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Social approval, competition and cooperation

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Abstract: Holländer (1990) argued that when non-monetary social approval from peers is sufficiently valuable, it works to promote cooperation. Holländer, however, did not define the characteristics of environments in which high valued approval is likely to occur. This paper 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. Our findings point to new institutions that rely on reward, rather than punishment, to efficiently promote generosity in groups.

JEL: D02, D03, D64, H4;

Key Words: Social approval, Cooperation, Signaling and Competition.

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I. Introduction

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 effective when combined with the opportunity to express social disapproval[2]. Aside from our own work in this area[3], however, we are unaware of any investigation into the impact of

[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.

[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

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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. We 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 and Tirole 2003, Harbaugh 1998, Glazer and Konrad 1996).[5] Drawing on signaling motives, our 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.

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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.

[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.

We 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 our 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.

Our 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, 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 our 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.

Our key finding is that competition for social approval promotes cooperation only when winners receive non-cash rewards with signaling value (the Mug). Moreover, our data reveal that approval is dispensed differently under different final rewards, and in a way that is consistent with Holländer

(1990). In particular, we 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. Our data is consistent with both of these predictions. Further, we 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, our 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 our 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 our experiment design, which varies the incentives that influence these two major factors. Section 4 describes our hypotheses, namely how the incentives we introduce may impact equilibrium. Section 5 reports our 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. Our comparison between treatments focuses on: (i) how people respond to contributions with approval; and (ii) how people respond to approval with contributions.

Our 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)

Holländer (1990) posits that an agent obtains approval from neighbours, colleagues, acquaintances, etc. This is the reference group of the respective agent and is assumed to be of equal size for all agents. Given that the model assumes only symmetric behaviour, the amount of approval received from a typical member of the reference group is an index of total approval received. Let $A(g_i)$ be a monotonically increasing function representing total approval received for contribution g_i. People have preferences regarding both the level of approval received and the relative approval $A(g_i) - A(\bar{G})$, where $A(\bar{G})$ is approval associated with the average behavior. Preferences are assumed to be additive in these two factors, with respective weights $(1-\alpha)$ and α. This implies that utility for approval is given by:

(1) $$U(A(g_i)) = A(g_i) - \alpha A(\bar{G}) \qquad 0 \le \alpha \le 1$$

Total utility is assumed to depend not only on approval, but also on additively separable components. This is due to consumption of private and public goods. Departing slightly from Holländer's notation, we weight these components according to non-negative constants "θ_i" which sum to one (without loss of generality). While these weights are not explicitly specified in Holländer (1990), it is convenient for the purpose of our analysis to do so.

Thus, the utility function for person i is as follows:

$$(2)\ U_i = \theta_p U_p(\pi - g_i) + \theta_{\bar{G}} U(\bar{G}) + \theta_A U_A(A) \qquad 0 \le g_i \le \pi$$

$$\theta_p + \theta_{\bar{G}} + \theta_A = 1$$

Note that in our proofs below, as in Holländer (1990), we assume monotonicity and concavity of the utility function. We further assume that the absolute elasticity of $U'(A)$ is smaller than one.

Having specified preferences, we turn now to the process by which approval is received. We first define the subjective value of a unit contribution, w, as the "approval rate." Then, we assume total approval is determined by a weighted average of absolute $wg_i$and comparative $w(g_i - \bar{G})$ components, with corresponding weights $(1-\beta)$ and β. It follows that the amount of approval received is determined by:

$$(3) \qquad A_i = w(g_i - \beta\bar{G}) \qquad \text{where } 0 \le \beta \le 1.$$

Then, by substituting (3) into (1), we can express utility for approval as a function of the approval rate, person i's contribution, and the average contribution, as follows:

$$(4) \qquad U(A(g_i)) = w(g_i - \sigma\overline{\mathrm{G}}) \quad \text{with } 0 \le \sigma = \alpha + \beta - \alpha\beta \le 1$$

The coefficient σ is important for our purposes below, and indicates the strength of the externality stemming from the average contribution. One can think of σ as "status orientation": when others contribute more, utility is reduced due to the fact that one's own status is lower. With this notation, utility can be expressed as:

$$(2)' \qquad U_i = \theta_p U_p(\pi - g_i) + \theta_{\bar{G}} U(\bar{G}) + \theta_A U_A(w(g_i - \sigma\overline{\mathrm{G}})) \qquad 0 \le g_i \le \pi$$

We turn now to the way people choose to send approval. Holländer (1990) hypothesizes that the individual approval rate v is equal to the marginal rate of substitution between endowment π and average contribution $\bar{G}$ with respect to the utility function (2).

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

It follows that an agent's approval rate is his subjective value of another agent's marginal contribution.

In Hollander's (1990) model, agents are rational actors. In particular, for given $\bar{G}$ and w, an agent is assumed to choose g_i in order to maximize utility. The inequality below characterizes optimal decisions, and holds with equality if g_i>0.

(6) $$\theta_p U'_p(\pi - g_i) \geq w\theta_A U'_A[w(g_i - \sigma\bar{G})]$$

We are now in a position to state and prove the following propositions.

Proposition 1: *Optimization defines an individual contribution function* $g_i(w, \sigma\bar{G}, \pi)$ *with (i)* $g_i > 0$ *if and only if* $U'_p(\pi) < w * (\theta_A/\theta_p) * U'_A(-w\sigma\bar{G})$ *and (ii)* $g'_w, g''_{\sigma\bar{G}}, g'_\pi > 0$ and $g''_{\sigma\bar{G}}, g'_\pi < 1$ for all $g > 0$.

The first condition derives from the concavity assumption of the utility function. *Ceteris paribus*, a stronger status orientation (a bigger σ) will lead to higher individual contributions. Increased average contributions by others also increases contributions, in an effort to induce efforts to regain the status lost.

Define a $g\bar{G}$ equilibrium to occur when each individual contribution is equal to the average contribution, in the sense that $\bar{G} = g_i(w, \sigma\bar{G}, \pi)$. Substituting this constraint into (6), one obtains the $g\bar{G}$ curve:

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

Exploiting the properties of the utility function, one then obtains:

Proposition 2: *In a $g\bar{G}$ equilibrium, individual contributions and the supply of the collective good are a function $\bar{G}(w,\sigma,\pi)$ with i) $\bar{G} > 0$ if and only if $w > U'_p(\pi)/U'_A(0)$ and ii) $\bar{G}_w, \bar{G}_\sigma, \bar{G}_\pi > 0$.*

Next, define an approval (*VW*) equilibrium as occurring when aggregate approval rates equal individual behavior, so that $v = w$. Substituting this condition into (6) into (5) and observing $g_i = \bar{G}, v = w$, one obtains the following:

(7) $$w = \frac{\theta_{\bar{G}} U'_{\bar{G}}(\bar{G})}{\theta_p U'_p(\pi - \bar{G})} - \sigma$$

When both *VW* and *gG* equilibria exist simultaneously, we (like Holländer) say there is a "social exchange" equilibrium (see Figure 1).

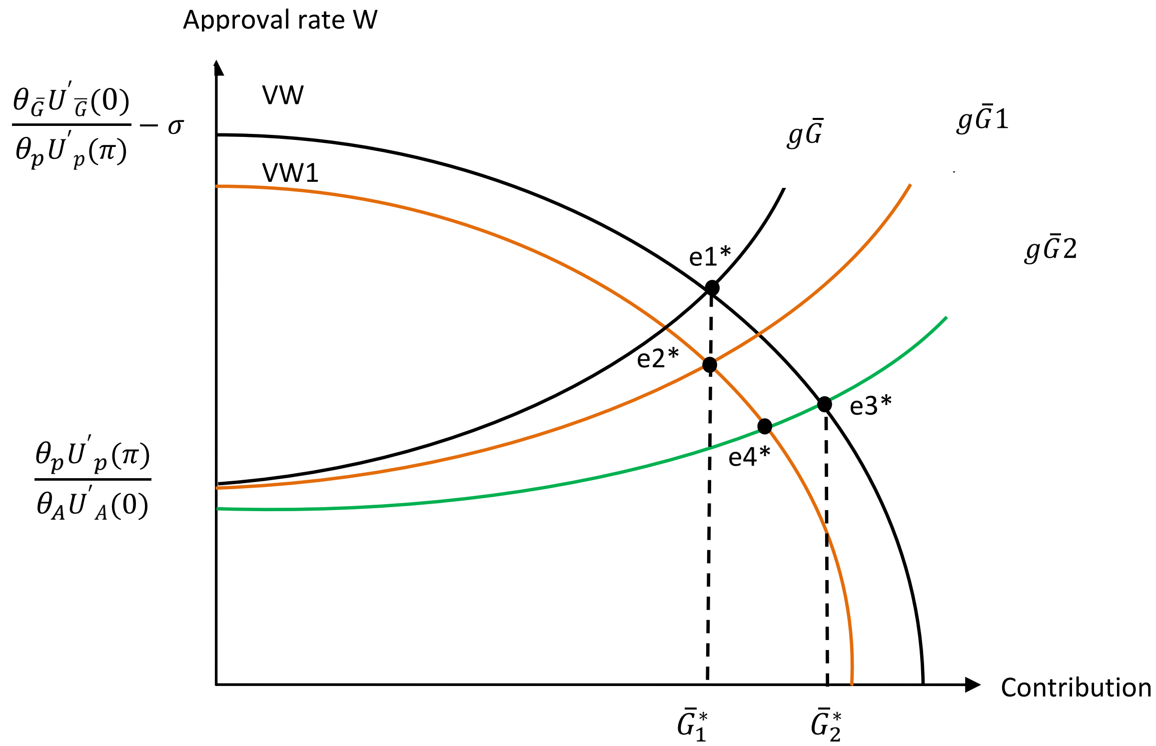


Figure 1: Approval rate and contributions in a "social exchange" equilibrium.

Figure 1 demonstrates the existence of unique social equilibrium e1*. The figure depicts how an increase in σ, status orientation, and an increase in θ_A, the weight of utility derived from received approval, affects equilibrium. In general, an increase in σ leads to a decrease in the approval rate *w,* and has an ambiguous affect on equilibrium contributions. This is represented in Figure 1 by a change from e1* to the new equilibrium e2*. An increase in θ_A alone necessarily results in higher equilibrium contributions, causing $g\bar{G}$ to shift right to $g\bar{G}_2$, resulting in lower approval rate at e3*. While the effect of an increased σ has either positive or negative effect on contributions in equilibrium, an increase in θ_A has an unambiguously positive impact on equilibrium contributions.

Proposition 3: *The effect of increased σ on equilibrium is to decrease the approval rate in equilibrium while having an ambiguous impact on contribution.*

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 e2* has the same contribution level as the old equilibrium e1*. 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.

Proposition 4: *The effect on equilibrium of an increase in θ_A is to increase the level of contributions and to decrease the approval rate.*

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^*.

Proposition 5: 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 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 we would not expect to observe the social equilibrium exchange between contribution and approval.

It is worthwhile to further discuss the impact of status orientation (σ) and the weight on approval utility (θ_A) on contributions and approval rate in equilibrium. Suppose there is an increase in both θ_A and σ; if an increase of σ has positive impact on contribution in equilibrium, then we would expect the effect of σ and θ_A influence the equilibrium in the same direction, leading to a lower approval rate and an increased contribution. On the other hand, if an increase of σ has negative impact on contributions in equilibrium, then the overall equilibrium change in contributions depends on which effect is greater. In either case, the approval rate is predicted to be lower in equilibrium.

Our experiment design informs the theoretical results described by the propositions. In particular, as detailed in the next section, one of our treatments influences only σ (*Star*), while others impact both σ and θ_A (*Mug* and *Ice-cream*). In addition, we also consider a treatment absent both σ and θ_A (*Baseline*).

3. Experiment Design

Motivated by Holländer (1990), the goal of our 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. Our 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).

We use a two-stage linear public good experiment with various reward conditions. The first treatment, the *Baseline* treatment, includes neither competition nor signaling incentives. We introduce competition in the *Star* treatment. The *Mug* and *Ice-cream* treatments include both competition and a final reward with small (and equal[6]) 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.

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

[6] 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

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

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.

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. At the end of each period, subjects are informed of (i) the accumulated gold stars they have earned (in the format of electronic gold stars displayed on top of their screen); (ii) the total approval they have received; (iii) the contribution of gold star winners that round; (iv) their own contribution; and (v) their current and accumulated monetary pay-off. 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 our 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. In particular, it measures how the presence of competition alone affects social approval, and how people respond to such shift. Comparing the approval assignment and the corresponding contributions between the *Star* and *Ice-cream* or *Mug* treatments helps us understand whether providing additional rewards with low monetary value and/or signaling value influences the assignment of social approval. In particular, we are able to discover whether the signaling incentive enhances the value of received approval, thereby promoting cooperation.

2.3 Procedures

A total of 200 students from George Mason University participated in our 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.

2.4 Willingness-to-pay (WTP) Elicitation

We 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. We 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 arguments demonstrate that if we assume the competitiveness of the environment is positively related to the monetary value of the reward, then rewards with higher monetary value should result in an increase in both σ and θ_A, leading to a reduction in equilibrium approval rate. In our experiment, monetary values of the rewards are ordered as follows: mug=ice-cream[7]>star=baseline. This implies that σ and θ_A are ordered according to $\sigma_{mug} = \sigma_{ice-cream} > \sigma_{star} = \sigma_{Baseline}$, and similarly for θ_A, where $\theta_{mug} = \theta_{ice-cream} > \theta_{star} = \theta_{Baseline}$. Given that an increase in

[7] Our WTP elicitation illustrates that subjects displayed statistically identical willingness-to-pay for mug and ice-cream.

either factor leads to a decrease in the approval rate, we expect approval rates to follow a reversed order: $w_{Mug} = w_{Ice-cream} < w_{Star} = w_{Baseline}$. The equality between the *Star* and *Baseline* treatments can become a strict inequality if participants preferences' respond to competition itself, thus triggering a stronger status orientation than *Baseline*, $\sigma_{star} > \sigma_{Baseline}$ or an increased weight placed on approval utility, $\theta_{star} > \theta_{Baseline}$ or both. Any of these changes would cause a change in the approval rate, therefore resulting in a lower approval rate in equilibrium than in *Baseline*, $w_{Star} < w_{Baseline}$. At the same time, if the mug reward further triggers the signaling motives, then we would expect a strictly stronger status orientation in *Mug* than in the *Ice-cream* treatment, $\sigma_{mug} > \sigma_{ice-cream}$; or we would expect additional weight to be added to approval utility, $\theta_{mug} > \theta_{ice-cream}$, or both. Together, an increase in either of these two parameters will lead to a decrease in the approval rate in equilibrium, thus $w_{Mug} < w_{Ice-cream}$ would follow. Therefore, after taking into the account of signalling value and competition, we have:

$$H_0: w_{Mug} \leq w_{Ice-cream} < w_{Star} \leq w_{Baseline}$$

The next hypotheses are based on Proposition 4 above. While increased competitiveness increases both σ and θ_A , both of which reduce approval rate *w* in equilibrium, their aggregate influence on contributions is uncertain. In particular, while an increased θ_A serves to promote contributions, an increase in σ may have either a positive or negative impact on contributions (Propositions 3 & 4).

Hypothesis 2A: **Suppose that increasing σ, the status orientation, leads to increased cooperation. Then contributions in *Mug* should be greatest, followed by *Ice-Cream*, then *Star* and finally *Baseline*.**

If increasing σ has a positive effect on contributions, then competition will only increase cooperation, so that contributions will exceed *Baseline* in all treatments: $g_{Mug}, g_{Ice-cream}, g_{Star} > g_{Baseline}$. With added monetary value in both *Mug* and *Ice-cream*, and the unique signaling effect only in *Mug,* we would expect an enhanced value of both σ and θ, with $\sigma_{Mug} > \sigma_{Ice-cream} > \sigma_{Star,}$ and $\theta_{Mug} > \theta_{Ice-cream} > \theta_{Star}$. Both promote contribution in the same direction; therefore

$$H_{20}\text{: } g_{Mug} \geq g_{Ice-cream} > g_{Star} > g_{Baseline}.$$

***Hypothesis 2B:* Suppose increasing σ has a negative impact on cooperation. Then one of the following three outcomes will emerge:**

i) If the positive effect of increased θ_A on contributions can overwhelm the negative impact of increased σ, then either

H_{21}: $g_{Mug} \geq g_{Ice-cream} > g_{Star} > g_{Baseline}$; or

ii) H_{22}: $g_{Mug} \geq g_{Ice-cream} > g_{Baseline} > g_{Star}$; or

iii) H_{23}: $g_{Mug} > g_{Baseline} > g_{Ice-cream} \geq g_{Star}$; or

iv) H_{24}: $g_{Baseline} > g_{Mug} \geq g_{Ice-cream} \geq g_{Star}$

H_{21} maintains the same order a in H_{21}. It assumes that either the signalling value in *Mug*, the monetary value in *Ice-cream* or the competition in *Star* induces a stronger positive influence from a change in θ_A than does the negative influence from a change in . H_{22} occurs when competition alone (*Star)* induces a stronger negative effect from increase in σ than the positive effect from an increase in θ_A; Similarly, H_{23} occurs when not only the competition fails, but also the monetary value fails to generate enough approval weight on θ_A. Or, as in H_{24}, none of these effects is sufficient to induce enough weight on approval utility. This means the positive impact from θ_A fails to elicit further contributions due to the negative effect of σ. It follows that, in this scenario, contribution in *Baseline* exceed all other treatments.

5. Results

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

We 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.

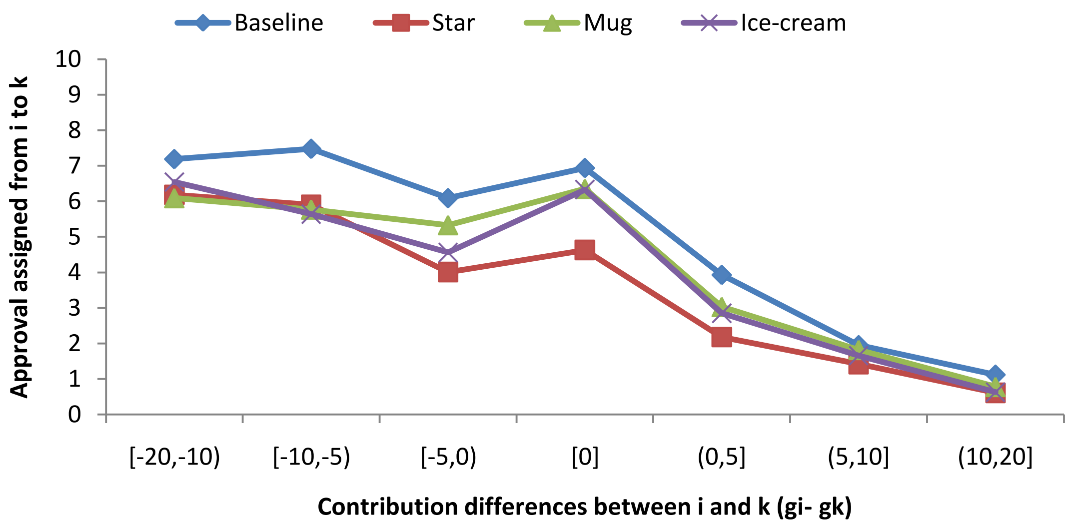


Figure 2: Approval assigned from *i* to *k* in response to contribution differences between *i* and *k*. Given the same contribution differences, approval was assigned most in *Baseline*. While the other three treatments do not appear to differ in general, in the [-5,0], [0] and [0,5] category, approval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

Result 1b. Given the same relative contribution (differences), approval is withheld the most in *Star* and least in *Mug*.

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*. This is consistent with Figure 2 where we 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*** (0.399)
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*: $\max\{0, \overline{G^t} - g_k^t\}$	-.303***
	(.028)
Constant	7.13***
	(.351)
Period Dummies	Yes
# of Obs.	6000

Note: Dependent variable: Approval Points i received in period t, robust standard error clustered by individual

Result 1 shows that approval assignment is based on relative contributions in treatments that include competition. Result 2 (Table 3) reports estimates of the equation $A = w(g_i - \beta\bar{G})$[8]. As detailed in Section 3, this equation takes into account both relative and absolute contributions.

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

Table 3 provides the results of an estimation of approval rate *w*, as well as the assignment weight β. We 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 in *Baseline*, but do not significantly differ. This result is consistent with hypothesis 1 above.

[8] In the theoretical model, the $\bar{G}$ is assumed to be the group average for simplicity and ease of
generalization. Here, we calculate gbar as equal to the average contributions of one's group members.

Table 3: Estimation of approval rate w and the assignment weight β

Nonlinear regression	
Approval rate_Baseline	1.234***
	(.067)
Approval rate_Mug	0.941***
	(.115)
Approval rate_Star	1.103***
	(.104)
Approval rate_Ice-cream	1.190***
	(.061)
β in Baseline	0.133**
	(.063)
β in Mug	0.161
	(.120)
β in Star	0.216***
	(.072)
β in Ice-cream	0.144*
	(.080)
Constant	42.814***
	(1.060)
Period Dummies	Yes
# of Obs.	2000

Note: Dependent variable: Approval Points i received in period t, robust standard error clustered by group

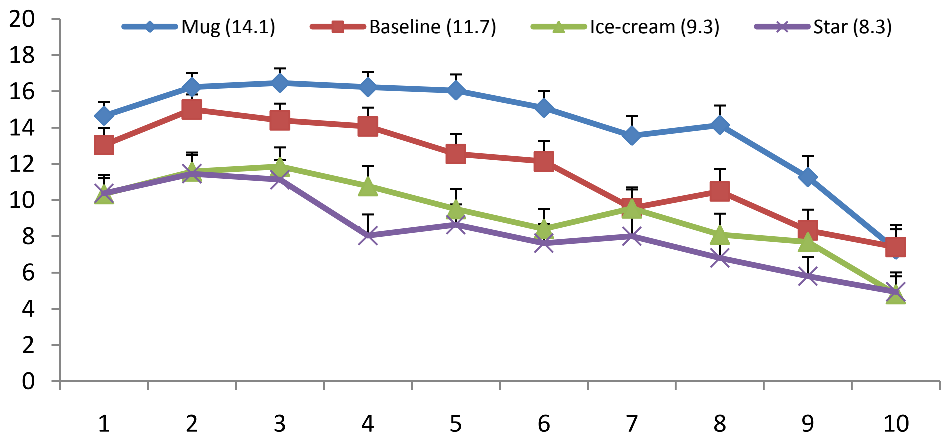
Result 3: Contributions are highest in *Mug* and lowest in *Star*.

Overall contributions are significantly higher in *Mug* than any other treatment (Figure 3a). We 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, we 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, we find support for hypothesis H_{23}: the positive effect of increasing approval utility θ_A driven by monetary value does not overwhelm the negative impact of increased status orientation σ due to increased competition, thus we observe a lower contribution in *Ice-cream* than *Baseline*. Yet, such negative impact is evidently more than offset by increases in θ_A resulting from the mug's signaling value.

a.



b.

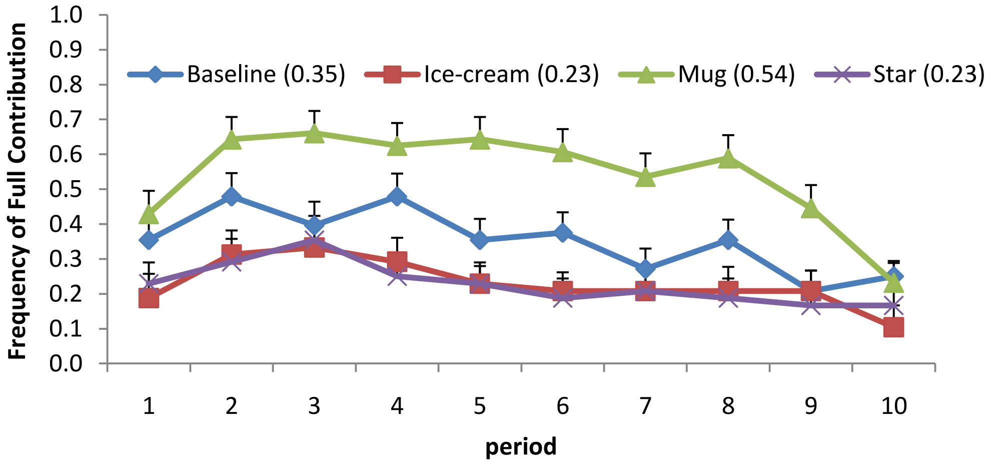


Figure 3. Contributions to the public good over 10 periods across treatments. Cooperation is highest in *Mug* both by **a**, average contribution, or **b**, frequency of the full contribution. a. The numbers in parentheses indicate mean contribution (over 10 periods) for that treatment. Contributions 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

We studied the impact of peer-to-peer competition for social approval on cooperation in a social dilemma environment. We 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.

Our 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). Our design varied features of the environment that we 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. We 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)[9], 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.

We 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. Given the same contribution differences, absolute approval is withheld the most in *Star* and least in *Mug.* This may partially explain a lower contribution in all competition treatments except

[9] 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) to influence social norms. Rather, norms in their models emerge through herding, reciprocity or types of social-learning.

Mug, where competition may drive attention towards a spiteful withholding of approval rather than creating a healthy competition for higher contributions.

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.

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. We 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 we observe between the *Mug* and *Ice-cream* treatments.

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 .

Our 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 our environment[10], a public reward, particularly one with signaling value, may serve to further promote cooperation (Andreoni and Petrie 2004, Rege and Telle 2004).

Our 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.

Finally, our 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, our study has highlighted a "hidden benefit" of extrinsic incentives.

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

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