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Ian McDonald
Nikos Nikiforakis
Nilss Olekalns
Hugh Sibly

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Department of Economics
The University of Melbourne
Parkville VIC 3010
www.economics.unimelb.edu.au

Social Comparisons and Reference Group Formation: Some Experimental Evidence*

Ian McDonald, Nikos Nikiforakis, Nilss Olekalns and Hugh Sibly†

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Abstract

We investigate reference group formation and the impact of social comparisons on ultimatum bargaining using a laboratory experiment. Three individuals compete in a real-effort task for the role of the proposer in a three-player ultimatum game. The role of the responder is randomly allocated. The third individual receives a fixed payment - our treatment variable - and makes no decision. The existence of a non-responder has a dramatic effect on bargaining outcomes. In the most extreme treatment, more than half of the offers are rejected. Behavior shows individuals exhibit self-serving bias in the way they define their reference groups.

JEL Classification: C78, C91, D63

Keywords: social comparisons, ultimatum bargaining, laboratory experiments, self-serving bias, real-effort.

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†McDonald, Nikiforakis and Olekalns: Department of Economics, The University of Melbourne, Victoria 3010, Australia; Sibly: School of Economics and Finance, University of Tasmania

1 Introduction

Economic theories are often founded on the assumption that individuals maximize utility without regard for the utility of others. However, the accuracy of this assumption is questioned by some anthropologists and social psychologists. They argue that individuals often compare themselves with relevant others and that this affects their decisions (e.g. Festinger, 1954; Olson, Herman, and Zannan, 1986). These social comparisons may have important implications for a range of economic issues such as labor supply (Neumark and Postlewaite, 1998), saving and consumption decisions (Abel, 1990), optimal taxation (Frank, 1985), migration (Stark and Taylor, 1991), wage determination (Frank, 1984; Babcock and Loewenstein, 1997) and performance (Torgler and Schmidt, 2007; Torgler, Schaffner, Frey, Schmidt, and Dulleck, 2008).

To date, the evidence on the importance of social comparisons comes primarily from the field. A number of studies have found that as the income of a reference group increases, the self-reported levels of happiness decrease (see Clark, Frijters and Shields, 2008). However, using only field data to evaluate the impact of social comparisons has limitations. In order to identify the presence of a social-comparisons effect, information is required about (1) the individuals' relevant reference groups, (2) the variables of interest (e.g. salary), (3) the information individuals have, and (4) when this information reaches individuals. Field datasets typically lack this level of detail.[1] Further, even if one was to obtain such a detailed dataset, it would be difficult to preclude the possibility that what appears to be a social-comparisons effect in the field is in fact the product of strategic reasoning.[2] For these reasons, one cannot safely conclude from field data that social-comparisons exist and are of economic significance.

In this paper we present results from a laboratory experiment using a game especially designed to investigate reference group formation and the existence and significance of social comparisons. The advantage of collecting data from a laboratory experiment is that apart from containing the necessary level of detail one can also ensure that strategic considerations are not driving behavior.

As a testing ground, we use a new three-player ultimatum game. Similar to the

[1] This is reflected on the fact that virtually all studies using field data have relied on hypothetical reference groups, imperfect information about the timing of the information arrival and on the assumption that group formation is exogenous. For a detailed discussion see Clark et al. (2008).

[2] For example, consider wage negotiations. If delays in negotiation are more costly for an employer than for her employees, it might pay for the latter to claim that the employer's offer is unfair and that other "equally qualified" employees have received higher offers.

standard two-player ultimatum game, a proposer must divide a fixed sum of money with a responder who decides whether to accept or reject the suggested division. A rejection results in zero payments for both players. Our game, however, differs from the standard ultimatum game in that the game also includes an additional (third) participant, the non-responder. As the name suggests, the non-responder makes no decisions and receives a fixed payment regardless of the bargaining outcome achieved by the proposer and responder. The non-responder's payment is our treatment variable.

Festinger (1954), who coined the term "social comparisons", suggests that a person's reference group consists of people who are "close to [their] own ability" (p. 121). For this reason, roles in the experiment are allocated through a real-effort task; the most efficient at this task becomes the proposer, the other participants are randomly allocated the roles of responder and non-responder. As the responder and non-responder are only informed about the fact that they were not the most efficient, but not about their relative performance, the real-effort task has the potential to establish a potential peer relation between them.

If both proposer and responder in our experiment are purely self-regarding, then the equilibrium outcome in both the two-player and the three-player ultimatum game involves the proposer offering the smallest possible amount to the responder who would then accept the offer. Experimental evidence, however, shows that low offers in two-player ultimatum games are frequently rejected suggesting that responders are not purely self regarding. If social comparisons are unimportant in this context, we should observe similar bargaining outcomes to those observed in standard, two-player, ultimatum games. If, on the other hand, social comparisons are indeed important and the non-responder is part of the responder's reference group, then varying the payment received by the non-responder in the three-player ultimatum game should influence the minimum offer the responder is willing to accept and the amount willing to be ceded by the proposer.

The results from the experiment show that social comparisons play an important role in ultimatum bargaining and that reference group formation is affected by a self-serving bias. The payment to the non-responder has a significant non-monotonic influence on the offers responders are willing to accept. There is also evidence that proposers' offers are affected. The most striking effect, however, is on the rejection rates. To the best of our knowledge, we find the highest rejection rates ever observed in ultimatum bargaining.[3] When the payment to the non-responder is close to zero, more than half of proposer-responder pairs fail to reach an agreement and leave the experiment with zero earnings. Analysis of the data shows that the high rejection rates may be attributed to a self-serving bias in the way subjects form their reference groups; responders are more likely to ignore the non-responder when the latter receives a low payment. The opposite holds for proposers. Therefore, our study contributes to an important aspect of social comparisons for which hardly any evidence exists: how reference groups are formed.[4]

The next section presents the experimental design in detail. The impact of social comparisons on responders' and proposers' decisions, as well as on rejection rates in our experiment is detailed in section 3 where we present our results. We then compare our study to previous experiments in section 4. In section 5 we discuss the implications of our results.

2 The Experiment

The experiment is divided into two parts. In the first part, individuals perform the Encryption Task. Performance in the task is used to allocate roles in the second part to participants. The Encryption Task is as follows. Subjects are given a table assigning a number to each letter of the alphabet. They are then presented with different words in a sequence (the same for all players) which they must encrypt using a computer screen as in Figure 1. If a subject encrypts a word correctly he is presented with a new word. A subject cannot proceed until he encrypts the word correctly. The player with the highest number of encrypted words in a fixed time period (7 minutes) is assigned the role of the proposer in the second part.

The purpose of the first part is to strenghten the relation between the responder and the non-responder, the two individuals least efficient at the Encryption Task. This is designed in a way that is consistent with Festinger's (1954) idea about how reference groups are formed. For this reason, the roles of the responder and the non-responder are assigned randomly to the two remaining subjects after a one-minute delay. The actual number of words encrypted by each individual is not revealed to the subjects and this aspect of the experiment is common knowledge.

[3] For an extensive survey see Camerer (2003).

[4] For a discussion see Clark et al. (2008) and Cooper and Kagel (2009).

In the second part, individuals play a three-player ultimatum game. The non-responder receives a fixed payment, Y, and makes no decision. The value of Y is common knowledge. The proposer is given 100 ECU (Experimental Currency Units) which he must divide with the responder by making an offer, X. Simultaneously the responder decides the minimum acceptable offer, $MAO\epsilon[0, 100]$.[5] These two decisions are made privately. If the proposer's offer is not smaller than the MAO, i.e. if $X \geq MAO$, then the proposed offer is implemented. The proposer's and responder's earnings in that case are $100-X$ and X, respectively. If the offer is rejected, then both have zero earnings.[6] To ensure that the rules of the game are common knowledge the experimenter reads aloud a detailed summary of the instructions as well as the answers to the control questions (once participants' answers have been privately checked).

The non-responder's payoff, Y, is the treatment variable. This payoff is not affected by the decisions of the responder and the proposer. Also, Y does not affect the amount given to the proposer which is always 100 ECU. We chose to study three treatments with a non-responder in which $Y\epsilon\{5, 20, 40\}$. The value of Y is common knowledge when the proposer and the responder are making their decisions. The rationale behind the particular values for Y is the following. We would like to observe bargaining outcomes when Y reinforces a fair division of the surplus (Y=40) and as Y moves progressively away from the equal split of the surplus.[7]

The empirical literature on social comparisons suggests that, all else equal, an increase in the earnings of one's reference group will lower the individual's utility (see Clark et al. 2008). Assuming the non-responder is part of the responder's reference group, as Y increases, the responder's payoff decreases relative to that of the non-responder and hence the reference group. Therefore, based on this evidence, we hy-

[5]We decided to use the strategy method as we wanted to see whether responders are ready to accept low offers when non-responders receive low payments, even if proposers never make such low offers. There is mixed evidence about whether the strategy method alters reciprocal behavior (see Casari and Cason, 2009). Given that we are interested in the changes in behavior across treatments and not in reciprocity *per se*, we chose to use the strategy method. Nevertheless, as we will see, behavior in our experiment is similar to that in experiments using the game method. This is the case both at the individual, as well as at the session level.

[6]To avoid confusion, the instructions repeated three times the fact that responders should state the minimum amount they are willing to accept and not the amount that they would like the proposer to offer. Instructions will be made available at one of the author's website. They are included at the end of the paper to assist reviewers in evaluating the paper.

[7]We chose $Y = 40$ rather than $Y = 50$ as previous studies using real-effort tasks to allocate roles in the ultimatum game have shown that most proposers offer 40 percent of the surplus rather than 50 percent (Hoffman et al., 1994). The explanation given is that effort creates property rights over the surplus.

pothesize that as Y increases, responders will increase their MAOs. Proposers will anticipate this and make progressively more generous offers to responders.[8] Thus, we are interested in the following two hypotheses.

Hypothesis 1: *The responder' MAO increases monotonically with the payment to the non-responder.*

Hypothesis 2: *The proposer's offer increases monotonically with the payment to the non-responder.*

In order to evaluate the impact of non-responders on bargaining outcomes we also conducted a two-player ultimatum game with roles being determined by the Encryption Task. Apart from the absence of a non-responder, the Baseline treatment is otherwise identical to the other treatments. The Baseline treatment allows us to compare our results with those in previous studies. Table 1 summarizes the experimental design.

As both the encryption task and the three-player ultimatum game were played only once, there was a considerable chance that some individuals would walk away with zero earnings from the experiment. Despite this possibility, we were reluctant to pay participants a show-up fee as this could affect the reference point of the agents (see Knez and Camerer, 1995). Instead we chose to compensate them for their opportunity cost indirectly by giving them a daily ticket for public transport. The ticket at the time of the experiment was worth AU$3.40 (although this was not explicitly written in the instructions). The exchange rate used in the experiment implied that the 100 ECU given to the proposer equaled AU$40 (at the time of the experiment approximately $40). The experimental sessions lasted 40 minutes on average.

The experiment was conducted in the Experimental Economics Laboratory at the University of Melbourne between November 2007 and August 2008 using z-Tree (Fischbacher, 2007). The 329 participants were students from the University of Melbourne recruited randomly using ORSEE (Greiner, 2004) from a pool of more than 1400 volunteers. Subjects were from different academic backgrounds including (first-year) economics. Each subject took part in only one of the four treatments, and none of the subjects had previous experience with a similar experiment. Upon arrival at the laboratory, participants were seated in partitioned computer terminals and were randomly divided into groups of three players. Individuals then read a set of instructions which

[8] Roughly 10 percent of offers tend to be rejected in two-player ultimatum games (see Camerer, 2003). Based on this evidence, we also anticipate some rejections of similar magnitude.

explained in detail both parts of the experiment. Before the experiment began each participant answered a number of control questions aimed to help participants understand the game.

3 Experimental Results

The first result summarizes our findings with respect to rejection rates in our experiment.

Result 1: *The non-responder's payoff has a dramatic effect on rejection rates which increase as the non-responder's payoff decreases.*

SUPPORT: Table 1 presents rejection rates in each treatment. It is clear that both the presence of non-responders, as well as their payments, have a dramatic impact on bargaining outcomes. Rejection rates are relatively low in the Baseline treatment (10.7%) and comparable to those in previous studies (Camerer, 2003; p.50-55). This indicates that neither the real-effort task nor the use of the MAOs impact greatly on the ability of proposers and responders to agree to a division of the pie in our experiment.[9] The introduction of a non-responder increases rejection rates by 17.9 percentage points, from 10.7% to 27.6%, when the non-responder's payoff is close to the equal split (T40). Further distancing the payment to the non-responder from the 50-50 split increases rejection rates by 21.6 percentage points (T20) and 47.4 percentage points (T5) relative to the Baseline treatment. In T5 the majority of subjects (58.1%) did not reach an agreement and left the experiment with zero earnings (and a public transport ticket).[10]

Given the random pairing of individuals, arguably a better way of examining rejection rates is to calculate the likelihood that the median offer in a treatment would be rejected. In Baseline, all responders stated an MAO equal to or less than 50 ECU.

[9] The fact that subjects were given information about the second part of the experiment before the start of the first part, could in principle help subjects select in different roles. For example, one could argue that a subject would feel less compelled to encrypt words in T40 relative to T5 as she could receive a high payment if selected to be the non-responder. However, this seems unlikely as the role of the non-responder was randomly allocated and the responder's earnings depended on proposer's offer. Indeed, we find no evidence of differences in the number of words encrypted across treatments. In particular, the average number of words encrypted in Baseline, T5, T20 and T40 is 30.43, 31.57, 31.83, and 29.89. Using a Mann-Whitney test, we find that all pairwise comparisons yield insignificant differences (p-value>.17).

[10] It is worth noting that no subject that was allocated the role of a responder complained about the outcome. The few participants that expressed their dissatisfaction were all proposers.

Therefore, the median offer of 50 ECU would never be rejected. In T40, T20 and T5 the median offer would be rejected 21%, 26% and 49% of the times, respectively.

We now turn our attention to responders' MAOs in an attempt to explain the effect non-responders and their payoffs have on rejection rates. Given our hypotheses, all tests are two-tailed when comparing distributions, and one-tailed when comparing medians. To compare medians we use the Pearson χ^2 test.

Result 2: *The non-responder's payoff has a non-monotonic effect on minimum acceptable offers.*

SUPPORT: Table 1 presents the median, modal and average minimum acceptable offer (MAO) across treatments. Let us first compare the three treatments with a non-responder. All three measures of central tendency reveal that there is a non-monotonic (V-shaped) relation between the non-responder's payoff and the MAO. Reducing the non-responder 's payoff (Y) from 40 ECU to 20 ECU lowers MAOs consistent with Hypothesis 1. However, in contrast to Hypothesis 1, when Y is further reduced to 5 ECU, MAOs increase. The data reject the hypothesis that the three medians are the same across treatments (two-tailed, p-value<.1). Pairwise comparisons reveal that the median in T20 is significantly lower than the median in T40 (p-value<.05), the median in T5 (p-value<.05) and the median in Baseline (p-value<.05). The median in T5, although lower, is not significantly different from the median in T40 (p-value=.22). Interestingly, the median MAO in T5 (33 ECU), is very similar to the median MAO in the Baseline treatment(32.5 ECU), even though there are no non-responders in Baseline (p-value=.45). The latter suggests an explanation about what accounts for the higher MAOs in T5.

Conjecture: *The non-monotonic relationship is due to* some *responders ignoring the non-responder when the latter receives a very low payment.*

SUPPORT: Table 1 shows that the modal MAO is highest in T5 (50 ECU). This was unexpected and offers support for our conjecture that at least some responders in T5 do not consider non-responders to be part of their reference group.[11] In order to gain a

[11] Responses to a post-experimental questionnaire also support this conjecture. Responders where asked to state how important was the payment of the Non-Responder in determining their decision. Subjects could choose a number between 1 and 5 (1=not at all; 5=very important). The average response in T40, T20 and T5 was 3.08, 2.45 and 2.27 respectively. Note however that as we did not anticipate responders' self-serving behavior in T5, we did not administer a questionnaire in the first

better understanding of responders' behavior and how it affects rejection rates, Figure 2 presents the cumulative distribution of MAOs across treatments. Figure 2 clearly shows that the non-responder's payoff has drawing power on (at least some) responder's MAOs. The same can be seen in Figure A1 in the appendix. To this end, four things are noteworthy. Firstly, the slope of the distribution is markedly different in T5. Many responders in T5 are willing to accept low offers. In fact, more responders are willing to accept offers equal to 10 ECU or lower as Y decreases (T5: 29%; T20: 25.8%; T40: 20.7%; Baseline: 17.9%). Secondly, the 'hump' in the distribution in T20 at MAOs between 20 and 30 ECU shows that many responders (in fact, as Table 1 shows, *most* of them) choose MAOs close to the non-responder's payoff. Thirdly, the MAOs in T20 are lower than they are in T40. Finally, the distribution of MAOs is similar in T40 and Baseline which is understandable given that we chose Y=40 to reinforce the fair split which is known to have a strong impact on outcomes in the absence of non-responders.[12]

Taken together, this evidence shows that non-responders and the payoff they receive clearly affect responders' behavior. However, the extent of this effect depends on how high (or low) Y is. The lower Y is, the more likely some responders are to ignore non-responders. Presumably, this is related to the low earnings associated with low values of Y. This self-serving behavior on the part of responders is likely to be responsible for the high rejection rates discussed above.

Our next result from the experiment regards the relation between Y and proposers' offers.

Result 3: *The non-responder's payoff has a modest impact on the offers made by the proposers.*

SUPPORT: Table 1 presents the median, modal and average offer across treatments. While each of the three measures of central tendency presented in Table 1 suggests a slightly different relationship between the non-responder's payoff and proposer's offers, all measures indicate that offers are lower in T20 than they are in T40. Despite being small in magnitude, the difference in medians is significant (p-value<.05). The median

7 of the 12 sessions we ran. After observing responders' behavior in the first T5 sessions, we added the questionnaire. Hence the averages are based on the responses of 23 (T5), 23 (T20) and 9 (T40) responders. Despite the lack of incentives, the answers do provide support for our conjecture.

[12] For completenes, we report that a Kolmogorov-Smirnov test rejects the hypothesis that the distribution of MAOs is the same in T20 and T40 (p-value=.05), but cannot reject the same hypothesis for T5 and T20 (p-value=.32), T5 and T40 (p-value=.81), Baseline and T40 (p-value=1), Baseline and T20 (p-value=.28) or Baseline and T5 (p-value=.59).

offer in T20 is also significantly lower than the median offer in T20 (p-value<.01). These findings are consistent with Hypothesis 2 and with the behavior of the responders. All other pairwise comparisons of treatment medians fail to yield significant differences.

One could interpret the fact that offers are not significantly different in T5 and T40 (p-value=.22) as evidence that proposers correctly anticipate the responders' reaction to the presence of a non-responder. To this end, it is useful to examine the proposers' behavior in T5. Figure 3 shows that the non-responder's payoff does influence offers as 35.5% of proposers in T5 offer 30 ECU or less. This is clearly higher than in any of the other treatments (T20: 22.6%; T40: 20.7%; Baseline: 14.3%). In other words, the lower Y is the *larger* the fraction of proposers willing to make low offers. Therefore, while this aspect of the proposers' behavior is consistent with Hypothesis 2, it is inconsistent with the behavior of responders. This is especially true in T5 where, as we saw, in contrast to Hypothesis 1, the majority of responders demands 50 ECU. To the extent that proposers' behavior is inconsistent with that of responders, proposers actions can also be interpreted as being self serving. Similar conclusions can be drawn by looking at Figure A2 in the appendix.[13] The different expectations between proposers and responders can explain the high rejection rates in our experiment.

4 Related Experimental Studies

While social comparisons may affect behavior in any laboratory experiment in which information about payoffs is public, in most previous experimental studies it is difficult to disentangle a social-comparisons effect from other effects such as the desire to retaliate unkind actions. To identify a social-comparison effect it is essential that the payoff of the reference group is independent of an agent's payoff and actions. We have achieved this by exogenously altering the payoff to the non-responder.

We are aware of two studies in ultimatum bargaining that focus on the impact of social comparisons. The first study is by Knez and Camerer (1995) who use a variant of the ultimatum game in which a proposer makes two offers simultaneously to two different responders. Each responder can accept or reject the offer. An interesting feature of the game is that, in the event of a rejection, each party receives a different (positive) payment. The asymmetry creates an incentive for proposers to offer higher

[13] The difference in distributions is significant for T20 and Baseline (p-value<.05).not significant for T20 and T40 (Kolmogorov-Smirnov, p-value=.19), T40 and T5 (p-value=.76), Baseline and T40 (p-value=.94) or Baseline and T20 (p-value=.27).

amounts to responders with higher outside options. However, if responders are part of the same reference group, responders with lower outside option might also demand higher offers. Proposers in the experiment indeed offer more to responders with higher outside options. However, they fail to anticipate the fact that half of the responders demand more when they know that their counterparts are offered more causing an increase in rejection rates. Knez and Camerer attribute their results to a self-serving interpretation of the fairness of the offer. Furthermore, the authors find that rejection rates do not decline when the game is repeated five times.[14]

There are a few differences between our experiment and that by Knez and Camerer (1995). Apart from the different game used as a testing ground, another difference is that in Knez and Camerer (1995) subjects' roles were randomly allocated. Also, subjects in Knez and Camerer (1995) could see each other during the experiment. The authors acknowledge the fact that this design provides an environment that is likely to be conducive for social comparisons. Our results show that social comparisons are also important in an environment where participants are anonymous. Knez and Camerer (1995) also used a within-subject design; that is, subjects participated in two versions of the same game (first in one in which responders had to decide whether to accept the offer in isolation, and then in one in which they could condition their decision on the other responder's offer). The within-subject design has the advantage that individual characteristics are controlled across treatments but has the disadvantage that it could reveal the aim of the study and, in this case, encourage social comparisons. Our results show that social comparisons occur even in a between-subject design.

The second study focusing on social comparisons is Bohnet and Zeckhauser (2004). Participants in their experiment play a standard ultimatum game for 5 rounds. Proposers and responders are randomly rematched in every round. Prior to deciding whether to accept or reject the proposer's offer, responder's are informed about the *average* offer in the session in the previous round. This information leads to offers that are closer to the 50-50 split relative to a treatment in which there is no information about the average offer. Therefore, the study of Bohnet and Zeckhauser provides evidence that social comparisons can be important in ultimatum bargaining.

One feature of the Bohnet-Zeckhauser design is that as all proposers observed the average offer, a rejection by responder R of proposer A's offer could lead A to strate-

[14]We decided against having subjects participate repeatedly in our game. The main reason is that repetitions would most likely introduce past outcomes as additional points of reference. This would be undesirable and would confound the analysis.

gically increase his offer in the next round. This would increase the average offer and indirectly the offer of proposer B who will be matched with responder R in the future. Our game is played only once, which provides a harder test for social comparisons as subjects cannot learn from the actions of other participants. Second, responders in Bohnet and Zeckhauser (2004) evaluate the offer of the proposer relative to the whole set of proposers. This creates a "social norm" (Bohnet and Zeckhauser, 2004; p.496) and, therefore, could trigger the need to conform to it (e.g. Cason and Mui, 1998; Frey and Meier, 2004). Such need is absent in our experiment.

Our experimental design is also related to the studies of Gueth and van Damme (1998), Kagel and Wolfe (2001), and Shupp. Schmitt and Swoope (2006). These studies employ three-player ultimatum games to investigate the influence of a non-active party on ultimatum bargaining. However, unlike in our experiment, in all three studies the non-responder's payoff was not independent of the decisions made by the proposer and the responder. In particular, in the experiments of Gueth and van Damme (1998) and Kagel and Wolfe (2001) proposers suggest *a three-way split* between participants. One subject is responsible for accepting or rejecting the offer. If the offer is accepted the proposed split is implemented. A rejection results to zero earnings for the proposer and the responder. The rejection implies zero earnings for the non-active party in Gueth and van Damme (1998) and an (exogenously determined) consolation prize in Kagel and Wolfe (2001). In Shupp et al. (2006) the non-active party receives an exogenously determined fixed payment if the responder accepts the proposer's offer and zero otherwise. Unlike in our experiment, all three studies find the the presence of the non-responder has little or no impact on bargaining behavior.[15] One explanation for this could be the fact that the payoff to the non-active party is *not* independent of the responder's actions; for this reason the non-responder is often called a "hostage." Another explanation is that participants' roles were randomly allocated to subjects. In contrast, in our experiment, subjects compete in a real-effort task which determines who will be assigned the role of the proposer. The task should strengthen the link between responders and non-responders given that responders and non-responders are the "losers" in the real-effort task and that the offer is made by the "winner." Therefore, the non-responder is more likely to be part of the responder's reference group and his payment could be taken by both proposers and responders as a valid reference point

[15] Kagel and Wolfe (2001, p.216) make this point graphically be asking "what accounts for the near *invisibility* of the third player in terms of the responders' reactions to the [proposers'] offers?" (emphasis added)

for the amount responders deserve to receive.

5 Discussion

Cooper and Kagel (2009, p.49) write that "one of the biggest problems in the literature on other-regarding behavior and preferences [is] - who is the 'other'?" The answer to this question is very important. Without knowing how reference groups are formed one cannot understand how social comparisons affect behavior or even ascertain that social comparisons do occur. As Clark et al. (2008, p.112) write: "In the absence of accurate information about reference groups, we should be cautious in claiming to have evaluated the importance of social comparisons over income from happiness data." Understanding reference-group formation is also important for evaluating many of the recent theories of other-regarding behavior all of which rely on comparisons between "relevant" individuals (see Fehr and Schmidt, 2006).

The present study makes an important contribution towards understanding social comparisons and, in particular, reference group formation. The contribution is three-fold. First, our experiment provides clear evidence that social comparisons do occur and that they can have significant implications for bargaining. The fact that subjects in the laboratory engage in social comparisons supports the view that bargaining in the field can be critically affected by social comparisons (e.g. Babcock, Wang and Lowenstein, 1996). Second, by showing that individuals may form reference groups in a self-serving manner our results suggest a way in which reference-group formation can be modeled. Many responders appear to disregard non-responders when the latter receive very low payments. This is not the case when non-responders receive higher payments. Similarly, proposers seem to be more willing to make low offers when responders receive low payments without foreseeing the responders' reaction. Therefore, one might usefully consider a model of other-regarding preferences in which the weight placed on an individual's payoff is a function of the payoff itself. However, it is important to emphasize that not all of our subjects exhibit a self-serving bias. Therefore, agent heterogeneity could also be taken into consideration when modeling individual behavior. Third, our game can be used to test new models of social comparisons, examine instances in which self-serving bias is more likely to have an impact on outcomes, and test mechanisms for overcoming bargaining impasse. The advantage of our experimental design is that reference group formation can be exogenously influenced by changing the non-responder's payoff.

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Table 1 – Summary of experimental results

Treatment	Non-Responder's Payoff	Number of participants	Number of observations	Rejection Rates (%)	Median MAO	Median Offer	Modal MAO	Modal Offer	Average* MAO	Average* Offer	Standard Deviation* MAO	Standard Deviation* Offer
T5	5	93	31	58.1	33	40	50	50	27.8	37.2	18.34	14.20
T20	20	93	31	32.3	25	40	30	40	25.2	37.4	15.72	12.24
T40	40	87	29	27.6	40	45	40	50	32.1	41.7	16.83	10.41
Baseline	n.a.	56	28	10.7	32.5	50	40	50	30.7	45.5	15.35	10.25

*The calculation of the average and standard deviation excludes one observation for MAO with M=95 (T5), one observation for Offer from Baseline (X=95), and two observations for Offer from T5 (X=80, X=85). MAO stands for minimum acceptable offer.

Figure 1 – Screen shot of effort stage

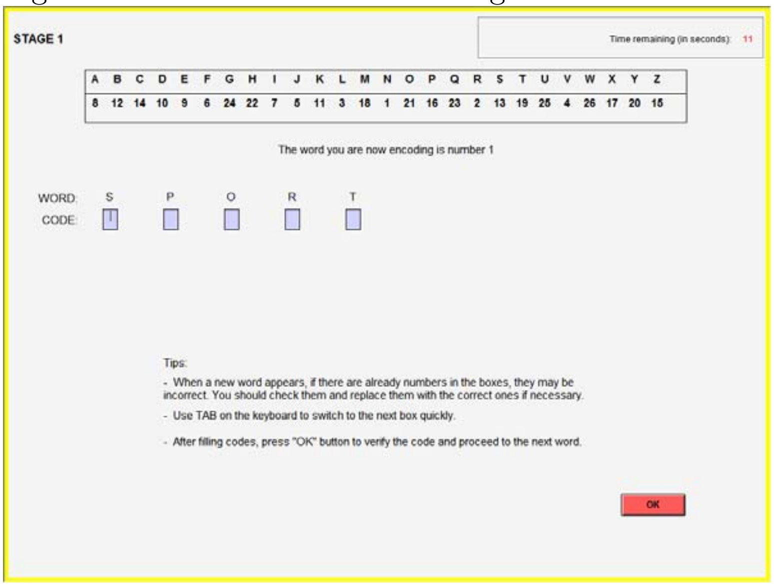


Figure 2 – Cumulative distribution of MAOs by treatment

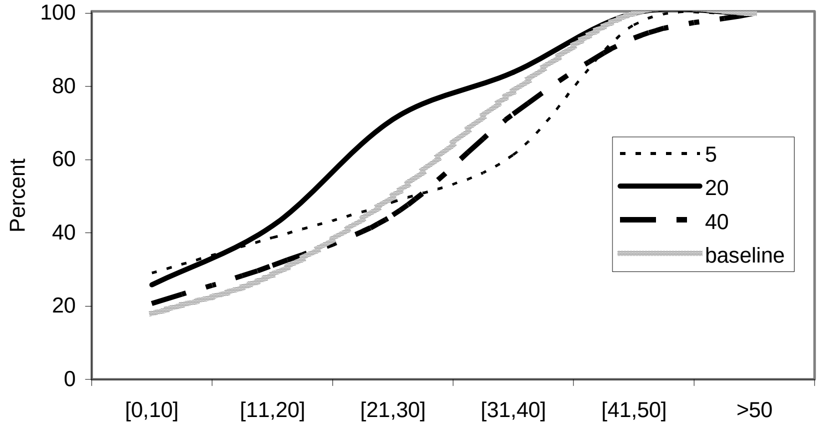


Figure 3 – Cumulative distribution of Offers by treatment

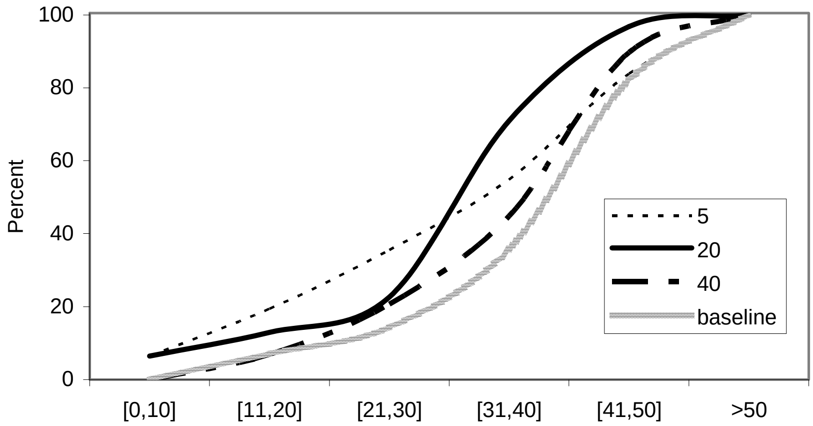


Figure A1 – Distribution of Minimum Acceptable Offers by treatment

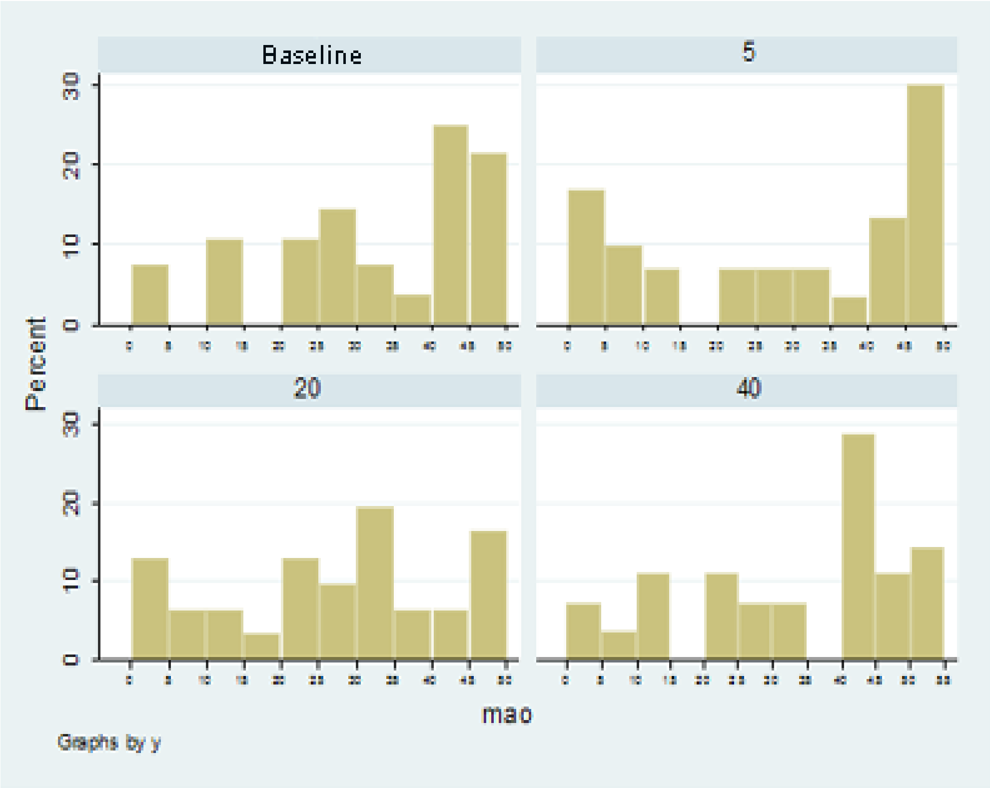
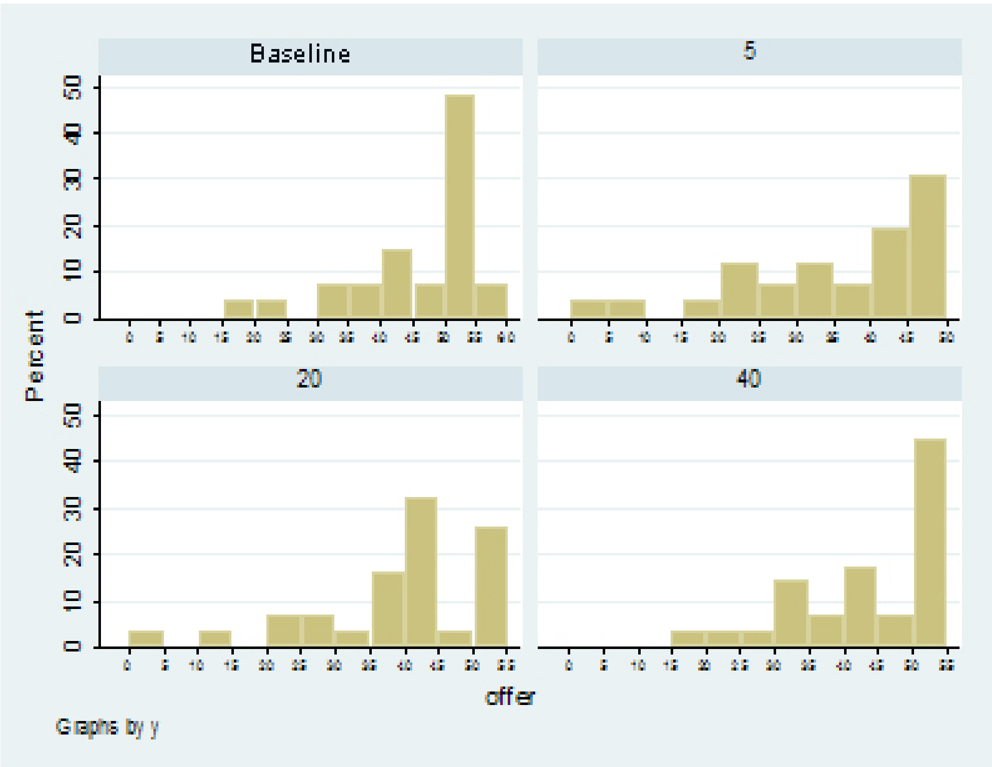


Figure A2 – Distribution of Offers by treatment



Instructions

These are the instructions for treatment T5. Instructions for the other treatments were appropriately adjusted.

You are now taking part in an economic experiment. If you read the following instructions carefully, you can, depending on your decisions and of those made by the others, earn a considerable amount of money. It is therefore important that you take your time to understand the instructions.

The instructions which we have distributed to you are for your private information. Please do not communicate with the other participants during the experiment. Should you have any questions please ask us.

During the experiment we shall not speak of Dollars, but of Experimental Monetary Units (EMU). Your entire earnings will be calculated in EMUs. At the end of the experiment the total amount of EMUs you have earned will be converted to Australian Dollars at the rate of **1 EMU = 40 cents** and will be immediately paid to you in cash. Payments will be private and none of the other participants will know how much money you earned in the experiment. Every participant in the experiment will also receive a daily zone 1 concession MetCard.

At the beginning of the experiment the participants will be randomly divided into groups of three. You will therefore be in a group with two other participants. The experiment is divided in two stages.

The effort stage

The first stage is common for all participants and we will refer to it as the 'effort stage'. In the effort stage, all participants will be given a task that will determine the role that they will play in their group during the experiment. The task in the effort stage is the same for everyone. You will be presented with a number of words and your task is to code these words by substituting the letters of the alphabet with numbers using Table 1 on the last page. The effort stage decision screen is seen in Figure 1.

Example: You are given the word FLAT. The letters in Table X show that F=6, L=3, A=8, and T=19.

Once you code a word correctly, the computer will prompt you with another word to encode. Once you encode that word, you will be given another word and so on. **This process will continue for 7 minutes** (420 seconds). All group members will be given the same words to encode in the same sequence.

Allocation of roles

There are three roles in this experiment: Proposer, Responder and Non-Responder. The role of the Proposer is allocated based on the relative performance of the individuals in your group. The person who encodes the highest number of words in will be assigned the role of a Proposer. The participants with the second and third highest number of encoded words in their group will be randomly assigned the role of either the Responder or the Non-Responder. If two or more participants tie in the first place, the computer will determine the roles randomly.

At the end of the effort stage you will be informed about whether you encoded the highest number of words or not. If you have not encoded the highest number of words there will be a random draw that will determine whether you will have the role of the Responder or the Non-responder. You will not be informed about the exact number of words that each group member encoded.

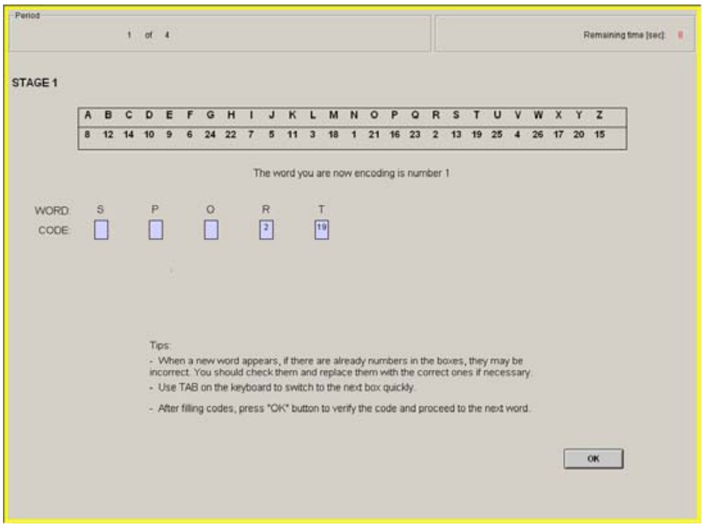


Figure 1

The decision stage

The task of each participant in the decision stage depends on the role they are assigned. The Non-Responder has no decision to make in this stage and will receive 5 EMU at the end of the experiment. The Proposer will be given an endowment of 100 EMU. S/he must then propose a division of the 100 EMU by making an offer to the Responder. The amount can be *any* integer number from 0 to 100 (inclusive). The Responder can accept or reject the offer. If the offer is accepted then the suggested division is implemented. If the offer is rejected then both Proposer and Responder receive 0 EMU. Note that Responders will have to make a decision about the offer they are willing to accept *before* they see the Proposer's actual offer. To do this the Responder will be prompted to state the *minimum* amount s/he is willing to accept from the Proposer.

If the Proposer's offer is an amount higher or equal to the Responder's minimum stated amount, then the Proposer's offer will be accepted. The Responder will receive the offer and the Proposer will earn 100 EMU minus his/her offer. If the Proposer's offer is lower than the Responder's minimum stated amount, then the offer will be rejected. In that case, both the Proposer and the Responder will receive 0 EMU. The earnings of the Non-Responder are independent of the decisions of the Proposer and the Responder and equal to 5 EMU.

Each decision will be made only once.

Note that if the minimum offer that the Responder is willing to accept is greater than the Proposers offer then both the Proposer and the Responder will have zero earnings from the experiment. Therefore, make sure you take your time to make your decisions.

Control Questions

Please answer the following questions. If you have any questions or have answered all the questions, please raise your hand and one of the experimenters will come to you.

1. What does the effort stage determine? (Tick the correct answer)

□ the roles of each participant
□ who will have the role of the Proposer
□ who will have the role of the Responder
□ who will have the role of the Non-Responder

2. The role of the Responder is (Tick the correct answer)

□ assigned randomly to one of the participants who ranked 2nd and 3rd in the effort stage
□ assigned to the person who ranked 2nd in the effort stage
□ assigned to the person who ranked 3rd in the effort stage

3. Assume that the Proposer offers an amount X to the Responder which is larger than the Responder's minimum stated amount. How much will

(i) the Proposer earn? ....
(ii) the Responder earn? ....
(iii) the Non-Responder earn? ……………………………………

4. Assume that the Proposer offers an amount X to the Responder which, however, is smaller than the Responder's minimum stated amount. How much will

(i) the Proposer earn? ....
(ii) the Responder earn? ....
(iii) the Non-Responder earn? ……………………………………

Table 1

Letters	**Numbers**
A	8
B	12
C	14
D	10
E	9
F	6
G	24
H	22
I	7
J	5
K	11
L	3
M	18
N	1
O	21
P	16
Q	23
R	2
S	13
T	19
U	25
V	4
W	26
X	17
Y	20
Z	15