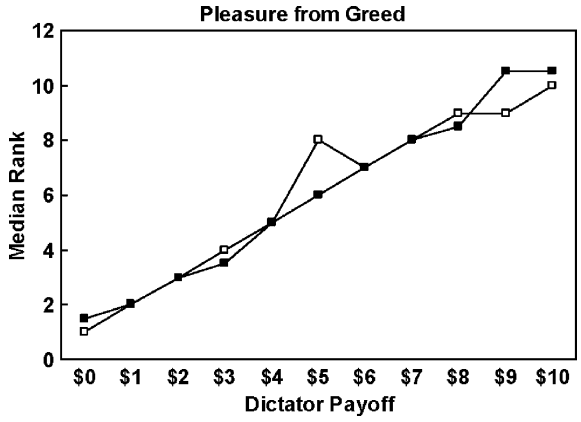


Fig. 11. Median ranks of pleasure (solid black points) and preference (white points) for dictators who derived pleasure from greed (i.e., those shown in Fig. 10 with the black bar).

We hypothesized that sophisticatedly selfish proposers, who were aware that others might not be rational, would derive greater pleasure from large payoffs than fair payoffs. In the ultimatum game, these proposers would maximize the expected pleasure of offers, and in the dictator game, they would maximize the direct pleasure of payoffs. In addition, proposers with a taste for fairness would derive greater pleasure from fair offers than large offers. These proposers would make fair offers regardless of the game because fair offers provided them with the greatest pleasure.[6]

The majority of players in both games fell somewhere between these two extremes. Their feelings of pleasure reflected a tradeoff between fairness and selfishness. In the ultimatum game, these players tended to make offers that were consistent with the expected pleasure of offers. In the dictator game, their offers were consistent with their direct feelings of pleasure about payoffs. For the most part, these players appeared to act fairly in the ultimatum game for strategic reasons. Although these players were not entirely "rational", their feelings and choices were generally consistent with the hypothesized patterns.

*9.1. Comparisons with other theories*

Social utility theories assume that people incorporate both absolute and relative payoffs in their utility functions.

[6] In other studies, we have used within-subject designs to examine whether those with a taste for fairness in the ultimatum game also have a taste for fairness in the dictator games. Results confirm that these players are generally consistent in their feelings and actions across games.

Such comparisons also occur in the emotional reactions to payoffs, which can, and often do, differ from utilities [27]. We use feelings of pleasure to represent social utilities and assume that they reflect a balance between acting selfishly and acting fairly. Our approach is similar in spirit to those of others [5,14,24], except that we allow different tradeoffs to occur in what provides players with pleasure and how their feelings of pleasure influence choice.

Inference theories, such as Rabin's [31] fairness equilibrium, rest on the assumption that one's tendency to cooperate depends on beliefs about the other player's behavior. Rabin proposes that people are motivated to help those who would help them and hurt those who would hurt them. Our framework, though different from Rabin's, is also sensitive to inferences about other players' actions and feelings. To the extent that players' preferences depended on strategic pleasure, their choices were influenced in part by their beliefs about the other player's likely actions.

By examining proposers' beliefs about responders' actions and proposers' forecasts about responders' feelings, we were able to construct the mental models that proposers used. Proposers and dictators who derived greater pleasure from selfishness than fairness tended to assume that responders would feel the same way. These proposers tended to think that responders would accept offers that benefited themselves. Similarly, proposers and dictators who derived greater pleasure from fair offers than selfish offers tended to assume that responders would feel the same way. These proposers also believed that responders would reject extreme inequality in either direction. In short, individual differences in judgments of pleasure were correlated with inferences about the imagined feelings and actions of other players.

A number of studies (e.g., [4,22,29,35]) have noted the existence of individual differences in economic games that may be related to fair and strategic play. Brandstätter and Königstein [8] examined the personality correlates of selfish and fair behavior. They found that traits such as independence and tough-mindedness were linked to selfishness, while traits such as emotional stability and extroversion were related to fairness. As previously noted, Sanfey et al. [34] found associations between neurological activity and the tendency to reject in responders playing in the ultimatum game. Sanfey et al. also demonstrated a relatively wide range of activations, even across participants who rejected the same proportion of offers (see Fig. 3 on page 1757). Future studies of the neurological activations of proposers are likely to reveal still other patterns of individual differences. These correlates may be useful in predicting who will truly be fair in economic games and who will behave selfishly.

Many questions remain unanswered. What factors might increase the relative proportions of players with a taste for fairness? Do positive moods lead to greater pleasure from fairness? Do negative moods such as anger lead to greater pleasure from greediness? How does the size of the stakes influence the imagined pleasure of payoffs? And what cross-cultural differences occur in pleasure ratings? Answers to these questions will provide a richer picture of human behavior in economic games.

In conclusion, cooperation can be represented in terms of tradeoffs in pleasure and preference. The pleasure of payoffs is a good predictor of cooperative behavior. Those who derive pleasure from acting fairly are more likely to cooperate, regardless of the game. Those who derive greater pleasure from large payoffs are equally likely to cooperate in the ultimatum game, but less likely to cooperate in the dictator game.

Our research shows that some players are sophisticatedly selfish, others have a taste for fairness, but the vast majority fall somewhere between these two extremes. Whether pleasure from fair offers simply correlates with cooperative behavior or whether it causes cooperative behavior is a question for future research. We do know, however, that the greater the pleasure one derives from fair behavior, the more likely one is to cooperate.

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