PROMOTING COOPERATION WITHOUT SANCTIONS: THEORY AND EXPERIMENTS

by

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A Dissertation
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of
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By

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Master of Arts
George Mason University, 2009

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

COOPERATION WITHOUT SANCTIONS: THEORY AND EXPERIMENTS

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Cooperation is indispensable in human societies, and much progress has been made towards understanding human pro-social decisions. Formal incentives, such as punishment, are suggested as potential effective approaches despite the fact that punishment can crowd out intrinsic motives for cooperation and detrimentally impact efficiency. This dissertation examines the role of non-monetary reward in promoting pro-social behaviors.

Following the theory of Holländer (1990), the first chapter provides evidence from a laboratory experiment indicating that people under competition value approval highly, but only when winners earn visible rewards through approval. The evidence implies that approval's value is tied to signaling motives. While the first chapter attempts to explain aggregate pro-social behavior using economic theory that can be generalized across

contexts, the second and the third chapters resort to theories of evolutionary psychology, with an emphasis on gender effects.

The second chapter examines gender differences in prosociality using theories from evolutionary psychology and empirical evidence from experimental economics. This chapter is to bridge this gap between the source of gender differences in pro-sociality and experimental research by arguing that differences in male and female motives for prosociality stem, at least in part, from gender differences in mating strategies. In particular, in: (i) signaling behaviors; (ii) conformance to social norms; and (iii) approaches toward resolving intra- and inter-group dilemmas. Drawing on costly-signaling theory that is heavily discussed in the second chapter and in light of the widely established competitive nature of males, the third chapter uses a controlled laboratory experiment to show that cooperation is sustained in a generosity competition with trophy rewards, but breaks down in the same environment with equally valuable but non-unique and non-displayable rewards. In particular, males' competition for trophies is the driving force behind treatment differences. In contrast, it appears that female competitiveness is not modulated by trophy rewards.

CHAPTER 1

Extrinsic monetary rewards or sanctions are frequently used to promote cooperation in social dilemmas. Typical results suggest monetary sanctions effectively promote cooperation, with peer-to-peer sanctioning especially useful in mitigating free-riding behavior (Fehr and Gächter, 2000). At the same time, sanctioning mechanisms can adversely impact economic efficiency and lead to spirals of revenge (Sefton et al., 2007, Denant-Boemont et al. 2007)[1]. While monetary reward can help to avoid such concerns, it is typically found to be less effective than sanctions at promoting cooperation (Andreoni etal. 2003, Sefton et al. 2007, Stoop et al. 2011); likewise, it is often found no more efficient than environments lacking sanctions (Jan et al. 2011). Yet another downside of monetary rewards and sanctions is that both may have a substantially detrimental impact on pro-social decisions when employed in competitive environments (Andreoni 1995; Fuster and Meier 2010).

In light of this, recently attention has turned to non-monetary incentives. Studies include Masclet et al. (2002), which reports that while non-monetary sanctions have a positive initial impact on cooperation, the positive impact cannot be sustained (see also Noussair and Tucker, 2005). Also, Dugar (2007) shows that social approval is most

[1] Other related papers reporting detrimental impacts of sanction include but are not limited to: Gneezy and Rustichini 2000, Fehr and Rochenbach 2003, Noussair et al 2007, Deber et al. 2008, Houser et al. 2008, Li et al. 2009.

effective when combined with the opportunity to express social disapproval[2]. Aside from Pan and Houser's work in this area[3], however, I am unaware of any investigation into the impact of competition on cooperation in environments with non-monetary rewards (and in particular, social approval).

Holländer (1990) provided an early and influential model of voluntary contributions under peer-to-peer approval[4]. He showed that as long as social approval is sufficiently valued by participants, equilibria with positive contributions can exist. On the other hand, if approval is not sufficiently valued, then Holländer's model implies that zero cooperation is the unique Nash equilibrium. Consequently, for the purpose of institution design, it is crucial to know which environmental features might encourage people to assign high value to social approval. I focus on the possibility that this might occur in environments that include competition for social approval.

So-called "signaling motives" are one of the reasons that the value of social approval might increase as a result of competition (see, e.g., Ariely et al. 2009, Bénabou

[2] Rewards are found to be effective in infinitely repeated interactions (Rand et al. 2009, Al-Ubaydli et al. 2010). Also note that the *Baseline* treatment we report below is modeled after Dugar 2007's "approval" treatment.

[3] Pan and Houser (2011) reports three of the four treatments reported in this paper (the new treatment is the "star" treatment, discussed below). The earlier paper connects the patterns in our data to theories in evolutionary psychology, with an emphasis on gender effects. The present paper pursues a very different approach, analyzing and interpreting aggregate data patterns through the lens of economic theory. Loosely speaking, the first paper is interested in identifying specifically who did and did not respond to specific treatment contexts and then developing an explanation for why; the present paper attempts to explain aggregate behavior using economic theory that might generalize across contexts in a way that informs the design of institutions to promote pro-sociality.

[4] This indirect monitoring mechanism is also proposed by Arnott and Stiglitz (1991) where they argued for its advantages over alternative systems in mitigating moral hazard. These other systems include direct monitoring (the principal monitoring the agents himself), or supervision (the principal hires a supervisor to monitor the agents). Moreover, they argued for the importance of utility interdependence among economic agents to incentivize such peer monitoring, which is presented here as a public goods game.

and Tirole 2003, Harbaugh 1998, Glazer and Konrad 1996).[5] Drawing on signaling motives, this study complements Holländer's theory by providing empirical evidence that helps to clarify when and how competition can be used to promote the value of social approval, and thereby encourage pro-social behavior.

I analyze two-stage public goods games with various non-monetary prizes as rewards. Public goods games have been widely used to investigate behavior when self-interest conflicts with social-interest (Fehr and Gächter 2000, Masclet et al. 2002, Noussair and Tucker 2007, Ledyard 1995). In these games, each player receives an identical monetary endowment. In the first stage, four players simultaneously select a fraction of the endowment to contribute to a group account, while keeping the remainder for themselves. All funds in the group account pay a positive return to each member of the group. In the second stage, each subject has an opportunity, after observing his/her group members' contributions, to assign non-monetary approval points to each of his/her fellow group members. The approval points range from zero to ten and come at no cost to the subject.

This experiment includes four treatments. *Baseline* includes neither competition nor rewards. Subjects learn only the total approval they received from other group members in each round. The other three treatments include rewards and competition,

[5] Also referred to as "image motives," the idea is that an individual's behavior can be directed by a desire to create a good impression in the eyes of others. Signaling motives have been invoked to explain a number of pro-social behaviors, including why charities advertise their donors' names (Harbaugh 1998), why football teams place highly visible emblems on the helmets of high performers (Wired 2011), and why top employees are rewarded with prizes, e.g., gold cups for employees of the month.

and are named after the available reward. The *Star* treatment includes competition for electronic gold stars in each period. As in *Baseline*, subjects learn the total approval they received; however, they also learn whether they earned the most approval. The subject who earns the most approval receives an electronic gold star. The *Ice-cream* and *Mug* treatments are identical to *Star* except that each gold star increases the probability of receiving a final reward by ten percentage points. The rewards in these two treatments are a Häggen-Dazs ice-cream bar or mugs emblazoned with the organization's logo, respectively. Note that the mug, which can later be shown to others, has a signaling value that electronic stars and ice-cream bars lack.

The key finding is that competition for social approval promotes cooperation only when winners receive non-cash rewards with signaling value (the Mug). Moreover, the data reveal that approval is dispensed differently under different final rewards, and in a way that is consistent with Holländer (1990). In particular, I show that Holländer's model predicts that a reward with signaling value can lead to approval being assigned based more on relative rather than absolute contributions, and further predicts increased contribution in equilibrium as a result of enhanced utility derived from approval received. The data is consistent with both of these predictions. Further, I find that a non-cash reward with the same monetary value but no signaling value is unable to instantiate a competition. Therefore, both approval assignment and contributions present a similar pattern in relation to the *Baseline* treatment without competition or rewards. Holländer's model also predicts that this should be the case. The reason is that in this environment,

approval should have little or no social value, and is thus unable to initiate an increase in contribution.

This paper takes a step toward a better understanding of alternatives to monetary incentives for promoting cooperation by examining how competition for non-monetary social approval impacts pro-social behaviors in a social dilemma experiment. Additionally, this investigation informs how different rewards out of competition impact peers' decisions on how to award approval.

The remainder of this paper is structured as follows: Section 2 introduces the extension of Holländer's (1990) theoretical model, which concludes that status orientation and the weight given to approval utility are two key factors influencing that rate of social approval and the level of cooperation in equilibrium. Section 3 describes the experiment design, which varies the incentives that influence these two major factors. Section 4 describes the hypotheses, namely how the incentives I introduce may impact equilibrium. Section 5 reports the results. Finally, Section 6 concludes and discusses further possible research.

2. The Model

This paper investigates how social approval impacts behavior in various competitive environments. The comparison between treatments focuses on: (i) how people respond to contributions with approval; and (ii) how people respond to approval with contributions.

This investigation is guided by Holländer (1990), which describes voluntary cooperation as a function of social approval. Broadly speaking, his model provides a mechanism that transforms the receipt of social approval into voluntary cooperation. It is worth noting that this perspective contrasts with frameworks that focus on the impact of social pressure or sanctions in depressing free-riding (see, e.g., Kandel and Lazear, 1992). While Hollander's model best matches the motivation in investigating the interaction between social approval and cooperation, there are certain limitations of the model in applications. First of all, Hollander assumes that approving behavior is automatic rather than strategic. The data is consistent with Hollander's assumptions, however, strategic approving could also have emerged during the process. Secondly, Hollander introduced a static game which has a unique equilibrium. The experiment has a dynamic game with each stage game equivalent to Hollander's model. While the equilibrium of a stage game can also be equilibrium for the dynamic game, further assumptions are needed. Concerning the approving behaviour, approval is an automatic process that is triggered by our emotion stimulus. Our emotion stimulus is determined by the amount of pro-social behaviours. Let *S* represent emotion stimulus, g as the level of prosocial behaviours. Emotion stimulus is a function of prosocial behaviors $S(g_i)$.

$$S(g_i) = w * (g_i - \beta\, \bar{G})^6 \qquad <1>$$

[6] Here, *w* is assumed to be emotion stimulus triggered by unit of contribution; β is the weight parameter a recipient places on the comparative level of the contribution amount; 1- β is the weight a recipient placed on the absolute level of contribution g_i. A weighted average for both components lead to $S(g_i) = (1-\beta)w * g_i + \beta w * (g_i - \bar{G})$.

Approval assignment is a function of emotion stimulus S, $A = f(S(g_i))$. Approval assignment takes a similar weighted average function as emotion stimulus to contribution amount.

$$A_i = w * (g_i - \sigma\, \bar{G})^7, \quad \sigma = \alpha + \beta - \alpha\beta, 0 \leq \sigma \leq 1, \qquad <2>$$

Total utility is assumed to depend on approval received private consumption and public goods. Departing slightly from Holländer's notation, I weight these components according to non-negative constants "θ_i" (without loss of generality). Thus, the utility function for person *i* is as follows:

$$U_i = \theta_p U_p(\pi - g_i) + \theta_{\bar{G}} U(\bar{G}) + \theta_A U_A(w * (g_i - \sigma\bar{G})) \;\; 0 \leq g_i \leq \pi, \theta_i \geq 0 \qquad <3>$$

The social exchange equilibrium is realized when *i*) individual contribution equals to the average contribution: $\bar{G} = g_i(w, \sigma\bar{G}, \pi)$, define as the $g\bar{G}$ equilibrium. *ii*) individual approval rate equals to average approval rate, $v = w$, whereas *v* is the average approving behaviour, equilibrium occurs when $v = w$.

The $g\bar{G}$ equilibrium is shown in appendix, $w = \frac{\theta_p U_p'(\pi - g_i)}{\theta_A U_A'[w*(g_i - \sigma\,\bar{G}]}$ <4>

To derive the *VW* equilibrium, a further assumption is needed. In the appendix, I showed why approval rate *v* is the marginal rate of substitute between endowment and public goods.

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[7] That is, approval assignment of a representative agent is a weighted average between absolute emotion stimulus and a comparative emotion stimulus: $A_i = (1 - \alpha) * S(g_i) + \alpha * [S(g_i) - S(\bar{G})]$, whereas α presents the weight a recipient placed on relative emotional stimulus and $(1 - \alpha)$ represents the weight on the absolute emotion stimulus. Substitute <1> into A_i, we have <2>.

$$v = \frac{\theta_{\bar{G}} U'_{\bar{G}}(\bar{G}) \theta_A \sigma w U'_A[w * (g_i - \sigma \bar{G})]}{\theta_p U'_p(\pi - g_i)} = \frac{\theta_{\bar{G}} U'_{\bar{G}}(\bar{G})}{\theta_p U'_p(\pi - g_i)} - \sigma$$

Together, to solve the social exchange equilibrium I have a set of two equations that were stated as proposition 1 and 2 in Hollander's 1990 paper.

$$\begin{cases} w = \dfrac{\theta_p U'_p(\pi - g_i)}{\theta_A U'_A[w * (g_i - \sigma \bar{G}]} \\ v = \dfrac{\theta_{\bar{G}} U'_{\bar{G}}(\bar{G})}{\theta_p U'_p(\pi - g_i)} - \sigma \end{cases}$$

When both *VW* and $g\bar{G}$ equilibria exist simultaneously, there is "social exchange" equilibrium (see Figure 1).

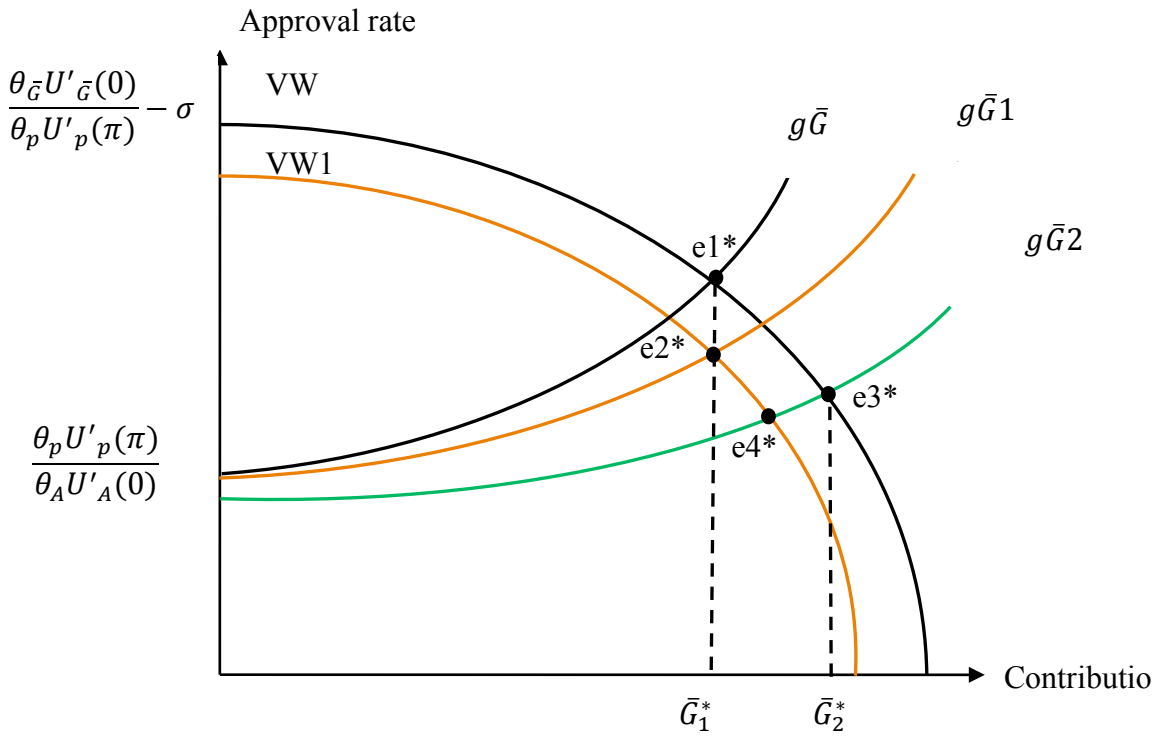


Figure 1: Approval rate and contributions in a "social exchange" equilibrium. An increase in status orientation (σ) leads $g\ \bar{G}$to $g\ \bar{G}_1$ and VW to VW_1, together resulting a new equilibrium to e_2^*. e_2^* has a lower approval rate *w* and an ambiguous contribution level compared to e_1^*. An increase in weight on approval utility (θ_A) alone causes $g\bar{G}$ to shift right to $g\bar{G}_2$, resulting in lower approval rate and higher equilibrium contributions at e_3^*.

It is worthwhile to further discuss the impact of status orientation (σ) and the weight of approval utility (θ_A) on contributions and approval rate in equilibrium. In this model, σ captures status orientation that usually comes with the competition while θ_A captures the weight placed on approval utility that caused by signalling value. In *Proposition 1* we know that increasing σ has an ambiguous effect on contribution while increasing θ_A unambiguously promotes contribution.

Proposition 1: *The effect of increased status orientation (σ) on equilibrium is to decrease the approval rate in equilibrium while having an ambiguous impact on contribution.*

Proposition 2: *The effect on equilibrium of an increase in θ_A is to increase the level of contributions and to decrease the approval rate.*

Proposition 3: For given π and σ, there exists a unique social equilibrium (*w*, g**) with *w*>0* and *g*>0* if and only if

$$\sigma < \frac{U'_{\bar{G}}(0)}{U'_{p}(\pi)} - \frac{U'_{p}(\pi)}{U'_{A}(0)}$$

This experiment design informs the theoretical results described by the propositions. In particular, as detailed in the next section, two of the treatments influences only status orientation (σ) (*Star and Ice-cream*, whereas *Ice-cream* hypothetically has an enhanced status orientation), one impacts both status orientation (σ) and weight on approval utility (θ_A) (*Mug*). In addition, I also consider a treatment absent both status orientation (σ) and weight on approval utility (θ_A) (*Baseline*).

3. Experiment Design

Motivated by Holländer (1990), the goal of the design is to exogenously vary competition and signaling incentives (see, e.g., Ariely et al. 2009) to discover whether they influence the utility value of social approval. The mechanism for doing this involves the use of non-cash rewards with small monetary value. This is a widely-

adopted approach that has been found effective in the cooperation literature (Lacetera and Macis 2010).

I use a two-stage linear public good experiment with various reward conditions. The first treatment, the *Baseline* treatment, includes neither competition nor signaling incentives. I introduce competition in the *Star* treatment. The *Mug* and *Ice-cream* treatments include both competition and a final reward with small (and equal[8]) monetary value. The key difference between the *Mug* and *Ice-cream* treatments is that the *Mug* reward is unique and durable, while the ice-cream bar is generic and non-durable. Consequently, the mug reward has signaling value, and the ice-cream bar does not. This difference is highlighted in Table 1 below.

Table 1. Features of experimental sessions

Treatments	Competition	Monetary Value	Signaling value	Number of groups
Baseline	No	No	No	12 groups of size 4
Star	Yes	No	No	12 groups of size 4
Ice-cream	Yes	Yes	No	12 groups of size 4
Mug	Yes	Yes	Yes	14 groups of size 4

[8] We conducted a willingness-to-pay elicitation to assess participants' subjective value for the two rewards. As described below, we found the values to be statistically (and nearly pointwise) identical.

3.1. The Baseline Treatment:

In the *Baseline* treatment, participants play ten periods of a public good game in fixed groups of four. In each period, each group member $i\epsilon\{1,2,3,4\}$ receives an endowment of 20 Experimental Dollars (E$) and can contribute any integer amount between 0 and 20 $(0 \leq g_i \leq 20)$ to a public good (referred to as a "group project"). All group members decide simultaneously on their g_i each period. The monetary payoff of each individual i from the group project each period is given by

$$\pi_i^1 = (20 - g_i) + m\sum_{j=1}^{4} g_j \qquad (5)$$

where m is the marginal per capita return from each 1E$ contribution to the public good. Following the previous literature (Fehr and Gächter 1999, Maslet et al. 2002), m is set to equal to 0.4. For each participant, the cost of contributing 1E$ to the public good is 0.6 E$, while the total benefit to his/her fellow group members is 1.2 E$. Therefore, it is always in a participant's material self-interest to invest 0 E$, regardless of the contributions of the participant's group members. At the same time, the group's payoff is maximized if all group members contribute their full endowment.

After group members have privately made their own contribution decisions, they are then shown the contribution decisions of each of their group members. Next, subjects are able to assign approval ratings to each of their group members. The ratings can be any integer value from 0 to 10, with 0 indicating the least approval and 10 indicating the greatest. All approval decisions are made simultaneously and subjects are

unable to assign approval to themselves. Sending approval is not costly and, in this treatment, has no impact on the final earnings of the receiver.

The approval assignment stage mirrors Hollander's theory which assumes that approval assignment is based on an emotion stimulus, which essentially depends on the contribution level. After every group member assigned their approval points, they receive feedback information about (i) approval points they received; (ii) their contribution decision for this period; (iii) their earnings for this period; (iv) aggregate earnings up to this period. This feedback information allows an individual to derive utility from social approval, private consumption and public goods consumption which is described in the model. 3.2 Reward Treatments

The *Star* treatment differs from the *Baseline* in that after the approval assignment, an electronic gold star is given to the participant with the highest approval ratings from his/her group members. In case of a tie, all of the most highly-approved subjects earn a gold star. Thus, each subject can receive up to ten stars over ten periods. Participants in *Star* also receive more information than participants in *Baseline*. In particular, at the end of each period, subjects learn all that is learned in in *Baseline* and are in addition told: (i) the accumulated gold stars they have earned (in the format of electronic gold stars displayed on top of their screen); (ii) the contribution of gold star winners that round; While subjects are informed of accumulated approval received, they know nothing about the approval points received from any specific member. This rules out any targeted reciprocal or spiteful behaviors.

Participants who have been winners in multiple periods will have several gold stars displayed on their screens. It is important to emphasize, however, that the gold stars in the *Star* treatment do not lead to any final reward for the star-winners. Therefore, as in the *Baseline* treatment, it is in each subject's material self-interest to contribute E$ each period, regardless of the contributions of others.

The *Mug* and *Ice-cream* treatments are identical to *Star* except that a chance of winning a final reward is proportional to the number of stars won over the ten periods, with each additional star increasing the chance of winning the final reward by ten percentage points. Thus, a person with zero gold stars at the end of the game has a zero percent chance of winning the award, while a person with ten gold stars wins the award with certainty.

In *Mug* and *Ice-cream*, participants have an added incentive to contribute, but my willingness-to-pay elicitation suggests these incentives are small and identical between reward treatments (see details in Section 2.4). Thus, the Nash equilibrium strategy would still be to contribute nothing to the public good. Nevertheless, if subjects place sufficient pecuniary value on the rewards, it becomes evident that positive contributions could be consistent with the Nash equilibrium in reward treatments. Any such pecuniary effects would be identical between reward treatments and therefore could not explain between-treatment differences.

Comparing the *Star* and *Baseline* treatments measures the effects of competition *per se* (pure symbolic rewards) on overall cooperation, and also helps to identify

quantitatively the influence of status orientation (σ) on approval assignments and how contributions respond to such shift. Comparing the approval assignment and the corresponding contributions between the *Star* and *Ice-cream* treatments informs whether providing additional rewards with low monetary value influences the assignment of social approval. In particular, a comparison between *Ice-cream* and *Mug* treatments enables us to identify the influence of signalling alone on contribution decisions and approval assignment.

3.3 Procedures

A total of 200 students from George Mason University participated in my public goods experiment at the Interdisciplinary Center for Economic Science. The experiment used the software z-Tree (Fischbacher, 2007).

Upon entering the laboratory, each subject was seated in a carrel separated from other subjects in a way that ensured anonymity. All interactions in the experiment took place anonymously. Participants then received written instructions. After the experimenter read the instructions aloud, participants were quizzed to ensure they understood the procedures and the payoff structure. The experiment did not proceed until each subject had completed the quiz successfully.

Participants who earned stars in the *Mug* or *Ice-cream* treatments had the opportunity to draw once from a deck of ten cards, numbered 1 through 10. Subjects would receive the reward if the number they drew was equal to or smaller than the number of stars they earned during the experiment. The experimenter distributed the

reward, along with the cash payment, to each subject privately. The experiments lasted 45-50 minutes, and on average subjects earned $16.00 per session.

3.4 Willingness-to-pay (WTP) Elicitation

I recruited 30 students who had not participated in the 'public goods' experiment to take part in the WTP elicitation. This experiment adopted the Becker-DeGroot-Marschak[22] random auction mechanism to elicit WTP for the ICES mug and the Haagen-Dazs ice-cream bar. Subjects were endowed with $10. The prices of the auctioned items ranged from $0 to $10 in increments of $0.50. The maximum value $10 exceeded their maximum expected WTP and the minimum $0 was at least equal to their WTP. Subjects in the WTP experiment were provided with the same information about the auctioned items as subjects in the respective reward treatments of the 'public goods' game. I find that the WTPs are statistically identical between ice-creams (mean=1.7) and mugs (mean=2.2, n=30, P=0.501, Wilcoxon signed-rank test).

4. Hypotheses

Hypothesis 1: **Approval rate will be lowest in the *Mug* treatment, followed by the *Ice-cream* and *Star* treatments, and highest in the *Baseline* treatment.**

The above argument assumes that the status orientation σ increases when competitiveness of the environment increases. While an electronic gold star reward distributed according to performance (*Star)* strengthens competition, a material reward does so even further. I expect competition to be equally high in *Ice-cream* and *Mug*,

followed by *Star* and then lowest in *Baseline*. This implies status orientation σ is ordered according to:

$$\sigma_{mug} = \sigma_{ice-cream} > \sigma_{star} > \sigma_{Baseline} \quad (6)$$

According to *Proposition 1*, increasing the status orientation σ reduces the approval rate:

$$w_{mug} = w_{ice-cream} < w_{star} < w_{Baseline} \quad (6')$$

Approval rates in equilibrium are also influenced by θ_A, the weight on approval utility, which is influenced in the *Mug* treatment through the signalling value of the reward:

$$\theta_{mug} > \theta_{ice-cream} = \theta_{star} = \theta_{Baseline} \quad (7)$$

According to *Proposition 2*, approval rate will be influenced by θ_A as follows:

$$w_{Mug} < w_{Ice-cream} = w_{Star} = w_{Baseline} \quad (7')$$

Combing the influence of status orientation σ and weight on approval utility θ (6') & (7'), I have,

$$H_{0w}: w_{Mug} \leq w_{Ice-cream} \leq w_{Star} \leq w_{Baseline}. \quad (8)$$

The inequality between the *Star* and *Baseline* treatments, and that between *Ice-cream* and *Star* treatments, becomes strict when (6) is satisfied. Similarly, the inequality between *Mug* and *Ice-cream* becomes strict when (7) is satisfied.

Hypothesis 2A: **Contributions in *Mug* should be greatest, followed by *Ice-Cream*, then *Star* and finally *Baseline*.**

Increasing weight on approval utility (θ_A), the relative importance of approval utility, will tend to increase contributions. Therefore, absent the influence of status orientation (σ), I expect contributions to be ordered according to:

$$g_{Mug} > g_{Ice-cream} = g_{Star} = g_{Baseline} \quad (9)$$

If increasing the status orientation (σ) has a positive effect on contributions, then contributions will be ordered the same way as described in (6):

$$g_{mug} = g_{ice-cream} > g_{star} > g_{Baseline} \quad (6")$$

Combing the influence of weight on approval utility (θ_A), represented by (9) into (6"), I have

$$H_{0g}: g_{Mug} \geq g_{Ice-cream} \geq g_{Star} \geq g_{Baseline}$$

The inequality between mug and ice-cream is strict when the inequality in (7) is strict. The inequalities between *Ice-cream* and *Star*, and *Star* and *Baseline,* are strict when the inequality in (6) is satisfied.

Consider now the case when increasing status orientation (σ) has a negative impact on cooperation.

Hypothesis 2B: **When increasing the status orientation has a negative impact on cooperation, contributions in *Mug* are still the greatest, followed by *Baseline, Ice-cream* and then *Star.***

$$H_{1g}: g_{Mug} > g_{Baseline} > g_{Ice-cream} \geq g_{Star}$$

When increasing the status orientation σ has a negative impact on contributions, then contributions in equilibrium will be in reverse order of (6):

$$g_{mug} = g_{ice-cream} < g_{star} < g_{Baseline} \qquad (6''')$$

The influence of increased θ_A on contribution is described in (9) where

$$g_{Mug} > g_{Ice-cream} = g_{Star} = g_{Baseline}$$

Combining (6''') and (9) I have the following ordering between *Ice-cream, Star* and *Baseline,* $g_{Ice-cream} \leq g_{Star} \leq g_{Baseline}$.

Depending on the positive influence from the weight on approval utility θ_A, the contributions in the *Mug* treatment can lie anywhere. Assuming the signalling value of the mug has a particularly strong influence on contributions, then the positive influence from it can overwhelm the negative forces from a higher status orientation σ, giving:

$$g_{Ice-cream} \leq g_{Star} \leq g_{Baseline} < g_{Mug} \qquad <10>$$

5. Results

Result 1. Approval assignment depends on relative contribution differences in treatments with competition.

I find that across treatments, the level of approval assigned by one individual to another is: (i) decreasing in the difference between the contributions of the approval sender and approval receiver; and (ii) decreasing in the difference between the contribution of the approval receiver and the average contribution of the other group members. This is shown in Figure 2 below, which demonstrates that for all treatments,

as the difference $(g_i - g_k)$ increases, person *i* assigns less approval to k. This effect is particularly apparent when the difference $(g_i - g_k)$ is positive. The next result provides a more formal analysis of the data that underlie Figure 2.

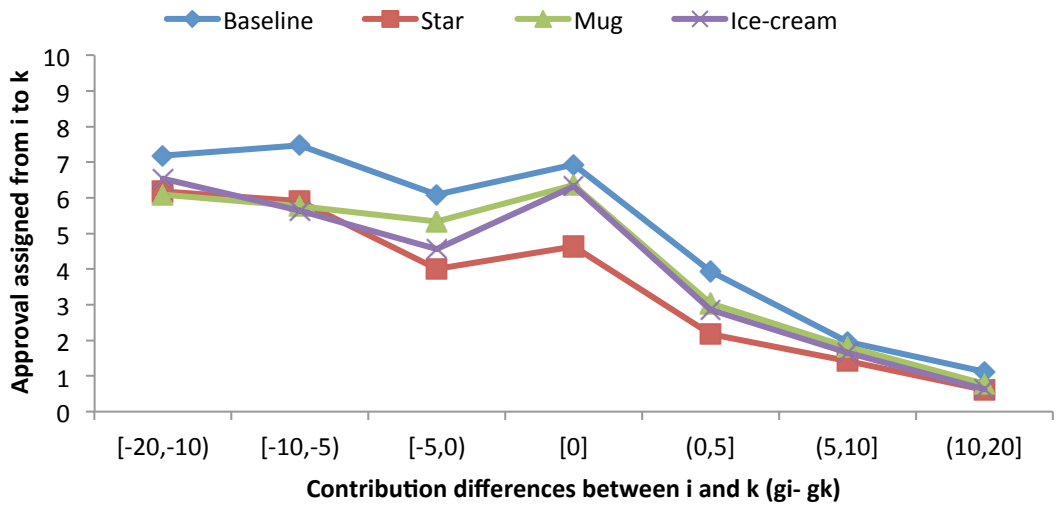


Figure 2: **Approval assigned from *i* to *k* in response to contribution differences between *i* and *k*.** Given the same contribution differences, approval was assigned most in *Baseline*. While the other three treatments do not appear to differ in general, in the [-5,0], [0] and [0,5] category, approval given was lowest in the *Star* treatment.

A regression of the approval person *i* assigned to *k* in period *t* on contribution differences between person *i* and *k* in the same period confirms the findings represented in Figure 2 after controlling the differences between person *k* and the average contribution of the other group members.

$$A_{ik}^t = \beta_0 + \beta_1(\max\{0, g_i^t - g_k^t\}) + \beta_2(\max\{0, g_k^t - g_i^t\}) + \beta_3\left(\max\left\{0, g_k^t - \overline{G^t}\right\}\right) + \beta_4\left(\max\left\{0, \overline{G^t} - g_k^t\right\}\right)$$

Table 2 describes the results of this regression. The main finding is that approval assigned is lower in reward treatments than in *Baseline*. *Star* has the smallest estimated coefficient (-1.68 and significant), while *Mug* has the least negative (-0.56, and statistically insignificant). This indicates that given the same contribution differences, participants withhold the most approval points in *Star*[9]. This is consistent with Figure 2 where I see the line for *Star* lower than its counterparts. Likewise, the asymmetric pattern revealed in Figure 2 is also confirmed in the regression results. Table 2 clearly shows that while person *i* sends significantly less approval to those who contributed less than him/her, he/she does not send significantly more to those who contributed more than him. Finally, from Table 2 one immediately sees that approval assignment increases (decreases) in the positive (negative) difference between the receiver and the average contribution of her other group members.

Table 2: Determinants of Approval Assignment

Star	-1.677***	(.399)
Mug	-0.555	(.419)
Ice-cream	-1.136***	(.429)
Positive differences between *i* and *k*: $\max\{0, g_i - g_k\}$	-0.179***	(.017)
Negative differences between *i* and *k*: $\max\{0, g_k - g_i\}$	.009	(.025)
Positive differences between *k and the others avg* : $\max\{0, g_k^t - \overline{G^t}\}$	0.276***	(.038)
Negative differences between *i* and *k*: $\max\{0, \overline{G^t} - g_k^t\}$	-0.303***	(.038)

[9] The regression controls for the contribution differences, however, it does not control for the absolute contribution level. Therefore, the lower approval assignment in *Star* and *Mug* can also be explained by the absolute contribution level.

Constant	7.13***	(.351)
Period Dummies	Yes	
# of Obs.	6000	

Result 1 shows that approval assignment is based on relative contributions in treatments that include competition.

Result 2: Approval rates are lowest in *Mug* and highest in *Baseline.*

Result 2 presents a robust check on theoretical predictions (*Proposition* 1) and hypothesis H_{0w}: $w_{Mug} \leq w_{Ice-cream} \leq w_{Star} \leq w_{Baseline}$. Using the data from experiments, I estimated the approval rate w and status orientation σ through equation $A = w(g_i - \sigma\bar{G})$. I find that the approval rate in *Mug (*w=0.94) is significantly lower than the approval rate in *Baseline* (w=1.23, F=4.93, P=0.03). Approval rates in *Star* and *Ice-cream* are both lower than that in *Baseline,* but do not significantly differ. This result is consistent with hypothesis 1 above.

Table 3: Estimation of Approval rate w and the assignment weight σ

Approval rate in Baseline: $w_{Baseline}$	1.234***	(.067)
Approval rate in Star: w_{Star}	1.103***	(.104)
Approval rate in Ice-cream: $w_{Ice-cream}$	1.190***	(.061)

σ in Baseline	0.133**	(.063)
σ in Mug	0.151	(.120)
σ in Ice-cream	0.144*	(.080)
Constant	42.814***	(1.060)
Constant	7.13***	(.351)
Period Dummies	Yes	
# of Obs.	2000	

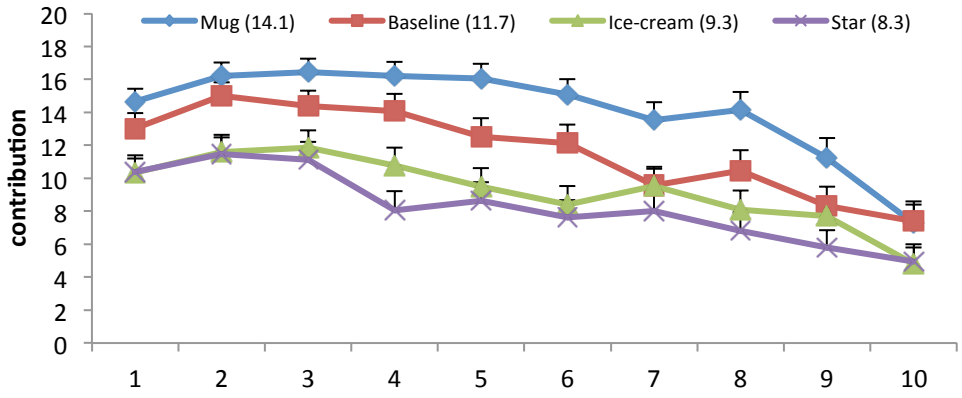
Result 3: Contributions are highest in *Mug* and lowest in *Star*.

Overall contributions are significantly higher in *Mug* than any other treatment (Figure 3a). I further find that the *Star* treatment has the lowest level of contributions (falling even below *Baseline*). Moreover, the frequency of full contributions is highest in *Mug*. For example, from period 6 to 10, 48.2% of subjects in *Mug* contributed their entire endowment, while only 29.2% did so in *Baseline* and 18.8% in *Ice-cream* (Fig. 3b).

A parametric analysis confirms these results. After controlling for group contributions and peirod effects, I find an unconditionally higher contribution in *Mug* using a random effect GLS regression (the dummy for the *Mug* treatment is significant at 4.18, but insignificant for the other treatments). Being a star-winner in period *t*-1 also has a positive effect on period *t* contributions in all rewards treatments (significant at 1.4 in Mug and at 2.4 in *Ice-cream)*.

Overall then, I find support for hypothesis H_{1g}: $g_{Mug} > g_{Baseline} > g_{Ice-cream} \geq g_{Star}$. The results are three folded: First, I find that an increasing σ, the status orientation has a negative influence on cooperation. This is supported by a significantly lower contribution level in *Star* than in *Baseline* treatment. Secondly, an enhanced status orientation through added monetary value does not have an influence on contribution. This can be shown through a comparison between *Star* and *Ice-cream* treatments. Thirdly, increasing approval utility θ_A, which is driven by signalling motives, significantly promotes contributions in *Mug* treatment. Such positive force overwhelms the negative influence of increased status orientation σ. This is shown through the contribution differences between *Mug* and *Ice-cream* treatments.

a.



b.

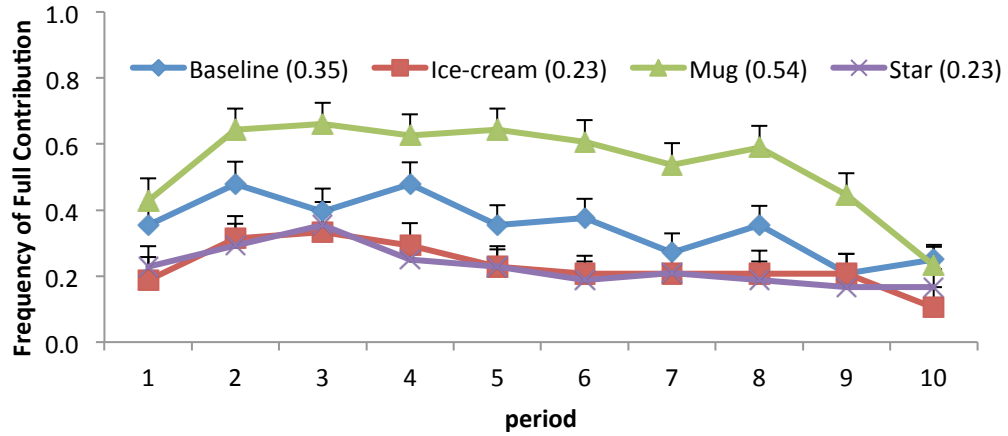


Figure 3. Contributions to the public good over 10 periods across treatments. Cooperation is highest in *Mug* both by **a**, average contribution, or **b**, frequency of the full contribution. a. The numbers in parentheses indicate mean contribution (over 10 periods) for that treatment. Contributions are significantly higher in *Mug* (N=14 groups) compared to *Ice-cream* (N=12 groups, z=2.675, P=0.008), *Baseline* (N=12 groups, z=-1.800, P=0.072), and *Star* (N=12 groups, z=3.138, P=0.002). *Star* is significnatly lower than *Baseline* (n=12 for both, z=2.079, P=0.038). **b**. The numbers in parentheses indicate mean frequency (over 10 periods) of full contributions in that treamtent. In the *Mug* treatment, most subjects contributed their full endowment (54%), significantly

more than those in both Baseline (35%, N=12 groups, z=-1.987, P=0.047) and Ice-cream (23%, z=2.734, P=0.006).

6. Concluding Discussion

I studied the impact of peer-to-peer competition for social approval on cooperation in a social dilemma environment. I obtained data suggesting that competition for a final reward with signalling value promotes pro-social behaviour. In contrast, when the reward has no signalling value, the same competition mechanism reduces cooperation in relation to an environment that includes only social motives for contributions.

My analysis was guided by a model proposed by Holländer (1990), who developed equilibria in which positive contributions exchange for social approval. The model suggests two key determinants of equilibrium: the relative importance of approval utility in overall utility (denoted above by θ_A), and one's status orientation (denoted above by σ). My design varied features of the environment that I expected to influence the value of those parameters. In particular, treatments varied in terms of: (i) the competitive environment; (ii) the presence of non-monetary social approval; and (iii) the nature of a non-cash reward out of competition. I found that people assigned approval and responded to approval differently under different treatments, and in a way that is consistent with Holländer (1990).

Note that other models, such as Kandel and Lazear (1992)[10], share the feature that individuals make strategic decisions regarding how much to approve (or disapprove, as in Kandel and Lazear) and how much to contribute. While both assume that approval (or disapproval) influences contributions, Hollander goes further to assume a specific relationship between the way approval is assigned and contribution decisions. This allows one to connect approval rates to contributions in equilibrium. Moreover, it is worth noting that displaying disapproval implies a utility cost in Kandel and Lazear's model. Consequently, increased cooperation arising from expressions of disapproval may not enhance social welfare.

I found approval assignment to vary with the nature of the reward out of competition. Under competition, approval assignment is based more on relative than absolute contributions. This may partially explain a lower contribution in all competition treatments except *Mug,* where competition may drive attention towards a spiteful withholding of approval when signalling motive is absent rather than creating a healthy competition for higher contributions when trophy is rewarded.

This higher cooperation level in *Mug* is consistent with higher utility associated with each unit of approval. The result is a "keeping up with the Joneses" contribution competition in *Mug*. On the other hand, cooperation in *Star* is lower than in *Baseline,* which appears to indicate that competition absent rewards with signaling value is detrimental to cooperation.

[10] Other theoretical models (see, e.g., Akerlof (1980), Lindbeck et al (1999)) also develop models that can incorporate the influence of peers through, for example, social norms. However, economic agents in these models are unable to use either approval (as in Hollander) or disapproval (as in Kandel and Lazear).

It is worthwhile to note that positive contributions in games with valuable final rewards are not necessarily inconsistent with a subgame-perfect equilibrium in which agents maximize their monetary payoff, so long as agents place sufficient value on ice-cream or a mug. I found, however, that WTP is identical between these rewards. This means that while a reward's value to any particular subject could potentially rationalize that subject's contributions, it cannot explain the substantial differences I observe between the *Mug* and *Ice-cream* treatments.

This research demonstrates that the value of social approval is high in environments with competition for displayable rewards. This promotes cooperation due to a direct effect on preferences as well as an indirect effect arising from a change in the process by which people assign and value approval. In particular, it appears that a competitive environment shifts the approval assignment so that it is based more on relative than absolute contributions. At the same time, it increases the value an individual places on the approval they receive.

As Holländer (1990) argued, approval's impact on contributions is consistent with the positive emotional impact of approbation (see also Fehr and Gätcher 2000, Fehr and Fischbacher 2003). In a standard public goods game, the negative emotion from cooperators may help to generate a collapse of cooperation over time. Indeed, it is perhaps surprising that the contribution momentum in *Mug* was sustained to the ninth round. This is particularly true in light of the presence of systematic low-contributors, as well as substantial theoretical and empirical evidence that free-riding is contagious (Fehr

and Fischbacher 2003; Fischbacher et al., 2001). The proximate mechanism behind sustained contributions may also work through an emotion mechanism. While cooperators express frustration with free-riders in a standard public goods game by reducing their contributions, approval from free-riders may help to appease cooperators. In particular, free-riders can reciprocate by assigning approval to cooperators, thereby increasing the chance that a cooperator receives a mug reward .

This paper is limited in that it investigates only non-cash rewards with small monetary value. Previous scholars have suggested that cash rewards have non-monotonic effects on pro-social behaviors (Gneezy and Rustichini 2000). Therefore, it might be interesting for further studies to measure the efficacy of non-cash rewards with alternative monetary values. Additionally, while rewards were distributed privately in this environment[11], a public reward, particularly one with signaling value, may serve to further promote cooperation (Andreoni and Petrie 2004, Rege and Telle 2004).

Finally, the results shed light on how to construct institutions aimed at enhancing the value of decentralized social approval, thereby promoting cooperation. For example, in a team environment with moral hazard where it is difficult to implement centralized monitoring, introducing social competitions for rewards with signaling value may help to foster pro-social behaviors in an efficient and positive way. In this sense, this study has highlighted a "hidden benefit" of extrinsic incentives.

[11] To avoid experimenter demand effect (our willingness-to-pay elicitation already controlled for alternative explanations for contribution differences between *Ice-cream* and *Mug* treatments).

CHAPTER 2

A human's interactions are determined by the level of his/her pro-sociality, i.e., concern for the welfare and rights of others. Throughout human history, pro-sociality has evolved alongside human nature and economic development. In hunter-gather societies, it was vital to human survival, with male warriors playing the lead role in fighting against nature. In industrialized societies, females' rapidly-increasing market participation has elevated them to a more decisive position in economic and social development. For these reasons, the connections between evolutionary theory and evidence on gender differences in pro-sociality are very important. Indeed, evolutionary psychology can help us to better understand gender differences in economic behaviors. Some examples include charitable giving, bargaining, and cooperation, all of which are ultimately the product of the interaction of male and female mating strategies. Nevertheless, previous surveys of gender differences have failed to examine these connections.

Understanding gender differences in prosociality is imperative. For example, in the context of theoretical models, having a better understanding of the type of environment in which one gender might display systematically greater pro-sociality and altruism than the other can aid in developing models on charitable giving, bargaining and household decision-making. This knowledge might also impact empirical research

by influencing views on gender differences in the labor market (Bobcock and Lasehever 2003), intergenerational transfers, or household bargaining among spouses. Indeed, fundraisers for charity have come to realize the substantial giving potential of female donors; as a result, they have begun to design sex-specific solicitation strategies (Andreoni and Vesturland 2001). Policymakers have also noted substantial sex differences in philanthropy, with women apparently more responsive to the need for charitable giving. Illuminating such systematic differences informs economists' models, data analyses, and research methodologies.

The previous experimental literature has provided evidence on gender differences in risk and other preferences (Holt and Laury 2002; Eckel and Grossman 2003; Croson and Gneezy 2009), competitive behaviors (Gneezy et al. 2003; Niederle and Vesturlund 2004), and altruism (Andreoni and Vesturlund 2001; Eckel and Grossman 1998). Likewise, various survey papers have also discussed gender differences in social dilemmas (Ledyard 1995) and economic decision-making (Eckel and Grossman 2008). Additionally, the social psychology literature has focused on gender differences in cognition, reasoning (Cross and Madson 1997; Gabriel and Gardner 1999; Baumeister & Sommer 1997), and social roles (Eagly 1987).

Although there has been extensive previous research in this area, there remains a large disconnect between the evolutionary source of gender differences in pro-sociality and experimental research aimed at informing cooperation and generosity. In the current study, I highlight the evolved role of sex-specific mating strategies in creating gender

differences in pro-sociality. In particular, I discuss that gender differences in pro-social behavior can stem from specific mating strategies associated with: i) male costly signaling; ii) female conformance to social norms; and iii) tactics for resolving inter- and intra-group dilemmas.

This paper integrates theory and evidence from experimental economics, evolutionary psychology, and social psychology. Each of these literatures has unique advantages. For example, the experimental approach uses a random selection and assignment process, leaving it possible to investigate causal relationships. Additionally, experiments allow researchers to isolate one factor (e.g., strategically-motivated pro-sociality) from other factors (e.g., pure warm-glow). Moreover, they are replicable, making it rather simple to test the robustness of hypotheses with individuals from different demographic backgrounds and directly compare competing theories. At the same time, evolutionary and social psychologists provide us with mating motive explanations for the origins of human pro-social behaviors, and shed light on how these behaviors evolved differently for males and females.

I have chosen to focus narrowly on mating motives as a source of gender differences, largely due to the fact that this explanation ties naturally to differences in pro-sociality. Nevertheless, while I focus on mating motives, I recognize that there are multiple explanations for evolved gender differences (Eckes and Trautner 2000). A specific example relates to costly signaling and pro-sociality. While there are both intrinsic and "status" motives for charitable contributions, Section II below focus

exclusively on "status" motives. Comparing and contrasting between multiple explanations is beyond the scope of this paper, so I leave this valuable task to future research.

This paper relates to the recent review of gender differences in preferences by Croson and Gneezy (2009). Their comprehensive paper reviews the literature on gender differences in economic experiments and identifies robust differences in risk preferences, social (other-regarding) preferences, and competitive preferences. This paper differs from theirs in that it focuses on the underlying source of gender differences in pro-social behavior, rather than the differences in the expression of preferences. Further, This paper discussions the mating motive, while Croson and Gneezy (2009) only speculate to some degree on the source of gender differences.

The remainder of the paper is organized into four sections. Sections II, III, and IV review the literature explaining how males and females are motivated differently for pro-social behaviors. Section II focuses on costly mating motives, which are ingrained in human nature and demonstrated primarily by males whose pro-social behavior can be explained as a costly signal of their underlying abilities. Section III centers on pro-social behaviors driven by social norms, with much female pro-sociality being explained by females' relatively greater sensitivity to social cues (Gilligan 1982). Section IV reviews pro-social behaviors driven by group effects, arguing that some male pro-sociality can be motivated by inter-group effects, while some female pro-sociality may appeal to

intra-group effects. Finally, Section V summarizes the paper and discusses potential policy implications.

II. Males' costly signaling: Prosocial to signal

Costly signaling, i.e., sacrificing one's own resources, may be a form of self-presentation. Some common examples of costly signaling include public philanthropy or time spent volunteering in a homeless shelter.

For instance, Griskevicius et al. 2007 documents that on Valentine's Day 2003, America's leading authority on philanthropy announced that real estate mogul Donald Trump had pledged $1 million to charity (Foundation Center 2003). A few days earlier, Ted Turner had also pledged an entire billion to humanitarian causes (Cable News Network (CNN) Interactive, 1997). The motivations of both men seem somewhat puzzling given that both appear to epitomize the cold-blooded and self-interested capitalist. Although it might have been a mere coincidence that Trump's donation was announced on Valentine's day, the connection between philanthropic displays and courtship is nevertheless solid.

In this section, I discuss studies that demonstrate how the costly-signaling motive manifests itself in men and women. I include experimental evidence on the differences between males' and females' conspicuous philanthropic displays in response to mating motives. I likewise include natural field evidence on human males' unique costly signaling in social dilemma environments (e.g., sharing food in hunter-gatherer

societies). Finally, I discuss the social welfare effect of costly-signaling behaviors (status-seeking).

I find that costly-signaling behaviors, particularly public philanthropic contributions, are observed mostly in males. This is likely due to the evolutionary benefit of such displays to courtship strategies. Indeed, the ultimate motive for philanthropic displays might be to enhance status and increase the chance of finding a desirable mate.

2.1. Gender differences in costly-signaling

Public philanthropy, a costly-signaling act, signals firstly: i) an individual's ability to procure resources (Miller 2000); and secondly ii) an individual's pro-social personality, i.e., willingness to sacrifice his/her own resources for others (Miller 2007). Both of these underlying traits are desirable in a potential mate, but their relative desirability differs between men and women. For instance, literature on human mate choice suggests that males and females exhibit asymmetric preferences for owned economic resources signaled by the opposite sex. Women indicate that economic resources in a man are a necessity, while men appraise economic resources in women as a luxury (Li et al., 2002; Li & Kenrick 2006). The differences may arise from the fact that a man's reproductive value may be more closely associated with his ability to provide economic resources to support his offspring. In contrast, a woman's reproductive value may be more related to health and fertility (Buss 1989).

Indeed, variations in men's status and resources seem to be universal across human societies and groups, both modern and primitive (Li et al. 2002). These variations directly affect the survival rates of potential offspring; as a result, women pay much more attention to males' status and ability to acquire resources. For example, Li et al. 2002 distinguished between male and female views toward necessities and luxuries, with a necessity being an essential consumption item that tends to be favored when budgets are low and choices are constrained. Necessities received high priority in the study, which found that men viewed physical attractiveness as a necessity, while women viewed status and resources as necessities. This makes sense, in that, to the extent a woman's fertility is related to her observable physical features, men may strongly desire at least a moderate level of physical attractiveness. Similarly, to the extent that variation in men's status and resources have affected survival rates of offspring in humanity's evolutionary past, it makes sense for women to require more of such traits before becoming concerned about other characteristics. Thus, while women have become evolved to scrutinize such cues as males' status and earning capacity, men have become evolved to value visual signals of physical attractiveness and age as fertility cues in women. Likewise, kindness and intelligence are necessities to both men and women (Li et al. 2002). Given these observations, I would expect men to be more likely to engage in conspicuous philanthropic displays of resources due to the fact that women place considerably more emphasis on cues of wealth and status when selecting a romantic partner.

2.1.1. Conspicuous / philanthropic displays

Psychologists have conducted a variety of lab experiments demonstrating that males are more likely to behave pro-socially in environments that present mating opportunities. Table 1 lists theories and experimental evidence on gender differences in costly signaling behaviors. Janssens et al. (2010) investigated whether exposure to mating cues, such as physical attractiveness, activates the goal to signal one's mate value to members of the opposite sex. Men should be more likely to notice products that would signal their financial resources to women, as their mate value is partly determined by their financial prospects. The study demonstrated that exposure to a sexily-dressed woman increases single males' likelihood of noticing status products in a visual display.

A recent study by Sundie et al. (forthcoming) further demonstrated the connection between showy spending by males and the mating motive. Meanwhile, females perceive those males who conspicuously consume as more desirable mates (for short-term mating). The study further showed that such conspicuous consumption may serve more as a short-term rather than a long-term mating strategy. Both findings support the link between conspicuous consumption and male mating strategies. Saad & Gill (2003) investigated gift-giving among young adults. They conducted a survey to investigate motives for offering a gift to a romantic partner. The subjects responded to the frequency of giving a gift for different causes, and also responded to the motive as either tactical (e.g., a motive arising from internal factors like "displaying long-term interest," or "displaying generosity") or situational (e.g., a motive triggered by external factors, like "occasional demand for birthday"). They showed that men's gift-giving

behaviors are motivated significantly more by tactical motives (e.g., displaying financial resources, showing affection, and displaying generosity) than are women's.

Meanwhile, Griskevicius et al. (2007) compared males' and females' different pursuits of conspicuous displays under mating motives. They showed that the mating motive boosted females' conspicuous (i.e., blatantly social and easily observable, such as helping in public) benevolence, but failed to boost their inconspicuous (i.e., nonsocial and unlikely to be observed) helping. On the other hand, the mating motive led men to increase their spending on conspicuous purchases (products that are luxurious and publically consumed, like philanthropic contribution), but failed to lead men to spend more on inconspicuous purchases, such as necessities.

Investigating gender differences in conspicuous consumption is particularly important to studies on public philanthropy. The costly signaling theory suggests that conspicuous consumption, e.g., public philanthropy, could potentially act as a display of resources and generosity, signaling an individual's ability to incur cost by sacrificing his/her resources. It ultimately serves to increase the signaler's prestige and status (Griskevicius 2007).

As quoted by Dowd (1996), Ted Turner said, "I talked to both Bill Gates and Warren Buffett, the two richest men in the country, and they would be inclined to give more if there was a list of who did the giving rather than the having." Glazer and Konrad (1996) observe that charities frequently publish the names of contributors, providing various threshold amounts of giving in clearly defined, rank-ordered categories with

labels such as "contributor," "benefactor," etc. (in lieu of reporting the actual amounts given). As early as 1974, Gary Becker developed an economic model wherein the amount the donor gives (rather than the quantity of the public goods he receives) enters into the utility function. Harbaugh (1998) used empirical data on charitable contributions grouped by threshold categories to estimate a utility function that can differentiate between intrinsic motivations and extrinsic concerns for "prestige." While Harbaugh reported that both factors play a role in the amount given, his study did not distinguish between genders.

Human males' unique sharing behavior can also be explained by costly signaling. Miller (2007) argued that this altruistic meat-provision might possibly be favored in part by sexual selection. Risky big-game hunting ensured the best hunters could feed their own offspring . Recent studies suggest that the most successful hunters provide the pro-social public good widely and unconditionally when it is costly to acquire, but are more likely to keep it for their own household when acquisition costs are much lower[12](Bliege Bird 1999; 2001; Bliege Bird and Bird 2001). This indicates the signaling function of the pro-social behavior. Indeed, the shift of foraging strategies depending on scarcity of the resources tends to attract higher quality female mates (Gurven et al. 2000; Hawkes and Bliege Bird 2002). Gurven et al. 2000 collected data among forager-horticulturists tending to indicate that those who shared and produced

[12] Both Hadza and the Meriam meat-sharing patterns are best supported by costly signaling theory as evolution of "men's work." Evidence of both Hadza and the Meriam meat-sharing pattern cannot be explained by hypothesis like "sharing as an exchange" or risk-reduction related reciprocity (Hawkes Conell and Blurton Jones 2001).

more than average (signaling cooperative intent or ability to produce) were rewarded more than those who shared below average. These results provide insight into the motivations behind costly expenditures for establishing and reinforcing status and reputation. Such wide sharing of meat may not be a conscious courtship strategy or a causal factor of good hunters' reproductive success; however, an evolved hunting strategy may be caused by underlying traits such as high-quality genes (Daly and Wilson 1988).

2.2. Costly signaling and status-seeking behaviors

Costly signaling behaviors are usually associated with the goal of enhancing status, which ultimately contributes to reproductive success. While evolutionary and social psychologists have focused on human's costly signaling behaviors, economists turn to its efficiency impact, i.e., the externality of status-seeking behaviors. Table 4 juxtaposes the theories and experimental evidence for the two arenas. The central tenet of costly signaling theory is a variety of conspicuous animal displays (Miller 2000, Zahavi 1975) indicating one's ability to support offspring, e.g., the ability to procure resources, or pro-social acts that work as a good indicator of ability to support offspring. For instance, the peacock shows off its gorgeous tail, which signals its ability to garner resources, as well as possible desirable traits that can be passed on to offspring. Likewise, male Arabian Babbler birds compete to be the sentinel for their group members to enhance their status and attract potential mates. Chimpanzee hunting is best explained as a male strategy for gaining and maintaining higher status. Gurven and von

Rueden (2006) showed that the Kuna of Panama maintain records (trophies) of individual tapir kills and accord status to men with the greatest number of trophies. Evolutionary and social psychologists argue that different approaches taken by men and women in pursuit of costly signaling-directed pro-social behaviors have significantly affected status-seeking behavior among peers, and, consequently, led to their different social and economic statuses (Baumeister and Sommer 1997, Markus and Kitayama 1991).

The tendency of males to invest in positional goods and strive for high status is characteristic in a hierarchical society, mainly due to the privilege enjoyed by the high status group. Several experiments have studied how status influences the general population. Kumru and Vesterlund (2008)'s experiment showed that the low status group would mimic the behavior of the high status group, but not vice versa. Shang and Croson's (2007)'s field experiments on voluntary giving for charity found that people consider the gender of past donors important in deciding whether to mimic their contribution. While women are influenced by women, men are influenced by men. This finding may indicate that social status is competed for among the same genders, rather than across genders[13]. Glaeser et al. (2000) found evidence suggesting that individuals with high-status characteristics tend to extract larger rents from a voluntary non-market transaction. Ball et al. (2001) pointed out that status may have become an evolved signal to entitlement of resource, which over time, affects resource allocation between high and

[13] It also coincides with the idea of Eckel and Grossman (1998b) on bargaining power between genders. The difference of bargaining power between genders will be further discussed in session III.

low status groups. Ultimately, males with a high status have a better chance of attracting desirable females.

Nevertheless, the efficiency of such status-seeking behaviors is controversial. For a long time, status-seeking has been regarded as inefficient (Congleton 1989; Hopkins and Kornienko 2004). The argument was that expenditures on positional goods do not create social wealth but merely redistribute it. Thus, the investment in positional goods may be regarded as a dead-weight loss. These conclusions were based largely on the observation that status-seeking imposes negative externalities on other status-seekers. Nonetheless, many status games involve activities that benefit individuals not actively involved in the game of interest (Congleton 1989) (e.g., competition for the generous philanthropist.). Hawkes and Bird (2002) provided the connection between displaying costly signal and pro-social behaviors: if pro-social behaviors result in displays that can signal the obtainers' desirability, then competition for such displays can result in pro-social activities. This striving and competition to show off resources is further supported by experimental research on inducing philanthropy.

Table 4: Theory and Experimental evidence on Costly Signaling Behaviors.

Evolutionary and Social Psychologists		
Theory: Costly Signaling: Zahavi (1975)	In Brief: A variety of conspicuous displays serve as important communication functions, advertising an individual's ability to garner scarce resources and possibly signaling the possession of desirable	Males conspicuously consume to display, i.e. philanthropy

	traits.	
		M > F
Experimental Evidence		
Saad & Gill 2003	Tactical motive for gift giving Subjects from an eastern Canadian university	M > F
Jassens et al. 2010	With mating cues vs. Control Subjects are males ranging from ages 17-32	Spending: Young male spent much more on conspicuous consumption
Griskevicus et al. 2007	Induce mating goals for both Males and Females. Subjects from introductory psychology class	M: Conspicuous Consume; F: Boost public helping.
Sundie et al. 2010	Who conspicuous consumes; how it is interpreted. Subjects from a large public university	Conspicuous consumption: Driven by Males. Interpreted: Short-term > Long-term mating
Nature Field Evidence		
Hawkes et al .2001	Hadza meat sharing Tanzanian Hadza people	Male: Star hunters share irrespective of the return
Smith & Bliege Bird 2000	Turtle hunting and sharing strategies Meriam people of Torres Strait, Australia	Males: Costly signaling is not subject to reciprocation, but serves as a means to broadcast signals of the signalers
Economists		
Status-seeking: Frank (1985), Congleton (1989)	*Positive*: Status-seeking behavior might have lots of positive externalities. *Negaitve*: Individuals may overinvest in positional goods.	

Ball et al. 2001	High Status subjects always capture the rent. Undergraduate students from Virginia Tech or University of Arizona
Kumru & Vesturlund	Low status mimic contributions by high status leaders, but not vice versa. Subjects recruited from the Pittsburgh Experimental Economic Laboratory subject pool
Other Evidence	
Glazer and Konrad (1996)	Charities publish names of contributors in ranked orders.
Harbaugh (1998) charitable contributions	Prestige motives play an important role in

III. Females' other-regarding: Prosocial to conform to social norm

The stereotype is that women are more other-regarding than men. Other-regarding preference is indispensible in human social interaction. Other-regarding preferences affect individuals' views on whether and how to enforce social norms, which directly affect the giving and helping behaviors in any society. A series of studies model other-regarding preferences as fairness reciprocity (e.g., Rabin 1993), inequity aversion (e.g., Bolton and Ockenfels 2000, Fehr and Schmidt 1999), and altruism (e.g., Andreoni 1989). While the models give a better description of individuals' other-regarding preferences, gender differences in such preferences and the consequent pro-social behaviors also vary. A better understanding of the origin and development of gender differences in other-regarding preferences provides a basis for more accurate

modeling of markets with increasing female participation, particularly those for philanthropy and charity giving.

In this section, I review literature examining gender differences in role-related social norms. I find that, in general, women are more sensitive to social cues; as a result, they are more responsive to social approval and disapproval. I include evidence on gender differences in reasoning from social psychology literature and studies on investigating role-related expectations for men and women. I further include evidence on interaction between genders. I review studies discussing approaches for promoting pro-sociality based on such gender differences. I also note a caveat to my findings: different genders may display different risk attitudes, providing an alternative explanation for some of the differences I note below.

3.1. Reasoning social norm

One way in which women and men have been thought to differ with respect to other-regarding preference-related pro-social behaviors is in their reasoning about such preferences (Mills et al. 1989; Gilligan 1982). Social psychologists claim that the "economic man" is a good predictor of men's behavior in situations where social norms permit or reinforce the pursuit of pecuniary self-interest. In contrast, women present different social norms (Eckel and Grossman 1996). Indeed, Gilligan (1982) contended that women are socialized to conceive of themselves as connected to others; consequently, their moral sensibility reflects a strong concern with the care and connection to others, while men are more concerned with justice. Eckel and Grossman

(1996) showed provocative evidence that men make decisions on principle, while women's morals are more situational and sensitive to changes in environment.

Women are also more inclined to mention dilemmas involving personal relationships where the dilemmas seem to have elicited care-oriented reasoning (Mills and Pedersen 1989). While men are nurtured to be more assertive than women, women are encouraged to show empathy and be egalitarian (Niederle & Vesterlund 2007). Harenski et al. (2008) investigated the neural mechanisms underlying moral sensitivity. They confirmed that females evaluating moral stimuli show more activity in brain regions associated with care-based processing, while males show more activity in regions associated with justice-based processing. The studies, taken together, paint women as valuing and being valued for fairness and cooperation.

The difference in reasoning implies that females' strong connection to interpersonal interaction makes them more sensitive to external forces that compel them to behave. This is particularly true for those external forces that emphasize female role-related norms. On the other hand, if males behave more in accordance with principles, then they may perceive norm enforcement with negative incentives (i.e., threat, punishment) as unfair. This might detrimentally affect their generosity. The following sub-section discusses males' and females' different role-related responses to social norms.

3.2. Role-related social norm

One way in which women and men have been thought to differ with respect to their pro-social behaviors is the role-related expectation. Social-role theory suggests that

different norms lead men and women to develop different expectations about the costs and rewards of altruistic behaviors; thus, they develop different reactions to situations governed by these norms. While mating motives are believed to lead women to display care and empathy and to conform more to others' preferences, men are usually expected not to conform (Griskevicius 2006 et al.).

A wide variety of experiments have provided evidence on this issue. Solnick (2001) explored the behavior of men and women in an ultimatum game with gender open information. Her study used the strategy method, where responders indicated their minimum willingness to accept. Gender was communicated by the first name of the counterpart. Solnick (2001) found that the proposers offered less to female responders, while responders demanded more from female proposers (higher minimum acceptable amount). Such difference in expectation significantly affected the bargaining power between males and females. Ayres and Siegelman (1995) found significantly different negotiated prices depending on the gender of the bargainers; dealers using scripted bargaining strategies quoted significantly lower prices to white males than to black or female buyers. Babcock and Laschever (2007)'s evidence further supports the expectation that females conform to others' preferences. They concluded that when women negotiate, they are very pessimistic about how much is available. Thus, women typically ask for, and get, 30 percent less than men. Such pessimistic expectation is further evidenced by the fact that women will pay as much as $1,353 to avoid negotiating the price of a car.

3.2.1 Prosociality in cross-sex interactions

The different expectations regarding social norms for males and females further affect the interaction between genders. Evolutionary psychologists predict that sex pairing will be an important factor, with each sex exhibiting a preference for the other. Eckel and Grossman (1998b) found chivalry between female proposers and male responders, with men accepting lower offers from women than from men. They also found solidarity, with women accepting lower offers from women than from men. Castillo et al. (1999) presented similar results in a field experiment where they investigated bargaining in the taxi market in Lima, Peru. They found that male passengers received higher initial prices than women[14]. In addition, men were 7 percent more likely to be rejected than women, and were also more likely to face shorter negotiations. Such chivalrous relationships are also consistent with males' costly signaling mating motives. Saad and Gill (2006) argued from the evolutionary perspective that males make more generous offers when pitted against a female as opposed to a male. Females, on the other hand, make equal offers independently of the sex of the recipient. Male allocators are altruistic towards female recipients and yet competitive towards male recipients. This contrast is explained as a manifestation of social rules which evolved from the male pre-disposition to use resources to attract mates. In contrast, female allocators are more concerned about fairness when making offers to recipients. These stronger fairness concerns of females are further supported by Andreoni et al. (2002), who examined how charitable giving is influenced by the person

[14] Taxi drivers in Lima are predominantly males. In this field experiment, all drivers were male. Passengers were trained confederates.

in the household who is primarily responsible for giving decisions. Looking at single-person households, they found that men and women have significantly different tastes for giving, potentially setting up conflict for married couples. With respect to total giving, the study found that married households tend to resolve these conflicts in favor of the husband's preferences. In contrast, when women are the decision-makers, they tend to give to more charities, but to give less to each charity.

3.3. Response to social approval/disapproval

Females are more concerned about other people's perceptions of them, while males make decisions based more on principle (Gilligan 1982). As a result, females contemplating deviant acts perceive higher threats of embarrassment than their male counterparts. In contrast, condemning males' un-generous behavior may have a detrimental effect on male philanthropy.

Women's shame makes them more responsive to threats or punishments for behaviors that fail to conform to social norms. Garza and Ottone (2009) used a dictator game with three participants in a group. Two of the participants played a dictator game, with the third participant having the choice of incurring a cost to punish the dictator (strategy method was implemented). The study found that women reacted to the punishment threat by increasing their transfer to the recipient, while men did exactly the opposite. Specifically, male dictators would display significantly lower altruism after this credible threat.

The crowding-out effect of punishment incentives on norm-motivated behaviors has been investigated in some detail. Fehr and Rockenbach (2003) showed that

punishment incentives are detrimental to trustworthiness. They argued that while punishment incentives are aimed at promoting prosociality, they only work when perceived as just or legitimate. In fact, an unfair punishment may deter cooperation. Houser et al. (2005)'s results present even stronger evidence that punishment crowds out norm-based motivations, even when the offer is determined randomly by nature rather than intentionally by an individual. They attributed this phenomenon to a "cognitive shift" that crowds out norm-based motivations in general. The difference is that the threat in the latter studies is from a second party rather than a third party (see Fehr and Fischbacher 2004 for a clearer distinction between second and third party punishment). Meanwhile, emerging results show that women are more likely to perceive greater punishment threats than men (Carmichael 2004). The results also conform to the evidence that women are more risk-averse and more sensitive to threats of shame and embarrassment (Blackwell, 2000).

Role-related norms play an important role in generating both male and female generosity, which is consistent with the different ways males and females reason. For example, females exhibit situational morality, while males base their decisions more on principle. Although males' decisions are robust to the change of environmental parameterizations, males are usually no more generous than their female counterparts. For example, Eckel and Grossman (1996) investigated gender differences through a "punishment game." Subjects could choose to split a larger pie with a partner having bad cooperation records, or a smaller pie with a partner having good cooperation records. The results showed that when relative prices are higher, less females sacrifice their own

resources to punish defectors; however, females are no less generous than males' under both low and high relative prices. In contrast, male generosity is robust to the change in relative prices. The results conform with Gilligan's theory on males making decisions on principle, but also demonstrate the tendency of females to be more altruistic. Croson and Buchan (1999) found that women are more likely to reward generous contributions in the trust game. Eckel and Grossman (1998a) reached a similar conclusion. Andreoni and Vesturlund (2001) presented gender differences in a more detailed manner by varying both the price of giving and endowment of the subjects (see Table 5). They found that when the relative price changes in favor of giving (cheaper to give), males are more generous than females; however, when the relative price of giving is greater than or equal to one, women appear more generous than men. This is partially consistent with previous findings in which males' absolute amount of generosity remains relatively constant with increasing relative prices (Eckel and Grossman 1996).

Table 5: Differences in Male and Female's Altruism

Theory and Experimental Evidence	Study Details	Pro-social behaviors: Prediction and Evidence	
Theory: Gilligan 1982	*Reasoning diff.*: female situational morality, male on principle.	*Pred.: Female altruism more volatile.*	
Exp. Evid. : Eckel & Grossman 1996	Dictator game, varying punishment prices Subjects from Virginia Polytechnic Institute and State University and Wayne State University	*Low Relative Price* W > M	*High Relative Price* W=M
Andreoni & Vesturlund 2001	Dictator game varying altruism prices, endowment Subjects from university of Wisconsin and at Iowa State University	W > M (P<1)	W<M (P>1)[15]

3.5. Risk attitudes explains volatility in female pro-sociality

Females' sensitivity to environmental parameters can be explained by risk-aversion, which ultimately originates from mating motives. "Fitness variance" is much lower for females than males; as a result, females take less risk in the sexual selection process. Males are disposed to risky competitive tactics (especially under a more hierarchical society where winner-takes-all[16]), e.g., winning fights over other males or

[15] The altruism is measured in proportion to endowment. Looking at the absolute amount, male giving was stable, while female giving was more volatile.

[16] Dekel and Scotchmer (1999) developed an evolutionary model of preference-formation to investigate to what extent evolution leads to risk-taking in winner-take-all environments. For example, if winner-take-

displaying signs of "good genes," even at a higher likelihood of death. These risky tactics, however, have paid off in reproductive currencies on average over human evolutionary history (Daly and Wilson 1988). Consequently, females are selected to become much more risk-averse than their male counterparts.

Eckel and Grossman (1999) observed that gender pro-sociality seems to be conditional on the level of risk present in the experiment. In decisions where risk is involved, e.g., for the proposer in ultimatum games, there appear to be no systematic differences in behavior across genders. However, for decisions involving no risk, such as for dictators or "punishers," women tend to be more generous and socially-oriented in their behavior. Croson and Buchan (1999) presented similar results in a cross-culture trust game. They found significant gender difference in the riskless reciprocity decisions and no difference in the risky trusting decisions. In Brown-Kruse and Hummels (1993), males were found to contribute at higher rates than females. This may be due to different risk preferences between genders.

IV. Inter- and Intra-group effects on prosociality

Social norms are group level phenomena that may have shaped human pro-social behavior in decisive ways (Henrich et al. 2001). Norms emerge through interactions in groups and apply to interactions within groups; group members enforce them, and they often arise in the context of inter-group conflicts (Bornstein 2003). Evolutionarily-minded social scientists assert that human altruism and cooperation are the result of the

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all determines males' chances of reproduction, males will evolve to be risk-takers. Males inherited risk-taking behavior from ancestors in whom risk-taking was evolutionarily selected via winner-take-all games.

species' unique history of inter-group conflict and warfare (Van Vugt et al. 2007). Current evolutionary models are based on the idea that human altruism and pro-social behaviors evolved through the selective (cultural or biological) extinction of groups in inter-group conflicts (Henrich & Boyd 2001; Boyd et al. 2003).

Nevertheless, inter-group conflict and intra-group norm enforcement have shaped male and female pro-sociality in different ways. Such differences ultimately originate from sex differences in human mating strategies, which have shaped the minds of men and women differently (Buss & Schmitt 1993). The spoils of an inter-group victory substantially enhance males' mating opportunities (Van Vugt et al. 2007); thus, it is important for men to invest their resources in forming coalitions to engage in inter-group aggression. By contrast, it is attractive for women to invest resources in creating and maintaining supportive social networks for the protection of themselves and their children (Taylor et al. 2000). Therefore, women may have a stronger interest in keeping the group together. They may also take on the role of peacekeeper (Van Vugt et al. 2008).

This section reviews the effects of inter- and intra-group norm enforcement on male and female pro-sociality and explores their differences in reasoning, individual and group conflict (e.g., the traditional public goods games), and intra- and inter-group conflict, (e.g., games that involve tension between intra- and inter-group; a step-level public goods game; in-group and out-group members).

4.1. Reasoning differences

Evolutionary psychology and social psychology literature indicate gender differences toward in-group and out-group members. Table 3 compares theories and experimental evidence demonstrating gender differences in pro-sociality when conflicted with interests between inter- and intra- groups. Cross and Madson (1997) argue that important gender differences in social behavior may be explained by differences in the construction and maintenance of self-definition, e.g., like self-construal proposed by Markus and Kitayama (1991). The idea is that men rely on independent self-construal, while women depend on interdependent self-construal. For example, women more often described interpersonal problems as a source of distress. In addition, women were more likely to discuss interpersonal topics, such as personal feelings and problems, while men were more likely to discuss less personal topics such as sports and politics (Cross and Madson 1997). Baumeister and Sommer (1997) offered an extension of Cross and Madson's analysis of gender differences by arguing that men have the same motivation for social bonds; however, men seek social connections in larger groups, with the aim of achieving a favorable position in the social hierarchy. Women, on the other hand, seek those connections in smaller, or even dyadic, relationships. If this is true, I would expect to observe systematic differences in males' and females' group-oriented behaviors. While male behavior is more inter-group oriented, female behavior is more intra-group oriented (Baumeister & Sommer 1997).

The differences in the way males and females reason in conflicts are consistent with the social-role theory (Eagly 1987). The theory suggests that females facing conflicting interests between themselves and their group defect much less out of greed

than out of fear. Specifically, the male role includes norms that encourage competition and aggression (Eagly 1987), while the female role not only de-emphasizes aggression but emphasizes avoidance of aggression from others or harm to oneself. This leads to more pro-social behavior from females in this scenario. In addition, women are more concerned than men about the quality of interpersonal relationships, group cohesiveness, and the development of shared norms in a group. Thus, while men have a higher drive to display independence and distinctiveness in a group (Baumeister & Sommer 1997, Cross & Madson, 1997), women are more willing to shun female group mates who act against group norms.

4.2. The social dilemma: Individual and group conflict

The public goods game captures the tension between individual and group interests, enabling us to test Taylor et al (2000)'s argument on females' pro-sociality to invest in their own groups. As early as 1965, Rapoport and Chammah raised the question of whether gender affects cooperation in social dilemmas involving conflicting interests between individuals and their groups; they reached strong theoretical expectations of sex differences in cooperation. Nevertheless, there is a lack of findings on systematic differences between males and females. Some find females to be more pro-social than males in such dilemmas (Dawes et al. 1977; Nowell and Tinkler 1993; Seguino et al.1996), while others find males more cooperative than females (Brown-Kruse and Hummels 1993). Others find no differences at al. (Sell et al. 1993).

Therefore, it is unclear which is the more pro-social gender in social dilemmas. This is partially due to the volatility of the environment. Females' low level of

cooperative behavior in Brown-Kruse and Hummels has already been attributed to the risk involved, i.e., to contribute either all or zero endowment (Eckel and Grossman 1998b). If gender does capture the diffused status characteristics in organizations (Sell et al. 1993 find group composition does not matter for cooperativeness), then a sequential public goods setting may further promote pro-sociality (Kumru and Vesturlund 2008).

The failure of previous literature to draw conclusions was attributed to failure to distinguish between free-riding behaviors driven by "fear" and "greed" (Simpson 2003). Simpson hypothesized that while male defection is motivated by greed (e.g., the temptation to cheat and exploit others: the payoff for unilateral defection is higher than for mutual cooperation), female defection is motivated by fear (e.g., the risk of exploitation by cheaters: the payoff for mutual defection is higher than for unilateral cooperation). Simpson showed that in the prisoner dilemma with no fear but only greed, females present significantly more cooperative behavior than males. However, he failed to find gender differences in pro-sociality under the dilemma with no greed but only fear. Kuwabara (2005) re-tested Simpson's hypotheses through a new asymmetric game. The new experiment supported the fear hypothesis and suggested mediating effects of expectations about partners on sex differences in cooperation. Overall, such differences in fear are driven by risk-aversion, which ultimately originates from mating motives (see Section 3.5 for detail).

4.3. Intra- and Inter- Group conflict

If females are more pro-social in conflicting interests between themselves and the group, then males present much greater pro-sociality (i.e., sacrifice for in-group

members) when confronting conflicting interests between the group and out-group members. Such differences, as argued above, ultimately originate from males' mating motives; the spoils of an intergroup victory substantially enhance their mating opportunities (Van Vugt et al. 2007). Further, the Male-Warrior Hypothesis proposed that better male warriors achieve more status and reproductive success in traditional societies (Chagnon, 1988; Van Vugt et al 2007) and that men's behaviors and cognitions are more intergroup oriented than women's. Aside from the theory support from Cross and Madson (1997) and Baumeister and Sommer (1997), this hypothesis is also supported by the fact that in history, males have usually been the ones to fight against the out-group invasion and protect women and juveniles.

The Male-Warrior hypothesis leads to the prediction that men, more than women, may increase their altruistic group contributions during inter-group competition. Indeed, male warriors have more sexual partners and greater status within their community than do other men. Men also recall group events better than women (Gabriel and Gardner 1999). In fact, studies show that as early as adolescence, girls are more likely to value characteristics related to sensitivity to specific others and interpersonal harmony, while boys are more likely to value characteristics related to competitiveness and social dominance (Gabriel & Gardner 1999). Van Vugt et al. (2007) found that in step-level public goods games, men contributed more to their group if their group was in competition with other groups, as compared to no inter-group competition. On the other hand, female cooperation was relatively unaffected by intergroup competition.

Experimental evidence further supports different self-recognition between males and females. Charness and Rustichini (2009) conducted an experiment where people played a Prisoner's Dilemma Game with a partisan audience watching the choice. They found that behavior is significantly affected by the interaction of gender and place: males cooperate substantially more often when they are observed by people from the other group, while females cooperate significantly more when they are observed by people from the same group. It leads to the conclusion that while both males and females wish to gain the approval of their in-group members, the actions that are socially desirable differ across gender. Males wish to signal that they are formidable, while females wish to signal that they are cooperative.

Males' strong willingness to show formidability is highly evident in their punishment behavior towards out-group members. Goette et al. (2006) used all young male subjects from the Swiss Army to show that even with random assignment, punishment from a third party is especially high when the victim of defection in a prisoner dilemma is an in-group member as opposed to an out-group member. Bernhard et al. (2006) investigated indigenous groups in Papua New Guinea and found that the third party punisher punishes significantly more if the punisher and the recipient in the dictator game are from the same group. Nevertheless, neither study compared the punishment behavior between genders; Goette's subjects were all young males, while Bernhard et al. did not report specific gender composition. However, such strong out-group hostility cannot be supported by multi-level group selection theory, suggesting that normative obligations are more likely to apply only to in-group members. People

who do not belong to the group neither obey the norm nor benefit from norm enforcement.

Gender differences in pro-sociality toward in-group and out-group members are also supported by people's choice of leaders when confronting inter- or intra-group threats. Van Vugt and Spisak (2008) found a strong preference for female leaders during intra-group competition and male leaders during inter-group competition. Such preferences are consistent with the efficient outcome. Vugt and Spisak found that investments were higher under a female than under a male leader in the intra-group condition. Conversely, investments were higher under a male than under a female leader in the inter-group condition. The results are also supported by Little et al. (2007), who showed that people were more likely to vote for a (manipulated) feminine face when there is peace or internal conflict, but switch their vote to a (manipulated) masculine face when their country is at war.

Table 6. Theory and Experimental Evidence on Group effects

Inter-group Conflict	General Prediction	Intra-group Conflict	General Prediction
Henrich et al. 2001 Buss and Schmidt 1993 Boyd et al. 2003	Male pro-social to in-group members more with the presence of inter-group conflict	Tyalor et al. 2000; Rapoport and Chammach 1965; Cross and Madson 1997; Eagly 1987.	Females make effort to maintain intra-group relationships.
Experimental Evidence			
Inter- group Conflict		Intra-group Conflict	
Van Vugt et al 2007	M > F		
Undergraduate students at the University of Southampton, England			
Van Vugt & Spisak 2008 Undergraduate students from an English university.	Preference for gender of the leader: Inter Group Conflict: M > F. Efficient Outcome: M > F	Van Vugt & Spisak 2008	Intra group conflict: F > M (preferred) Efficient Outcome: F > M
		Simpson 2003 social dilemma without fear: F> M Undergraduates at a large university	Contribution in
Charness & Rustichini 2010 Students at the University of California at Santa Barbara	Male signal formidability to outgroup: M (Inter) > M (Intra)	Charness & Rustichini 2010	Female signal cooperatives to intragroup: F (intra) > M(intra); F (intra) > F (inter)
		Nowell and Tinkler 1994 Female group highest	Cooperation:

V. Discussion

This article has reviewed a stream of literatures that bridge the gap between evolutionary psychology and experimental economics on gender differences in pro-sociality. The fundamental sources for such differences are attributed to gender differences in mating strategies, which are demonstrated as males' costly signaling motive, females' conformity to social norms, and inter- and intra-group effects, which induce pro-sociality in both males and females. Such differences can contribute to empirical research on charitable giving, bargaining and gender differences in the labor market.

For example, while male generosity can be elicited through costly signaling (Section II) and inter-group conflicts (Section IV), female generosity can be generated by propagating role-related social norms or using social approval/disapproval (Section III). This is consistent with Griskevicius et al. (2007)'s results, but suggests that females' pro-sociality is judged more by their helpfulness and kindness, while male pro-sociality may be motivated by a willingness to expend resources.

In Section III, I conclude that female pro-sociality is sensitive to environmental parameters due to females' risk-aversion. Accordingly, charities that want to elicit female generosity may need to: i) appeal to women's caring natures (charities on

children); and ii) reduce the risk level of the product. Specifically, the seed money approach in charitable may be helpful in generating female generosity.

Meanwhile, females' stronger other-regarding preferences (Section III) may serve to overcome the difficulties faced by public bureaucracies in designing institutions aimed at encouraging efficient resource allocation by discouraging opportunism at the expense of the common good. Recent non-experimental evidence supports the hypothesis that gender-specific preferences matter for resource allocation. Lott and Kenny (1999) and Edlund and Pande (2001) argued that men and women may have different policy preferences, and Dollar et al. (1999) showed that female participation in politics is negatively correlated with corruption measures.

Given that in this field, literatures on laboratory experiments are generally focused on undergraduates, young males, and young females, there may be potential for a selection effect on males' pro-social behavior driven by mating strategies. While subjects in experimental studies are more representative of the unmarried population, marital status may nonetheless be relevant for pro-social behaviors. In fact, Janssens et al (2010) found that single males are more responsive to mating cues, which are less effective on married men. Additionally, while men and women have different tastes for giving (for instance, Andreoni et al. 2002 found that women prefer to give more to charities but to give less to each), it is also interesting to note that married households tend to resolve these conflicts largely in favor of the husband's preferences. These differences provide an interesting foundation for future research, for instance, on the function of joint decision-making in married households.

I bridged the gap between the source of gender differences in pro-sociality and experimental research aimed at informing cooperation and generosity. Nevertheless, certain conclusions about either sex (e.g., that men make decisions more based on principle) may not necessarily hold in a broader context (e.g., when men are interacting with females). Still, it is important to learn both the broad principle and the exceptions that may apply in certain special contexts.

Meanwhile, I also refer to risk preferences in explaining gender differences in pro-sociality, particularly females' volatility in pro-social decisions. It is important to note, however, that there are differences between risk and uncertainty, and that decisions are also influenced by the amount at stake. Given the limited cases explored here, a broader study distinguishing these factors would be interesting and useful.

In summary, I have identified three underlying factors that drive gender differences in human pro-sociality: i) males' costly signaling motive; ii) females' preference to conform to social norms; and iii) intra- and inter- group differences in tactics for resolving social dilemmas. Ultimately, these differences can be attributed to the human mating motive, which evolved differently for men and women. In addition, the evidence I reviewed informs that gender differences in pro-sociality are reinforced both by the "ingrained" nature and the exogenous impact of "nurture." For example, Andersen et al. (2008) found that the aggregate level of public good provision is much higher in matrilineal than in patriarchal societies[17]. I hope this article serves as a bridge for connecting evolutionary theories with experimental research, and in doing so provides

[17] Such difference is due primarily to Khasi men contributing more than patriarchy male counterparts.

inspiration for additional research aimed at designing institutions to promote cooperation and social welfare.

CHAPTER 3

Altruistic cooperation is indispensible in human societies, and much progress has been made towards developing institutions to promote pro-social decisions. Economists have focused on punishment and rewards, typically finding that cooperation can be sustained only with efficiency cost (Benabou and Tirole 2006; Gneezy and Rustichini 2000b; Falk et al 2005). At the same time, evolutionary biologists have long recognized that cooperation, especially food sharing, is typically efficiently organized in groups living on wild foods even absent formal economic incentives (Hawkes and Bliege Bird 2002; Gurven et al 2000; Gintis et al 2001). Despite its evident importance, the source of this voluntary compliance remains controversial. Drawing on evolutionary psychology, we hypothesize that such cooperation relies on male preferences for unique and displayable rewards (trophies) out of competition. Further, here we show with controlled lab experiment cooperation emerges in a generosity competition with trophy rewards. The same environment with equally valuable but non-unique and non-displayable rewards fails to result in cooperation. Moreover, we find under trophy rewards both the proportion and contributions of cooperative "types" significantly increase in males. In contrast, we find no evidence that female generosity is modulated by trophies. The evidence indicates that reciprocity from female free-riders towards co-operators mitigate

their negative emotion and consequently sustains cooperation. Our results open new paths to promoting cooperation in human groups without sacrificing efficiency. They could have important impact in any domains where voluntary compliance matters --- including relations between spouses, employer and employee (Falk and Kosfeld 2006; Fehr and Gachter 2001), market transactions and conformity to legal standards (Gneezy and Rustichini 2000; Bohnet et al 2001).

Throughout human evolution, cooperation among genetic strangers has played a crucial role in activities ranging from hunting large game to governing commons to investing in group reproduction. However, there is much individual heterogeneity, thus how to promote the behavior of altruists and depress that of egoists are vital for cooperation (Fehr and Fischbacher 2003; Fischbacher et al. 2001). The axiom of self-interested behavior suggests that the only remedy for the norm compliance problem is to provide sufficient incentives (Gneezy and Rustichini 2000b; Bohnet et al. 2001). Unfortunately, the remedies, especially the small pecuniary incentives, can do more harm than good because they enforce compliance at the costs of intrinsic altruistic motives as well as reduced economic efficiency (Benabou and Tirole 2006; Gneezy and Rustichini 2000b; Fehr and Gachter 2001; Fischbacher et al 2001; Houser et al 2008; Fehr and List 2004). Though research in anthropology and evolutionary biology implies that even small rewards facilitate cooperation, economists seem to have neglected this possibility (Hawkes and Bliege Bird 2002; Gurven et al 2006).

Evolutionary biologists began to focus on small rewards in an effort to unravel the mystery that human males provided food for a group even absent direct food reciprocity (Hawkes et al. 2001; Bliege Bird and Bird 1997; Trivers 1971; Nowak and Sigmund 1998; Bliege Bird 1999). Drawn from costly signalling theory (Smith et al 2003, Gintis et al 2001; Zahavi 1975) and evidence from existing groups living on wild foods (Hawkes et al. 2001, Bliege and Bird 1997, Smith et al 2003), argues that food contributions to public goods consumed by large groups can easily attract large audience and thus emerged as a status-bearing display for those who win the hunting competition. Food recipients confer status to the successful hunters, and in this way status emerges as a currency of reciprocity (Hawkes and Bird 2002, Gurven et al. 2006). An implication is that males may have an evolved preference for observable unique displays out of competition, due to their evolutionary connection to status. If so, status bearing displays, particularly unique and observable rewards (trophies), may mediate male generosity in contemporary competitive social environments.

We examined whether and how a competition for unique trophy rewards affects male generosity in 'public goods' game with real money stakes. A total of 152 subjects (104 male 48 female) participated in our experiment under three conditions: the "Mug" treatment which included a generosity competition for unique observable trophy rewards (Mugs with a unique ICES logo); the "Ice-cream" treatment which included the same competition but for a generic reward with the same subjective pecuniary value (a Haagen-Dazs ice- cream bar) and the Baseline, a public goods game absent competitive

pressure. “Mug” and “Ice-cream” treatments are identical except the final reward in “Mug” is unique and displayable while that reward in “Ice-cream” is generic and non-displayable. The Baseline treatment differs from the “Mug” and “Ice-cream” treatments in that it involves neither competition nor reward.

In all conditions, anonymous fixed groups of four subjects played a game they knew would last ten periods. Each member received an endowment of 20 E$ and decided how much to invest into a group project. Subjects could keep the money that they did not contribute to the project. For every 1E$ the subject chose to invest in the project, each of the four group members, that is, also those who invested little or nothing, earned 0.4 E$. Therefore, 0.4 E$ is returned to the member and 1.6 E$ goes to the group; whereas every 1E$ kept for himself returns 1E$ only to the subject. Thus, it was always in the material self-interest of any subject to keep all E$ privately regardless of how much other three members contributed. Yet, if every group member chose to keep his endowment privately, then each subject earns only 20 E$ for the period, whereas if all of them invest their 20 E$ every member earns a return of 32 E$.

All the interactions in the experiment took place anonymously. Members were never informed the identity of the others in the group. Subjects made their investment decisions simultaneously and once they finished, they were shown how many E$s each member of their group had invested to the project. Subjects were also able to register approval ratings for their group members’ decisions (details see method). All approval decisions were also made simultaneously and a subject can never assign points to himself.

At the end of each period in "Mug" and "Ice-cream" treatments, subjects who received the most approval points of his group will receive an electronic gold star. A subject can receive up to ten stars over ten periods, with each star increasing 10 percentage points to receive the final reward (see method). Our "Ice-cream" treatment constitutes a powerful control for the effects of mug on males' behavior because everything is kept constant relative to "Mug", except the "Ice-cream" reward is neither unique nor easily observable. Absence of social comparison and reward, the comparison between Baseline and "Mug" or "Ice-cream" enables us to detect how the introduction of competition for different small rewards affects cooperation when literatures provided controversial evidence on this issue. Note that distributing rewards absent public acclaim enables us to detect the intrinsic motive for the rewards without adding additional instrumental effect (Ball et al. 2001, Duffy and Kornienko 2010).

Clearly, systematic differences between males and females, or between Mug and Ice-cream rewards, can confound inferences regarding the source of behaviour in our treatments. For example, gender differences in the "Mug" treatment could be due to males' relatively higher willingness-to-pay for mugs; and differences in competitive tendencies between treatments could be caused by males having a greater value for Mugs than Ice-cream. To address this issue we conducted a standard WTP elicitation (Becker et al. 1964) (see Appendix C), are we are not able to find evidence of systematic differences in subjective values either between males and females or between items (Figure 5). This finding casts substantial doubt on any explanations for our results that

appeal to differences in subjective values to account for gender differences in competition within or between the "*Mug*" and "*Ice-cream*" treatments.

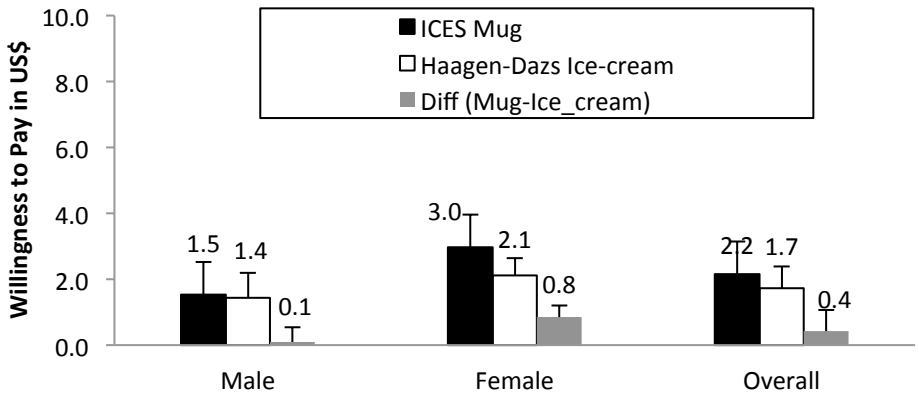
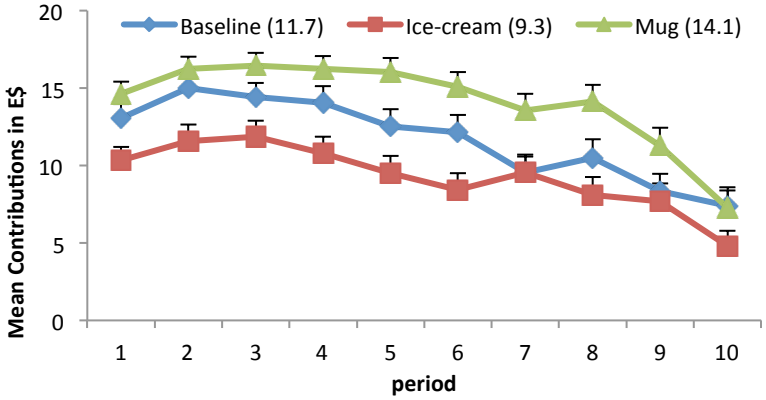


Figure 5: Willingness-to-pay (WTP) for ICES Mug and Haagen-Dazs Ice-cream. The Fig. describes males' and females' WTP for the ICES Mug, the Haagen-Dazs Ice-cream and differences between them. Category means are above the bars. WTP is statistically identical for males and females, for both the ICES mug as well as the Haagen-Dazs Ice-cream bar.

Overall cooperation under mug rewards is significantly higher than when the reward is ice-cream. For example, average contributions are significantly higher in "Mug" (mean=14.1 E$, n=14 groups) than "Ice-cream" (mean=9.26 E$, n=12 groups), (Figure 6a. Mann-Whitney U-test, z=2.675, P=0.008, two-tailed). Furthermore, on average of 54% of the subjects contributed their full endowment 20 E$ to the public goods in "Mug" (n=14 groups), much higher than that in Ice-cream (mean=23%, n=12 groups, z=2.734, P=0.006, two-tailed Mann-Whitney U-test) or that in Baseline (mean=35%, n=12 groups, z=-1.987, P=0.047, Figure 6b.) Not surprisingly, star-winners' contribution in "Mug" (mean=18.6 E$, n=14 groups) are significantly higher than that in

"Ice-cream" (mean=14.4 E$, n=12 groups, z=2.180, p=0.029, Mann-Whitney U-test, two-tailed). However, determinants of approval points received follow a similar pattern across the treatments. With frequency 90% or greater in all treatments, a star-winner was the group's highest contributor. Overall, the greater (smaller) was a person's contribution in relation to their group members, the greater (smaller) was the amount of approval a person received, and the strengths of this effect is identical among treatments (Appendix 3, Table 1A).

a.



b.

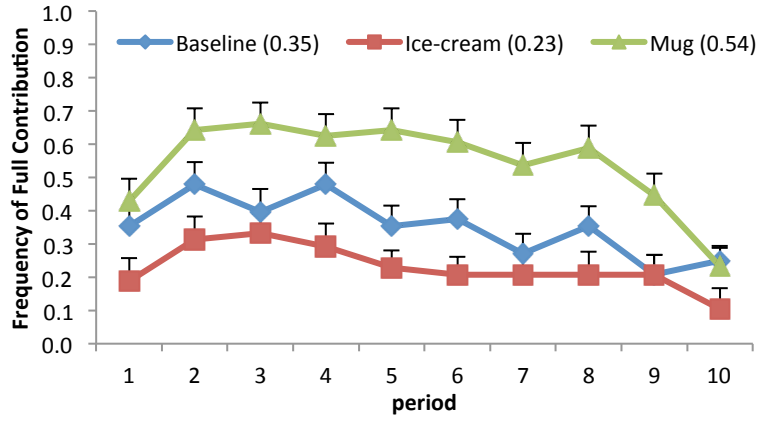
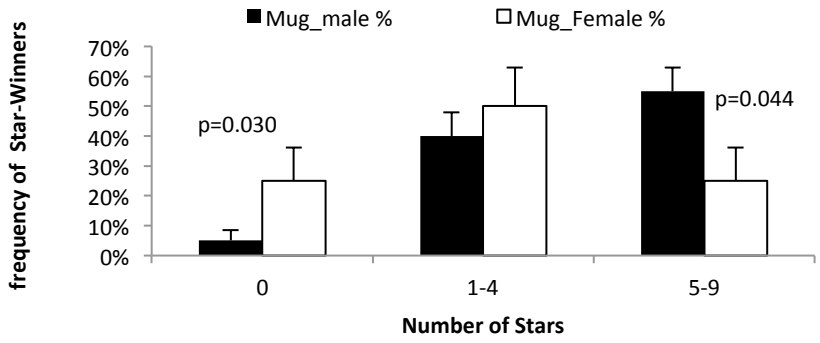


Figure 6. Contributions to the public goods over 10 periods across treatments. a. The numbers in parentheses indicate the mean contribution (over 10 periods) for that treatment. Contributions to the public goods is highest in "Mug" and lowest in "Ice-cream". b. The numbers in parentheses indicates the mean frequency of full contribution in that treamtent. In "Mug" treatment, subjects who contribute their total endowment 20E$s predominates the population.

Differences between the "Mug" and "Ice-cream" treatments are driven by male competitive behaviour. For example, in "Mug", 95% of males (n=40) won at least one star over the ten period game whereas only 75% females (n=16) did so (Fig. 7a, Mann-Whitney U-test, z=2.166, P = 0.030, two-tailed). Also, 55% of males won at least five stars while this is true for only 25% of females (Mann-Whitney U-test, z=-2.015, P=0.044, two-tailed). In contrast, no gender differences exists in "Ice-cream" (Mann-Whitney U-test, n=27 for male, n=21 for female, z=0.692, P=0.489, two-tailed) for those who have won at least one star, and the same test yields z=0.000, P=1.000 for 5 stars or more (see Fig. 7b). Comparing between "Mug" (n=40) and "Ice-cream" (n=27), a significantly greater fraction of males won at least one star in "Mug" (Mann-Whitney U-test, z=2.116, P = 0.034, two-tailed), while females display no significant difference between "Mug" (n=16) and "Ice-cream" (n=21, Mann-Whitney U-test, z=-0.813, P=0.16, two-tailed). The same pattern of gender differences is revealed by a random (individual) effect GLS regression analysis clustered by group (see Table 2A in Appendix 3).

a.



b.

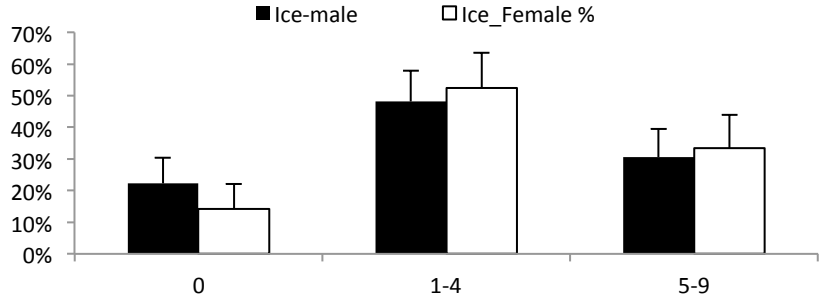


Figure 7: Number of stars won in "Mug" and "Ice-cream" treatments. Each panel describes the frequency of stars won (tying allowed) in the Mug or Ice-cream treatments. a. Frequency of males (filled bars, N=40) and females (open bars, N=16) winning 0, 1-4 or 5-9 stars in "Mug". Significantly more male than female won at least one stars, or at least five stars over 10 periods. b. Frequency of males (filled bars, n=27) and females (open bars, n=21) winning 0, 1-4 or 5-9 stars in "Ice-cream". No differences between how male and female compete for stars in "Ice-cream".

What mechanisms might be involved in generating the effect of trophy on male generosity? One possibility could be trophy modulate the belief system of male subjects towards altruistic acts. That is, males might have expected other males to compete for the mug reward. This possibility is consistent with the higher first-period contributions

we observed in “Mug” among males but not females. Using Mann-Whitney U-test we find first period male contributions in “Mug” (mean=15.4, n=40) significantly higher than that in “Ice-cream” (mean=9.3, n=27, z=3.696, P=0.000, two-tailed) while female in “Mug” (mean=12.9, n=16) not different from that in “Ice-cream” (mean=11.7, n=21, z=1.376, P=0.169, two-tailed).

Higher contributions in “Mug” may not be sustainable over periods given the presence of free-riders and widely-replicated result that free-riding is contagious (Fischbach et al. 2001). The presence of free-riders degrades co-operators’ morale, possibly as a result of inequity aversion (Bolton and Ockenfels 2000; Fehr and Schidt 1999) and preferences for reciprocal fairness (Rabin 1993, Fehr and Fischbacher 2002), leading to decay in cooperation over time.

We find, however, that this contagion is substantially mitigated in the “Mug” condition, both in the sense that there are increased numbers of “co-operators”, and that the contributions of cooperative “types” increases. We classify each subject, based on their behaviour, as either a co-operator or free-rider (for details, see the legend of Fig. 8.). A Mann-Whitney U-test shows significantly more male co-operator frequency in “Mug” (n=40) than in “Ice-cream” (n=27) (Fig. 4. z=2.294, P=0.022, two-tailed), along with 37% more contribution (Fig. 8. Mann-Whitney U-test, n=29 for “Mug” and n=12 for “Ice-cream”, z=2.802, P=0.005, two-tailed). The same test for distribution of female co-operators in “Mug” (n=16) versus “Ice-cream” (n=21) is insignificant at z=0.239, P=0.811 (two-tailed, Fig. 8), and their contributions are not statistically different z=1.880, P=0.060 (n=12 for “Mug”, n=15 for “Ice-cream”, Fig 8).

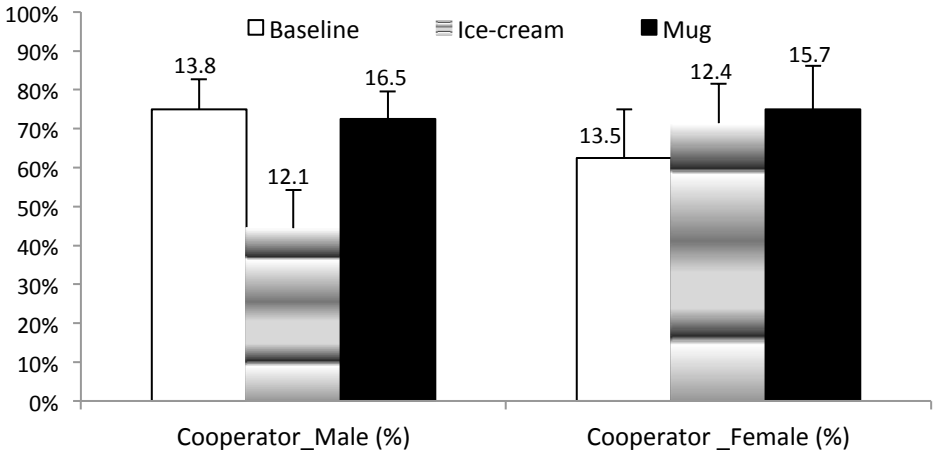


Figure 8: Frequency of cooeprators for males and females by treatment. Subjects are classified as either a Free-Rider or Cooperator. The numbers above the bars indicate the average contribution of subjects underlying the bars. One is a cooperator if the majority of his nine classifiable decisions are cooperative, and is otherwise called a Free-Rider. We define a decision as cooperative if the contribution for the current period is at least as great as the mean (rounded down to the nearest integer) of the other group members' previous period's contribution. Frequency of male cooperators is least in "Ice-cream" while that for female remains unchanged across treatments.

In relation to the Baseline, the frequency of male co-operators does not differ from "Mug" (Mann-Whitney U-test, z=0.237, P=0.812, two-tailed). On the other hand, male co-operators in "Mug" (n=29, means =16.5 E$) contributed significantly more than those in Baseline (n=24, means=13.8 E$) (Fig. 8, Mann-Whitney U-test, z=-2.692, P=0.007, two-tailed). In contrast, females display no differences between "Mug" and Baseline, the same test yields insignificant differences in frequency of co-operators (z=-0.751, P=0.4528, n=16 for both "Mug" and Baseline) along with z=-1.320, P=0.186 for contribution comparison between female co-operators in "Mug" (n=12) and Baseline (n=10).

Although with fewer free-riders, free-riding is not eliminated in the Mug condition, yet cooperation is sustained. Why is contagious free-riding mitigated in the "Mug" condition? One possibility is that receiving approval, or status, diminishes co-operators' negative emotions (Fehr and Gachter 2002; Frank 1988). In particular, free-riders can reciprocate by assigning approval points to co-operators, increasing the chance that a co-operator receives the reward. To the extent this is the fact, we would expect to observe different approval assignment patterns in "Mug" than in either "Ice-cream" or Baseline. Indeed, we find that female free-riders in "Mug" (n=4) assign significantly more approval points than female free-riders in "Ice-cream" (n=4) (Mann-Whitney U-test, z=2.021, P=0.043, two-tailed) and also assign more than male free-riders in "Ice-cream" (n=10, P=0.048, z=1.980). Trophy does not, however, modulate co-operators' approval behaviour. The approval points assigned by female co-operators in "Mug" (n=7) is no different from female co-operators in "Ice-cream" (n=9, z=0.053, p=0.958, Mann-Whitney U-test, two-tailed), or male co-operators in "Ice-cream" (n=10, z=0.781, P=0.435), or male co-operator in "Mug" (n=12, z=0.423, p=0.673). An OLS regression analysis provides convergent evidence for this result (Appendix 3, Table 3A).

Our results argue that males' trophy-seeking preferences can promote cooperation through a generosity competition in social dilemma environments. Our "Ice-cream" treatment constitutes a powerful control for the effects of mug on males' behavior because everything is kept constant relative to "Mug", except the "Ice-cream" reward is neither unique nor easily observable. Our willingness-to-pay comparison between "Ice-cream" and "Mug" rules out any difference in perceived subject value for the tangible

rewards; the comparison also rules out competition per se (Gneezy et al. 2003) as an explanation for differences. We speculated that the proximate mechanism underlying cooperation under trophy mug could be a result of two combined forces: changes in expectations due to the presence of "Mug" and the use of approval by free-riders as a currency of reciprocity, perhaps especially among females. Our results offer new paths for designing institutions to promote cooperation in groups of genetic strangers; mechanisms that turn on reward rather than sanctions.

Methods

A total of 152 undergraduate and graduate master students (34.9% female) from George Mason University participated in variants of public goods experiments. Ten sessions with 12 subjects, and one with 8, were conducted for the public goods game under three different conditions (the extra session was a mug treatment). Subjects were first randomly matched into groups with three anonymous counterparts who they knew would be their group members for the entire ten periods. Each subject is endowed with 20 E$, with an exchange rate of 25E$ = 1 $. In every period, the subjects knew the contribution vector of the group members but were unable to track any specific group member's contributions over time. The process of registering approval involved distributing non-monetary approval points ranging from 0 to 10 to each of the other three members, with 0 points indicating the lowest level of approval and 10 points indicating the highest level of approval. Each subject knew the overall approval she received but not the specific amounts sent nor who did or did not send approval.

Approval had no consequence in the Baseline treatment. In the "Mug" and "Ice-cream" treatments, the subject who received the most approval points was awarded a gold star. (In event of a tie, stars were allocated to all tied group members). At the end of each period subjects were informed of the total approval they received, the gold star winner's contribution (In the event of a tie, the highest contribution among all gold star winners is revealed) and their own contribution, as well as their own monetary payoff.

At the end of each period, the accumulated gold stars won by a subject were displayed. Each star added ten percentage points to the probability a subject would win the Mug or Ice-cream reward. In particular, at the end of the rewards treatments, in addition to being paid privately with cash, all subjects had the opportunity to draw from a deck of ten cards, numbered through 1 to 10, and to receive the reward if the number s/he drew is equal to or smaller than the number of stars s/he earned during the experiment. The experiments lasted 45-50 min and on average subjects earned $16.00 per session.

Upon entering the laboratory each subject was seated in a carrel separated from other subjects in a way that ensured no subject could see any other subjects. Participants then received written instructions. After the experimenter read aloud the instructions, participants were quizzed to ensure they understood the procedures and the payoff structure. The experiment did not proceed until each subject had passed the quiz. The public goods game was written using the experimental software Z-tree (Fischbacher 2007).

APPENDIX A

Proofs: The $g\bar{G}$ and *VW* equilibrium

To first derive the f.o.c. condition of U_i with respect to g_i, I have

$\theta_p U_p'(\pi - g_i) = \theta_A w U_A'[w * (g_i - \sigma\, \bar{G})]$ so that

$$w=\frac{\theta_p U_p'(\pi-g_i)}{\theta_A U_A'[w*(g_i-\sigma\, \bar{G}]}$$

Hollander assumes that approving behaviour is not strategic but automatic:

"We generally approve of cooperative behaviour even if it does not make us significantly better off. In doing so, we often seem to consider the hypothetical advantage we would enjoy if everybody else behaved cooperatively in like manner."

This motives the assumption that an individual's approval rate, his subjective value of another agent's marginal contribution stimulating approval, is equal to the hypothetical advantage, measured in terms of the private good, that the former agent would enjoy if not only the latter but also all other agents except him increased their contributions marginally. Formally, this means *v* is taken to be the marginal rate of substitution between endowment and public goods..

$$v = \frac{\theta_{\bar{G}} U'_{\bar{G}}(\bar{G})\theta_A \sigma w U_A'[w * (g_i - \sigma\, \bar{G})]}{\theta_p U_p'(\pi - g_i)} = \frac{\theta_{\bar{G}} U'_{\bar{G}}(\bar{G})}{\theta_p U_p'(\pi - g_i)} - \sigma$$

Proof of Proposition 1

Suppose there is an increase in σ. The *VW* curve will shift downward by $\Delta\sigma$ to *VW1*, and $g\bar{G}$ will pivot clockwise at $\bar{G} = 0$, to $g\bar{G}_2$. This will lead to a smaller *w** (approval rate) in equilibrium. Depending on the movement of $g\bar{G}$, the level of new contribution in equilibrium $\bar{G}_1^*$ remains unclear. If it pivots clockwise, then the new equilibrium e_2^* has the same contribution level as the old equilibrium e_1^*. Yet, if $g\bar{G}$ curve pivots less or further clockwise, then the new contribution in equilibrium will be either smaller or bigger than the previous contribution in equilibrium.

Proof of Proposition 2

Increasing the weight of approval on overall utility results in the slope of the $g\bar{G}$ curve becoming flatter at any given $\bar{G}$. This leads to a clockwise pivot of the $g\bar{G}$ curve. Also, a

reduced ratio $\frac{\theta_p}{\theta_a}$ generates a downward shift of the curve. It is clear that both of these effects lead to an increase in equilibrium contributions $\bar{G}^*$and to a decrease in the equilibrium approval rate *w**.

Proofs of Proposition 3

This is the condition which allows the *VW* and $g\bar{G}$ curve to intersect. If: (i) the marginal utility from private good at endowment $U'_p(\pi)$ is still too big; (ii) the marginal utility from approval at initial zero $U'_A(0)$ is too small; or (iii) the marginal utility from public goods at initial zero $U'_{\bar{G}}(0)$ is still small, then I would not expect to observe the social equilibrium exchange between contribution and approval.

APPENDIX B

Note: The descriptions that are both parenthesized and underlined are used to identify the differences between treatments.

Instruction

Thank you for participating in today's experiment. You have earned a $5 show-up bonus for participating. Whatever you earn in this session will be in addition to this $5. If you read the instructions below carefully, you will have the potential to earn significantly more. In this experiment you will earn Experimental Dollars (E$). For every 25 E$ you earn, you will be paid 1 US Dollar in cash at the end of the experiment. Neither before nor after the experiment will you receive any information about the identity of your group members. During the experiment, you will not be allowed to talk to other participants or to use cell phones. You will be paid privately in cash. If you have any questions, please raise your hand and an experimenter will assist you.

The experiment will consist of 10 periods. All participants will be divided into groups of 4 people. You will stay with **the same** 3 other participants for all 10 periods of the experiment. In today's experiment, Players 1, 2, 3 and 4 will stay in the same group, while Players 5, 6, 7 and 8 will stay in the same group and Players 9, 10, 11 and 12 will stay in the same group. Each period of the experiment consists of **two stages**. In the first stage you will receive an endowment and you will then decide how much of your endowment to contribute to a project. In the second stage, you will be informed how much your other three group members contributed to the project. You will then be able to decide how many approval points (0-10) to give to each of your group members. The details of each stage are as follows:

First Stage

At the beginning of each period, each participant will receive 20 E$ as his or her endowment. In the first stage you will decide how much of the endowment to contribute to a project, and how much you want to keep for yourself. The amount you keep for yourself is equal to the difference between your endowment and your contribution to the project.

After all the members have made their decisions, your screen will show you the total E$ contributed to the project by **all four** members of your group (including your own contribution). This screen will also show how many E$ you have earned.
Your income consists of two parts:

1) the E$ you kept for yourself; and
2) your income from the project = 40 percent of the total contribution of all 4 group members (including your own contribution to the project).

Your E$ income each period = (20-your contribution to the project) + 0.4*(total group contribution to the project)

Since everyone in the group is paid 40 percent of the total amount contributed to the project, all group members will receive the same income from the project. Suppose the total contribution of all group members is 60 E$. In this case each member of the group will receive an income of 0.4*60=24 E$ from the project. If the total contribution to the project is 10 E$, then each member of the group will receive 0.4*10 = 4 E$ from the project.

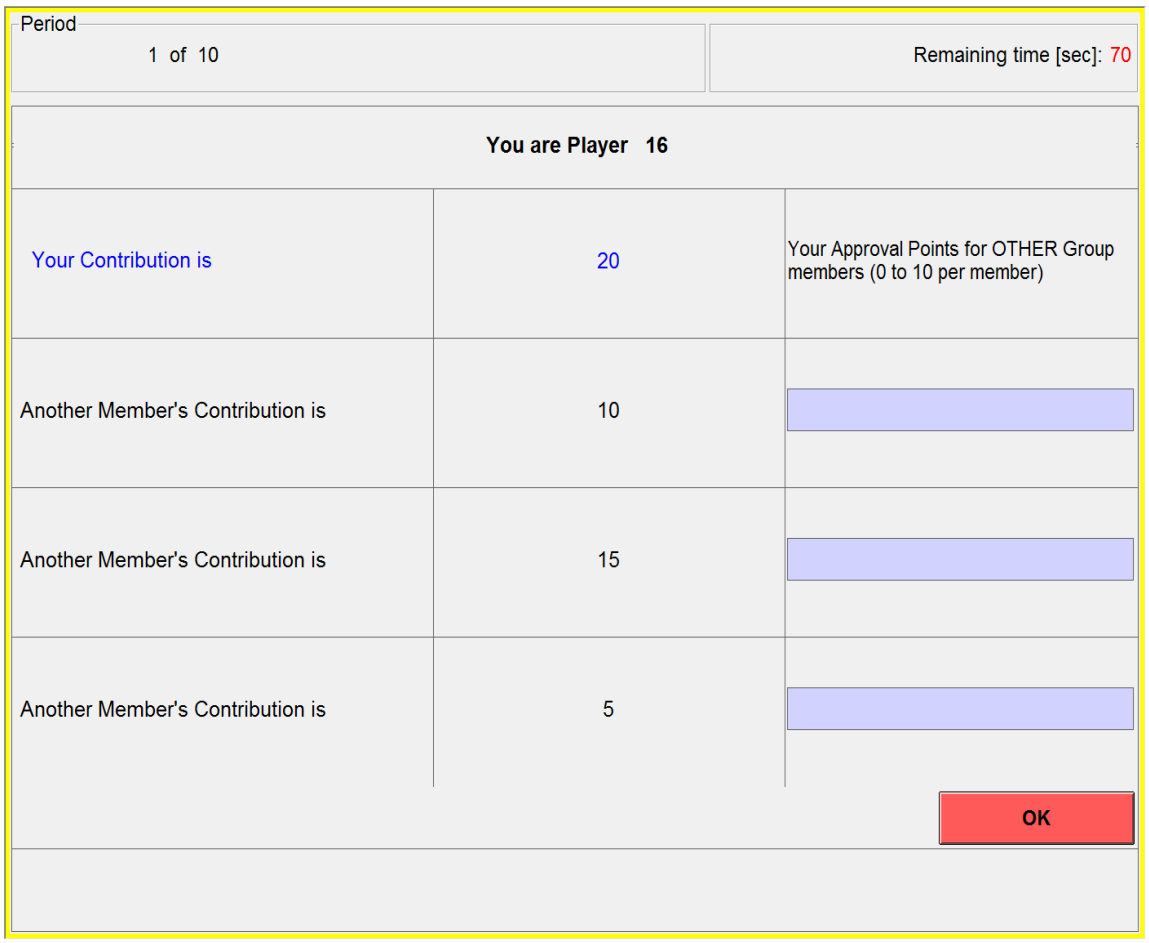
The Second Stage

At the beginning of the second stage, you will be shown how many E$s each member of your group contributed to the project. The example on the next page shows what you will see on the screen. The period and remaining seconds are displayed on top, and you are suggested to make your decision before the time hits zero. The experiment will not proceed until all participants have clicked the "OK" button. You will have the **same Player ID** during the **entire experiment**. In the graph on the next page, for example, "You are Player 16**"** for the entire experiment. Your contribution is shown in the first row in blue, while the contributions of the other three group members are shown in the remaining three rows. Their contributions will be displayed in **random order** so that your contribution in each period will remain anonymous to the other group members. Specifically, the "Another Member" displayed in the second row of this period could be different from the "Another Member" displayed in the second row in the following period.

Allocating Points

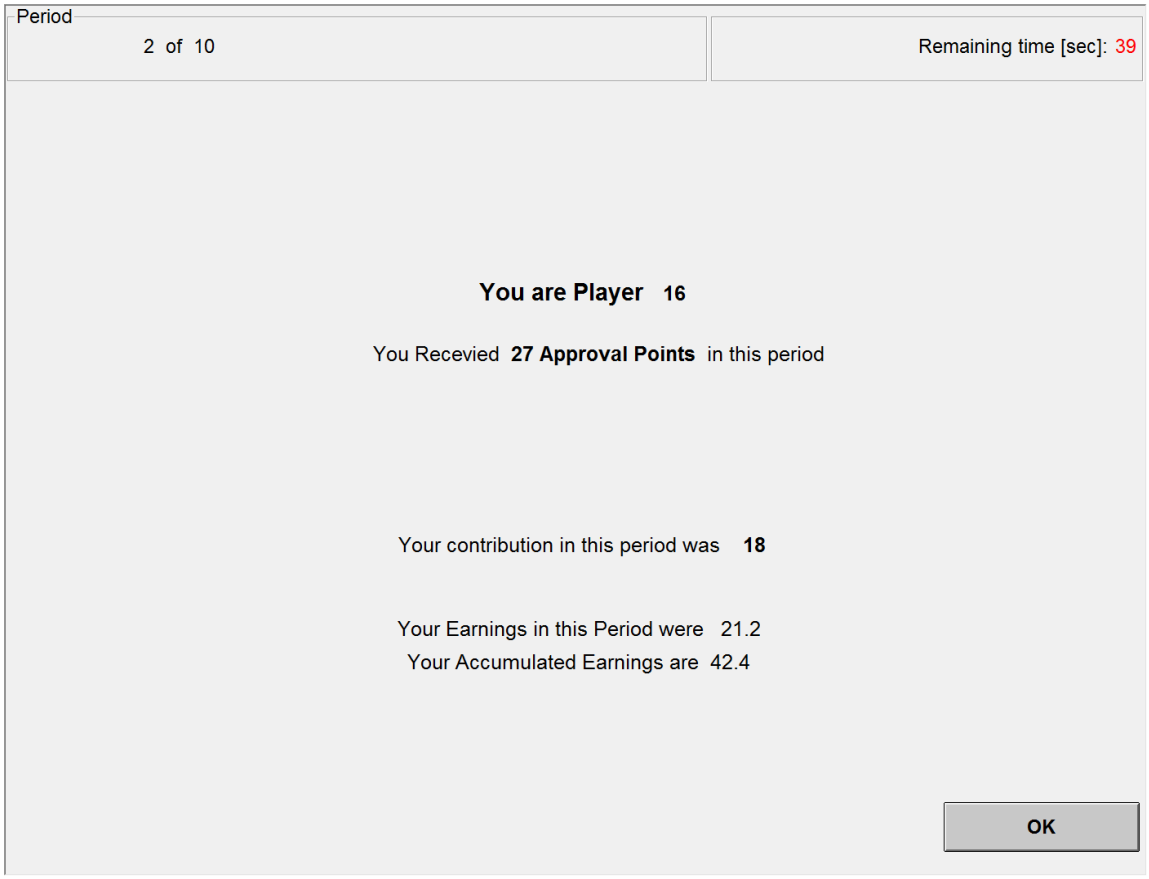
In the last column of the box, you will have the opportunity to register your approval of each other group member's decision by **distributing approval points.** The points have **no monetary value**. **They will not affect the earnings of either you or your other group members.** They will, however, tell others how much you approve their decisions. You must decide how many points (between **0** and **10**) to give to each of the **other three** group members. **In each period**, you can distribute up to ten points to **each** of your group members. Zero point indicates the least amount of approval and ten points indicates the most amount of approval. The other group members can also assign points to you. That is, a player can receive at most 30 approval points in each period. This happens when your other three group members each assign 10 points to you.

The input screen at second stage



(only in *Baseline)* At the end of each period, you will be told how many approval points you have received for this period. As shown in the graph on the next page, "You

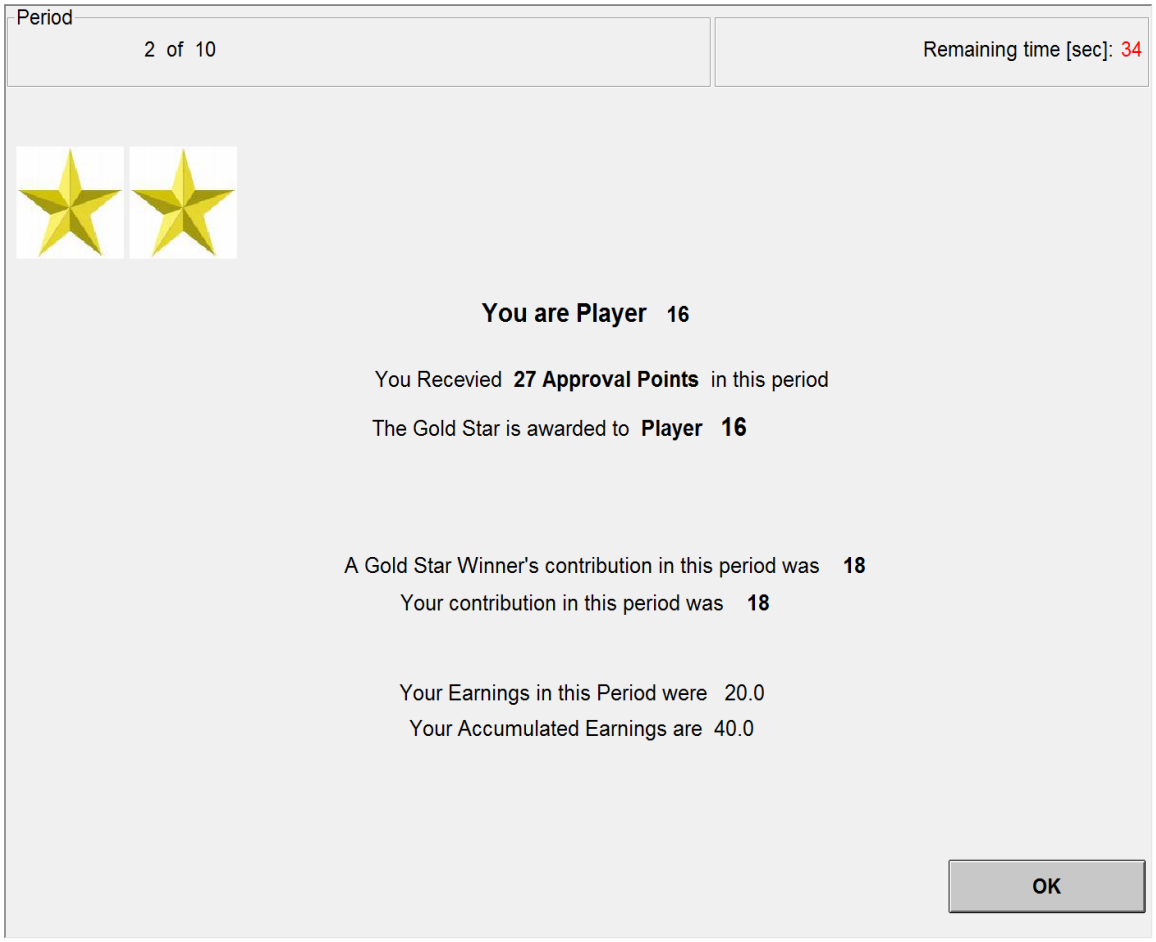
received **27 Approval Points** in this period". A summary of your contribution in this period and your earnings will also be displayed.



(The figure above will only be shown in *Baseline*)

(**Only in *Star, Ice-cream* and *Mug* Treatments**) At the end of each period, a Gold Star will be awarded to the subject who received **the most Approval Points** of their group in that period. **The Gold Star will be displayed** for that person on top of the screen. As shown in the graph on the next page, your group members will also be informed that you received the star: "The Gold Star is awarded to **Player 16.**" In the next period, if you again receive the most approval points of your group, you will receive **another Gold Star**, as did Player 16 in the example. You will then see two Gold stars displayed on top of your screen including the one you received in the previous period. Meanwhile, a Gold Star Receiver's contribution in this period will be displayed. It is also possible for **both you and your group members** to be awarded the Gold Star if more than one of you receives the same number of **Approval Points** for a given period. (**From here on, appear only in *Ice-cream* and *Mug* Treatments**) After ten periods, subjects who have

received stars will have a chance to draw from a deck of 10 cards to get an ICES mug (**ICES mug is replaced by Haggen-Dazs Ice-cream bar in *Ice-cream* Treatment**) (numbered 1 through 10). You will get a mug if the number of stars you received is **greater than or equal to** the number you draw from a deck of 10 cards. For example, if you received 2 stars, then you get a mug (**mug is replaced by Ice-cream in *Ice-cream* treatment**) if you draw either a 1 or a 2. If you received 8 stars, then you get a mug if you draw **any** number between 1 and 8. The mug will be given to you with your cash payment privately.



(The figure above will appear in *Star, Ice-cream and Mug* treatments)

APPENDIX C

Table 1A: Determinants of Approval Received

	Random Effect GLS
Ice-cream	-2.613*
	(1.427)
Mug	-2.753
	(1.706)
Ice-cream x Others Avg. Contribution	1.021***
	(.120)
Mug x Others Avg. Contribution	0.821***
	(.139)
Baseline x Others Avg. Contribution	0.882***
	(.093)
Baseline x Positive Deviation from others' average	0.999***
	(.095)
Mug x Positive Deviation from others' average	0.726***
	(.168)
Ice-cream x Positive Deviation from others average	1.041
	(.119)
Baseline x Negative Deviation from others' average	-1.287***
	(.090)
Mug x Negative Deviation from others' average	-1.053***
	(.109)
Ice-cream x Negative Deviation from others' average	-1.312***
	(.107)
Constant	5.174***
	(1.141)
Period Dummies	Yes
# of Obs.	1520

Note : Dependent variable: Approval Points i received in period t
Random Effect GLS regression, robust standard error clustered by group
Level of significance : *p<0.1, **p<0.05, ***p<0.01

Note for Table 1A:

Table 1 shows that determinants of approval points received follow a similar pattern across the treatments. In particular, the greater (smaller) the contribution in relation to others, the greater (smaller) was the amount of approval a person received, and the strength of this effect is identical among treatments. This is shown by the coefficient for "Treatment variable (Baseline/Mug/Ice-cream) x Positive/Negative Deviation from Others' average". Moreover, in all treatments, the groups' highest contributor is also a star winner with frequency at least 90%.

Table 2A: Dynamic Contribution		
	Random Effect GLS	**Random Effect Tobit**
Mug_male	5.657***	14.479***
	(2.049)	(5.376)
Mug_Female	1.369	6.931
	(2.215)	(6.301)
Ice-cream_Male	1.175	6.245
	(2.157)	(4.977)
Ice-cream_Female	0.778	7.420
	(1.659)	(5.065)
Baseline_Male	.943	3.208
	(1.261)	(4.105)
Approval Points Received	.201***	.286***
	(.030)	(.050)
Male in Mug x Others Avg. Contribution	.324***	.819***
	(.088)	(.200)
Female in Mug x Others Avg. Contribution	.635***	1.277***
	(.111)	(.288)
Male in Ice-cream x Others Avg. Contribution	.339***	.492***
	(.113)	(.224)
Female in Ice-cream x Others Avg. Contribution	.490***	0.793***
	(.085)	(.239)
Male in Baseline x Others Avg. Contribution	.502***	.991***
	(.092)	(.174)
Female in Baseline x Others Avg. Contribution	.580***	1.284***
	(.061)	(.225)
Constant	4.203***	-1.340
	(1.235)	(3.859)
Period Dummies	Yes	Yes
# of Obs.	1368	1368

Note : Dependent variable: Contribution of i in period t, independent variable in period *t-1* .
Random-effects GLS regression, robust standard error clustered by group
Level of significance : *p<0.1, **p<0.05, ***p<0.01

Note for Table 2A: Female Conditional Cooperation and Male Unconditional Generosity. First period contributions are statistically identical among female co-operators' between *Mug* (n=12) and *Ice-cream* (N=15, z=1.001, P=0.317), while in the first period significant differences emerge between female co-operators' (mean=14.0, N=12) and male co-operators' in *Mug* (mean=17.4, N=29, z=-2.356, P=0.019). Over

time, female co-operators' (N=7 groups) contributions increase so that overall average contributions do not differ between male (N=12 groups) and female co-operators (N=7 groups) in *Mug* (z=-0.466, P=0.641). Table 2 provides evidence to support female conditional cooperation. We see coefficient for female conditional cooperation in *Mug* is 0.635 (z=5.72, P=0.000), which is significantly higher than 0.324, the coefficient for male in *Mug* (chi2 (1) = 6.94, P=0.008).

Table 3A: Allocation of Approval Points

Random Effect GLS	(1)	(2)
Cooperator_Mug	6.505**	4.584*
	(2.905)	(2.359)
Cooperator_Ice-cream	5.684**	4.229*
	(2.471)	(2.533)
Free-rider_Mug	4.908*	
	(2.731)	
Free-rider_Mug_Male		1.897
		(2.479)
Free-rider_Mug_Female		7.347***
		(2.592)
Free-rider_Ice-cream_Male		-1.527
		(1.614)
Pos. Dev. from Others' Avg. Contri in Mug	-.690***	-.451***
	(.225)	(.126)
Pos. Dev. from Others' Avg. Contri in Ice-cream	-.598*	-.494***
	(.311)	(.163)
Neg. Dev. from Others' Avg. Contri in Mug	-.008	.032
	(.225)	(.180)
Neg. Dev. from Others' Avg. Contri in Ice-cream	.282	.269
	(.191)	(.139)
Constant	7.796***	15.613***
	(1.055)	(1.235)
Period Dummies	Yes	Yes
# of Obs.	1040	1040

Note : Dependent Variable: Approval points assigned by persion *i* in period *t*
Random GLS regression with robust standard error clustered by group.

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