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Reaching for the Stars: An Experimental Study of the Consumption Value of Social Approval

Matthias Greiff* and Fabian Paetzel†

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Abstract

We present a theoretical model of a linear public good game in which heterogeneous players express social approval after observing contributions. The model explains how social approval is expressed and predicts positive contributions if subjects have a preference for social approval. Using a controlled laboratory experiment we test our model. In the experiment, subjects conduct computerized tasks that require substantial effort resulting in endowments from which contributions can be made to a linear public good. After observing others' contributions subjects express social approval. Our main hypothesis is that subjects have a preference for social approval so that the expression of social approval will increase contributions, even if reputation building is impossible. We vary the information available to subjects and investigate how this affects the expression of social approval and individual contributions. Our main finding is that the expression of social approval significantly increases contributions. However, the increase in contributions is smaller if additional information is provided, suggesting that social approval is more effective if subjects receive a noisy signal about others' contributions.

JEL Codes: C72, C91, D71, D83.

Keywords: Experimental Economics, Linear Public Good Games, Non-monetary Incentives, Social Approval.

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1 Introduction

We analyze how the expression of social approval and information about subjects' endowments affects contributions to a public good. We construct a theoretical model of a public good game with heterogeneous players and show that voluntary contributions can be explained by a preference for social approval. Using a controlled laboratory experiment we test our model. In the experiment subjects conduct computerized real effort tasks resulting in heterogeneous endowments. Then, subjects contribute to a linear public good before they evaluate others' contributions by expressing social approval.

Our experiment has two treatment effects. First, subjects express social approval after observing others' contributions. Second, subjects receive information not only about other subjects' contributions but also about other subjects' endowments, making it possible to evaluate relative contributions. We find that the first treatment effect increases voluntary contributions significantly, suggesting that free-riding can be reduced by facilitating the expression of social approval. However, the increase in contributions is smaller if additional information is provided.

In this paper we make two contributions to the literature: First, we present a model of a public good game which explains how social approval is expressed. We show that the model has a unique inner solution and predicts positive contributions if players have a preference for social approval. Second, we present results from a controlled laboratory experiment which tests the model. By comparing three different treatments we are able to analyze the effect of social approval on voluntary contributions and to analyze how additional information affects the expression of social approval and contributions to the public good.

Social approval is one explanation for the voluntary provision of public goods. A better understanding of social approval as an incentive would help to design incentive schemes which not only increase contributions to public goods but also could help solving related problems like shirking in team production and collective action problems.

2 Social Approval and Public Goods

While it is uncontroversial that people care about social approval, there are different reasons why social approval is valued. Following Bénabou and Tirole (2002) we distinguish between (1) signaling value, (2) motivational value and (3) consumption value of social approval. (1) When speaking of signaling value, we emphasize that social approval is information for others and facilitates building up a reputation. It is rational to demand social approval because the benefits of receiving social approval can be monetized. (2) Social approval has motivational value if an agent has imperfect knowledge of her ability. Then, social approval is a signal increasing the agent's self-

confidence and motivation, and a principal has an incentive to supply social approval.[1] (3) When speaking of consumption value, social approval is a good so that receiving social approval increases utility. In contrast to signaling value and motivational value, where the focus is on social approval as information, social approval has consumption value only if social approval is an argument in the utility function. It follows that social approval can be used as a reward in the same way than any good can be used as a reward. Social approval has consumption value because it gives rise to feelings like shame and pride, hence the expression of opinion increases utility. It is the consumption value of social approval that we will focus on in the rest of this paper.

For its effect to be strong, social approval has to be a qualified judgment, i.e., the judgment has to come from someone who has the competence required to give a judgment. According to Brennan and Pettit (2004) social approval is given to a person because this person is "good" at something. How exactly "good" is defined depends not only on the giver's competence but also on her information. Being absolutely ignorant about sports I find it hard to evaluate a runner finishing a marathon in 2:55 hours. Seeing that all other runners' took more than 3 hours I would probably be impressed by the runner's performance, but if I would have known that the runner's personal best is 2:40 hours my judgment would have been different. In the first case I have no information about the runner's ability, so I can only judge her performance relative to the other runners' performances. In the latter case I have some knowledge about the runner so I can judge her performance relative to her ability and to the others' performances.[2]

Many experiments have shown that the introduction of rewards or punishments increases contributions to public goods (e.g., Fehr and Gächter, 2000). Social approval expressed through standardized messages or communication has been investigated by Gächter and Fehr (1999) and Masclet et al. (2003). Gächter and Fehr (1999) conducted a ten-round public good game under partner matching and found that social approval has a significant effect if group identity is established at the beginning of the experiment. In a similar experiment Masclet et al. (2003) investigated the effect of monetary and non-monetary punishment under stranger and partner matching. Non-monetary punishment consisted of the opportunity to express disapproval after each round of the game, as opposed to Gächter and Fehr (1999) where social approval could only be expressed at the end of the last round. Masclet et al. found the effect of non-monetary punishment to be stronger under partner than under stranger matching. Higher contributions under partner matching could be indicative of both signaling value and consumption value of social approval.

Rege and Telle (2004) found that the anticipation of others' opinions, a form of indirect social approval, is a costless mechanism for inducing higher contributions. Similarly, Pan and Houser (2011) show that the expression of social approval increases contributions if signaling value is

[1] The assumption of the agent not knowing her own ability is central in Bénabou and Tirole (2002, p. 873). In this paper we follow Bénabou and Tirole's distinction between signaling value, motivational value and consumption value, however, it should be mentioned that social approval can also affect motivation if the agent knows her abilities. If this possibility is taken into account it is hard to distinguish motivational value from consumption value.

[2] For a more detailed discussion of social approval as an incentive the reader is referred to chapter 4.1 in Greiff (2011).

high. In a recent field experiment Kosfeld and Neckermann (2011) clearly distinguished between consumption value and signaling value of awards. They showed that symbolic awards significantly increase performance in real-life work situations even if the awards do not lead to future monetary benefits. In contrast to Kosfeld and Neckermann we test the consumption value of symbolic awards in the laboratory and focus on contributions to a public good rather than work performance.

Besides public good games rent-seeking games, ultimatum games and dictator games have been used to investigate the consumption value of social approval. Huberman et al. (2004) showed that in a rent-seeking game subjects are willing to trade off a monetary gain for an increase in status. Ellingsen and Johannesson (2008) and Xiao and Houser (2005,2009) documented that the anticipation of feedback in form of an anonymous written message induces feelings of shame or pride and leads to higher offers in a ultimatum and dictator games.

With respect to real effort previous experiments do not find clear effects on subjects' decisions to contribute. Some experiments find that there is no effect of real effort tasks on decisions (Clark, 1998, 2002; Rutström and Williams, 2000; Ball et al., 2001), others find that participants act more self-interested or have a higher willingness to take risks (Keeler et al., 1985; Thaler and Johnson, 1990; Keasey and Moon, 1985; Cherry et al., 2002). Even though it is possible that the real effort task has no effect on subjects' contributing behavior, to us it seems reasonable to allocate the endowments based on the results from a real effort task because how subjects obtain their endowments might affect the expression of social approval. If a subject's endowment is the result of real effort, a high contribution corresponds to a situation in which a subject exercises real effort for the benefit of the group. The high contribution results from the subject's decision to exercise real effort in order to earn the endowment, and from her decision to make a high contribution. Contrast this with the situation in which endowments are assigned randomly. Here, a subject's high contribution is due to luck (i.e., having received a high endowment) and the subject's decision to make a high contribution. If endowments are earned by exercising real effort, subjects evaluate others' decisions more seriously because they know that endowments are not assigned randomly.

3 Theoretical Model

The importance of non-monetary incentives points to the question of how to integrate non-monetary incentives into economic theory. An attempt into this direction is Kandel and Lazear's paper on peer pressure (Kandel and Lazear, 1992). In discussing both guilt and shame they distinguish between internal and external peer pressure. In their model, however, the driving force for exercising peer pressure is strategic because individuals profit from exerting peer pressure. But in order to integrate the consumption value of social approval into theory, a model in which people care not only about material consequences but about what others think (and say) about them is needed

(Ellingsen and Johannesson, 2007). For internal peer pressure the models by Andreoni (1990) and Brekke et al. (2003) are a step into this direction. For external peer pressure and social approval the model by Holländer (1990), on which our model is based, remains to be mentioned. In his model, a contribution to a public good is a gift which triggers the expression of social approval as an emotional reaction. This is in contrast with the theoretical models employed in Gächter and Fehr (1999), Masclet et al. (2003) and Rege and Telle (2004), in which the expression of social approval is not explicitly modeled. Holländer shows that under specific conditions a social exchange equilibrium exist. In that equilibrium, subjects contribute to the public good because they have an approval incentive. The approval incentive results from a comparative part in the utility function which describes a disutility if a player's own contribution is below average.

In the following we present our model, which is a modified version of Holländer's model. We choose a group size of three to anticipate the experimental design. In Holländer (1990) private consumption and the public good are two different goods. Since in our experiment private consumption and the return from the public good are both monetary payoffs, we simplify Holländer's model and assume that player i's utility function is given by eq. (1) in which e_i and c_i denote i's endowment and contribution:

$$U_i = e_i - c_i + \kappa(c_i + c_j + c_k) + u_a \log(a_i) \tag{1}$$

The public good results from the sum of individual contributions multiplied by the marginal per capita return (MPCR), κ with $\frac{1}{3} < \kappa < 1$. The last term of the right-hand-side represents the preference for social approval, which depends on the approval variable a_i which we describe below. We assume that utility is a quasilinear function and satisfies the common assumptions (monotonicity, concavity) with u_a as a constant parameter.[3]

Following Holländer (1990) we make the following three assumptions. First, we assume that the expression of social approval, i.e., the assignment of stars is an emotional reaction. Holländer (1990), for example, argues that the expression of social approval is "not rationally calculated but, rather, prompted by the stimulus-response mechanism of the human emotional system" (p. 1158). Second, we assume that high contributions go hand in hand with strong social approval. Subjects who make high (low) contributions will receive many (few) stars, i.e., we expect a positive correlation between contributions and received stars. This assumption can be traced back to Adam Smith (1976, originally published 1759), who describes social approval as a basic concept of *moral sentiments*. And third, it is not only a player's absolute contribution but her contribution relative to the contribution of some reference group. This assumption is common in sociology, where social comparisons and its effects are defined as a basic motive for social behavior (Homans, 1961). Holländer takes the average contribution as the behavior of the reference group because he as-

[3]Incorporating social approval in the utility function implies that the value of social approval can be expressed in monetary terms, for example as a willingness to pay for social approval.

sumes that there is a large group of homogeneous players. Since in our experiment players are heterogeneous and the group is small, we take the player's own relative contribution and the group's average relative contribution as the behavior of the reference group. The stimulus power prompted by a contribution c depends on the relative contribution of the player who contributes, the relative contribution of the player who observes the contribution and the average relative contribution. That is, the stimulus in player j's emotional system prompted by player i's contribution is given by:

$$s_{ji}\left(\frac{c_i}{e_i}, \frac{c_j}{e_j}, \frac{\bar{c}}{\bar{e}}\right) = w\beta_0 + w\beta_1\left(\frac{c_i}{e_i}\right) - w\beta_2\left(\frac{c_j}{e_j}\right) - w\beta_3\left(\frac{\bar{c}}{\bar{e}}\right). \tag{2}$$

The group's average relative contribution is denoted by $\frac{\bar{c}}{\bar{e}} = \frac{1}{3}\left(\frac{c_i}{e_i} + \frac{c_j}{e_j} + \frac{c_k}{e_k}\right)$, $\beta_{0,1,2,3}$ are positive parameters and w is the subjective value of a contribution, which we take as given. The stimulus power prompted by i's contribution will be higher if i contributes more, j contributes less (implying that the difference between i's and j's contribution is higher), or if the average contribution is lower (implying that the difference between i's contribution and the average contribution is higher). $\beta_{2,3}$ can be interpreted as social preference parameters, which indicate the strength of the externality when player j's relative contribution or the average relative contribution changes. Eq. (2) describes how the approving player j expresses social approval in response to player i's and average contribution. Since in our experiment the group size is three, each player receives social approval from two other players. Let

$$s_i = \frac{s_{ji} + s_{ki}}{2} \tag{3}$$

denote social approval triggered by i's contribution. Average social approval is denoted as $\bar{s} = \frac{s_i + s_j + s_k}{3}$. Substituting for $s_{i,j,k}$ from eq. 3, $\bar{s}$ can be simplified to:

$$\bar{s} = w\left[\beta_0 + (\beta_1 - \beta_2 - \beta_3)\cdot\left(\frac{\bar{c}}{\bar{e}}\right)\right], \tag{4}$$

which denotes average social approval within the group.

Next, we turn to players' preferences for social approval. Following Holländer (1990), we assume that the preference for social approval is a social preference. The approval variable a_i is the weighted average of absolute social approval (s_i) and relative social approval ($s_i - \bar{s}$) with $(1-\alpha)$ and α being the weights:

$$a_i = (1-\alpha)s_i + \alpha(s_i - \bar{s}) = s_i - \alpha\bar{s}. \tag{5}$$

Substituting s_i and $\bar{s}$ from (3) and (4) into (5), one obtains the approval variable as a function of contributions and endowments (eq. 6):

$$a_i = w\left((1-\alpha)\beta_0 + \beta_1\frac{c_i}{e_i} - \frac{\beta_2}{2}\left(\frac{c_j}{e_j} + \frac{c_k}{e_k}\right) - \left(\beta_3 + \alpha\left(\beta_1 - \beta_2 - \beta_3\right)\right)\left(\frac{\bar{c}}{\bar{e}}\right)\right). \tag{6}$$

By substituting i's, j's and the average absolute contribution for relative contributions in eq. (2) we would arrive at a special case in which players compare absolute contributions when expressing social approval. In this special case the approval variable a_i would be a function of absolute contributions.

Taking others' contributions as given, player i maximizes utility eq. (1) with respect to c_i. The first-order-condition is given by equation (7):

$$1 - \kappa = u_a \frac{1}{a_i} \left(w\beta_1 \frac{1}{e_i} - w \left(\beta_3 + \alpha(\beta_1 - \beta_2 - \beta_3) \frac{1}{3e_i} \right) \right). \tag{7}$$

Assuming that social approval does not matter, the theory predicts free-riding. If players have no preference for social approval ($u_a = 0$), utility is given by $U_i = e_i - c_i + \kappa(c_i + c_j + c_k)$. In the unique Nash equilibrium contributions are zero, $c_i = 0$, and each player's utility is given by e_i. This, however, changes if a preference for approval is introduced ($u_a > 0$). It can be shown that solving the system of reaction functions

$$c_i = c_i(\alpha, \beta_{0,1,2,3}, u_a, \kappa, e_{i,j,k}, c_{j,k}), \tag{8}$$

yields a unique interior equilibrium with $c_i^* = c_i^*(\alpha, \beta_{0,1,2,3}, u_a, \kappa, e_{i,j,k})$ and $c_{i,j,k}^* > 0$. Obviously, $c_{i,j,k}^* > 0$ only exists when $u_a > 0$ and $a_i > 0$. a_i is positive if β_0 is sufficiently large so that $\beta_0 > \frac{2\alpha\beta_1 + (3-2\alpha)\beta_2 + (2-2\alpha)\beta_3}{3(1-\alpha)}$.[4] In the interior optimum, utility-maximizing behavior is consistent with positive contributions if players have a preference for social approval and the β_0 restriction is fulfilled.

4 Experimental Setup

In order to test our model we design a linear public good experiment which is implemented with and without the option to express social approval. According to our hypothesis subjects have a preference for social approval. If true, we will observe higher contributions to the public good in treatments in which social approval can be expressed.

In order to isolate the consumption value of social approval we run the experiment with stranger matching. Under the stranger matching protocol subjects are rematched after each round into new groups of three. It is unlikely that the same two subjects will interact in two subsequent periods, and even if this is the case, they have no way of recognizing each other because all interactions are anonymous and identities are never revealed. Thus, social approval has no signaling value because subjects cannot build up a reputation and signal their qualities/ability to others

[4] Setting $\frac{c_i}{e_i} = 0, \frac{c_j}{e_j} = \frac{c_k}{e_k} = 1$, characterizes the extreme case when a player's own relative contribution is equal to zero and both remaining players contribute their full endowment. Substituting the values for relative contributions into eq. 6, setting equal to zero and solving for β_0 yields $\beta_0 = \frac{2\alpha\beta_1 + (3-2\alpha)\beta_2 + (2-2\alpha)\beta_3}{3(1-\alpha)}$.

who have the possibility to reward the subjects' behavior. Also, it is unlikely that social approval has motivational value. Since subjects are anonymous, subjects do not know each others' abilities so that social approval cannot inform subjects about their own ability.

In our experiment social approval is visible to all group members. Subjects cannot abstain from expressing social approval; they have to assign between zero and ten stars to each group member's decision. Social approval can be expressed by assigning between zero and ten stars to your opponent's decision.[5] We use a positive framing by using stars (a symbol with a positive connotation) rather than points. Subjects are told that ten stars correspond to maximum social approval. One objection could be that subjects will be lavish in their assignment of stars because it is costless. Introducing a small cost associated with every star that is assigned could solve this problem. We think that this is not necessary because of status effects. Subjects do not only care about how many stars they receive but care about how many stars they receive compared to their group members.

Our experiment differs from Gächter and Fehr (1999) and Masclet et al. (2003) in at least three ways. First, our work combines real effort and social approval. Subjects have to exercise real effort in order to earn an endowment which they can contribute to a public good. The real effort task is taken from the experiments in Paetzel (2011) and is designed as an intelligence test. In contrast to Gächter and Fehr (1999) and Masclet et al. (2003) subjects do not contribute part of a given endowment ("windfall"). Second, our experiment explicitly tests the consumption value of social approval. In this respect our experiment is closest to the social approval, stranger matching treatment in Masclet et al. (2003). In Masclet et al., however, the emphasis was on disapproval while in this study it is on approval. Third, our experiment differs from the existing literature because we conduct a quantitative analysis not only of subjects' decisions to contribute but also of subjects' decisions to express social approval.

4.1 The Three Treatments

In our experiment subjects' endowments result from an intelligence test which takes place before each round of the game. Consequently, subjects will have heterogeneous endowments depending on the outcome of the intelligence test.

The two treatment effects in our experiment concern the expression of social approval and the information available. Since it is difficult to evaluate the content of a written message we take a different route by letting our subjects express social approval by assigning between zero and ten stars to each of their opponents' actions. Hence we are concerned with the consumption value of social approval expressed by symbolic stars. In the Control Treatment subject cannot express

[5]Subjects had to choose social approval by moving a slider with initial position zero. In order to prevent subjects from accidentally choosing zero it was required that the slider had to be moved at least once before they could proceed to the next screen.

social approval while in Treatments 1 and 2 they have to express social approval.

The instructions and control questions make sure that subjects understand the game and know how their own payoff changes if others contribute more, i.e., they are in the position to give a qualified judgment. The difference between Treatment 1 and 2 is the information that subjects have. While in Treatment 1 only information about all group members' absolute contributions is available, in Treatment 2 subjects have additional information about the distribution of endowments. We argue that due to this additional information subjects can give a more qualified judgment whose consumption value will be higher. Our three treatments are summarized in Table 1.

Treatment	Social Approval	Information
Control Treatment (T0)	no	-
Partial Information Treatment (T1)	yes	absolute contributions
Full Information Treatment (T2)	yes	contributions and endowments

Table 1: The three different treatments.

General features for all treatments: In each session fifteen or eighteen individuals are randomly assigned in groups of size three ($n = 3$). Each session consisted of eight rounds. Each round subjects are asked to solve questions taken from an intelligence test. The test consisted of ten questions and subjects were given fifteen seconds to answer each question, so that the intelligence test takes 150 seconds in total. After the test, subjects are assigned an endowment depending on the ranking from the intelligence test. The subject with the highest score gets the highest endowment, the subject with the second-highest score gets the second-highest endowment, and the subject with the lowest score gets the lowest endowment. If two or more subjects' scores are identical, a fair coin is tossed to determine unique ranks.[6]

The distributions of endowments are depicted in Table 2 and were generated in the following way. There is an urn containing eight different distributions of endowments. The distributions were generated by randomly drawing numbers from the interval $[3, 10]$. Drawing took place without replacement to ensure that no two subjects have identical endowments. In all treatments the same eight distributions are used to ensure comparability across treatments. In each round one of the eight distributions is drawn without replacement. The distribution of endowments is identical across all groups within the same round but varies as we move from one round to another. The rationale behind varying distributions between rounds is that it is not possible for subjects

[6]If ranks are determined by a coin-toss, ranks do not accurately reflect subjects' abilities. For our experiment this is not an issue because the it still holds that endowments are not assigned randomly. Moreover, we did refrain from revealing the ranking from the intelligence test because by subjects' expression of approval should be an evaluation of subjects' contributions and not an evaluation of subjects' performance in the intelligence test.

to learn something about the distribution, which is important in Treatment 1.[7] Since each subject plays one round with an endowment drawn from each of the eight distributions the distributions are identical across sessions and treatments.[8]

Period:	1	2	3	4	5	6	7	8
Rank 1	10	10	9	6	8	8	9	8
Rank 2	7	6	8	5	6	7	5	5
Rank 3	6	3	7	3	3	5	4	4
Total	23	19	24	14	17	20	18	17

Table 2: Assignment of endowments to subjects based on rank.

After taking part in the intelligence test and having been assigned an endowment, subjects decide how much to contribute to the public good, $0 \leq c_i \leq e_i$. The language that was used referred to the group as "team" and contributions were referred to as "contributions to team production". The MPCR is given by $\kappa = 0.5$ and the resulting quantity of the public good is given by eq. (9):

$$G = n\kappa \sum_{i=1}^{3} c_i = 1.5 \sum_{i=1}^{3} c_i. \tag{9}$$

After each round subjects were informed about their individual payoff, given by:

$$\pi_i = (e_i - c_i) + \frac{G}{3}. \tag{10}$$

Subjects were not informed about the payoffs of other group members in order to avoid that subjects could guess the distribution of endowments in Treatment 1. Subjects are rematched into new groups and the next round begins.

Control Treatment: The game is played as described above. Subjects receive no information about others' endowments and the distribution of endowments is unknown. All subjects make their contributions simultaneously. After each round subjects are informed about contributions of their group's members but no social approval can be expressed.

Treatment 1 (Partial Information Treatment): Same as Control Treatment but in addition sub-

[7] If subjects would learn about the distribution of endowments they would assign social approval based on relative contributions instead of assigning social approval based on absolute contributions, blurring the distinction between Treatment 1 and Treatment 2. We thank Stefan Traub for bringing this issue to our attention.

[8] For all periods except for period 2 it holds that a group of subjects can achieve a Pareto improvement by moving from the Nash prediction, in which no contributions are made, to the situation in which all subjects contribute their endowment completely. In period 2 the endowments are such that this change would result in an improvement for subjects 2 and 3 but not for subject 1, whose payoff would be 9.5 if everyone would contribute her endowment completely.

jects evaluate the behavior of other group members. After all contributions are made each subject can see the absolute contributions of her fellow group members, i.e., (c_i, c_j, c_k) is made public information. The subjects' endowments remain private information. Subjects simultaneously express social approval by assigning between zero and ten stars to each other subject in her group. After all members of the group expressed social approval the results are displayed so that subjects see their own "stars" as well as the "stars" that the other (anonymous) group members received.

Treatment 2 (Full Information Treatment): Same as Treatment 1 but instead of observing absolute contributions group members observe relative contributions. Relative contributions were not expressed as a percentages of endowments but the distribution of subjects' endowments (e_i, e_j, e_k) and the subjects' contributions (c_i, c_j, c_k) are made public information. As in Treatment 1, each subject expresses approval by assigning between zero and ten stars to each other subject in her group.

4.2 Hypotheses

Our main hypothesis is that subjects have a preference for social approval, even if receiving social approval does not increase future payoffs. In other words, we test the consumption value of social approval. Denoting individual contributions in treatment i by $c(i)$ allows us to further specify our hypotheses.

Hypothesis 1: The expression of social approval induces higher contributions, $c(T0) < c(T1)$ and $c(T0) < c(T2)$.

Hypothesis 2: Contributions in Treatment 2 (Full Information) will be higher than in Treatment 1 (Partial Information) because additional information allows subjects to evaluate others' contributions more accurately. Since social approval is based on more information, we hypothesize that its consumption value will be higher in Treatment 2 than in Treatment 1, resulting in higher contributions in Treatment 2.

Hypothesis 3: The higher a subject's contribution, the more stars the subject receives, i.e., contributions and stars are positively correlated.

Hypothesis 4: The number of stars a subject receives increases in her own contribution and decreases in the contribution of the subject who expresses the stars.

Hypotheses 1 and 2 are concerned with the effect from the expression of social approval on individual contributions. Hypothesis 1 states that the expression of social approval increases contributions to the public good, as predicted by our model. Hypothesis 2 is concerned with the effect of additional information. We suspect that if subjects have information about endowments and contributions, the consumption value of social approval will be higher because the additional information reduces uncertainty and allows for a more accurate judgment. In Treatment 1 subjects

do not know whether a small contribution resulted from a small endowment or from the subject behaving selfish. This uncertainty makes it difficult to evaluate the subject's small contribution. It is possible to compare the contribution to others' contributions, which will result in an inaccurate judgment because the subject's endowment is not taken into account. In Treatment 2 we do not have this kind of uncertainty since contributions and endowments can be observed. Since the additional information about subjects' endowments reduces uncertainty, we expect judgments to be more accurate and hence better signals for social approval in Treatment 2. Hypotheses 3 and 4 are concerned with subjects' decisions on how to express social approval. Both hypotheses are formulated in order to test the assumptions regarding the expression of social approval in our model.

5 Results

The experiment took place at the University of Bremen in October 2010 and was conducted using the z-Tree software (Fischbacher, 2007). We conducted 6 sessions and in each session 15 or 18 students participated. In total, 102 students participated. Students were recruited using the recruitment system ORSEE (Greiner, 2004). Students came from different departments and were randomly assigned to a treatment. Subjects played 8 rounds of the game and in each round subjects were randomly and anonymously paired. Subjects' identities were never revealed to one another, and subjects were paid in private. Each subject received 5 euros as show-up fee plus her earnings in the experiment. During the experiment payoffs were denoted in tokens. At the end of the experiment one round was randomly selected and this round's payoffs, together with the show-up fee, determined the subjects' payments. The exchange rate between tokens and euros was 1:1 and was common knowledge. The average payment (across treatments) was 12.80 euros and each session lasted about 90 minutes. We believe that earnings were sufficient to cover the opportunity costs of time for our subjects.

Upon arriving subjects were randomly assigned to a computer terminal and received a set of written instructions. The experimenter read the instructions aloud and presented an example to illustrate how payoffs are calculated. Subjects had the opportunity to ask questions. Before the experiment started subjects had to answer seven control questions, testing whether they understood the experiment correctly. The vast majority of subjects answered at least six questions correctly.

Our main result is that the expression of social approval increases contributions, supporting Hypothesis 1. However, contributions in Treatment 2 are significantly lower than contributions in Treatment 1, hence the additional information about subjects' endowments does not increase contributions. Before we take a closer look at contributions to the public good in sections 5.2 and 5.3 we analyze the expression of social approval in the following section.

5.1 The Expression of Social Approval

In this section we check whether the expression of social approval in the experiment is in line with the theoretical assumptions regarding the expression of social approval. ϕ_{ji} denotes the number of stars given from j to i. We find that in Treatment 1 the (Pearson product moment) correlation between stars received and absolute contributions is $\rho(\phi_i, c_i) = 0.821$ (p-value 0.000) and between stars received and other subjects' absolute contributions is $\rho(\phi_i, c_{-i}) = 0.025$ (p-value 0.688). For Treatment 2 we look at relative contributions and the corresponding correlations are $\rho(\phi_i, \frac{c_i}{e_i}) = 0.871$ (p-value 0.000) and $\rho(\phi_i, \frac{c_{-i}}{e_{-i}}) = -0.042$ (p-value 0.476). The correlations provide evidence for the assumption that high (low) contributions receive much (little) social approval, but there is no clear-cut evidence for a negative relation between social approval received and others' contributions.

Regression No.	1	2
Dependent var.	ϕ_{ji}	ϕ_{ji}
Constant	1.174***	1.590***
	(0.182)	(0.295)
$\frac{c_i}{e_i}$	7.049***	7.049***
	(0.307)	(0.303)
$\frac{c_j}{e_j}$	-1.121***	-1.122***
	(0.306)	(0.302)
$\frac{\bar{c}}{\bar{e}}$	0.223	0.083
	(0.644)	(0.645)
Treatment 2		0.631***
		(0.155)
Period		-0.151***
		(0.034)
N	1104	1104
$\bar{R}^2$	0.503	0.519
F	373.32***	238.87***

Table 3: Stars given from j to i as a function j's, i's, and the group's relative contribution; standard errors in parentheses. Significance codes: $0 \leq$ p-value < 0.001 : ***, $0.001 \leq$ p-value < 0.01: **, $0.01 \leq$ p-value < 0.05: *.

In Table 3 we estimate eq. (2) which describes how subjects assign social approval. Subject i receives more social approval from subject j if i's own relative contribution is higher or if j's relative contribution is lower. The regressions show that when expressing social approval, subjects compare others' contributions to their own contribution. However, the group's average contribution has no significant effect. In addition, we find that subjects assign more stars in Treatment 2 and less stars over time.[9] Taken together, the correlations and regressions 1 and 2 support Result 1, which corroborates Hypotheses 3 and 4.

Result 1: There exists a positive correlation between a subject's contribution and the number of stars she receives, i.e., high contributions receive more social approval than low contributions. Moreover, the number of stars a subject receives increases in her own contribution and decreases in the contribution of the player who assigns the stars. Hypotheses 3 and 4 are supported.

Other regressions, in which we regress the number of stars given from j to i on all subjects' contributions and endowments strengthen Result 1. By controlling for subjects' rank from the intelligence test we find that subjects who performed better are more generous in expressing social approval. Although significant, this effect is rather small and is only present in Treatment 2, in which the distribution of endowments was public information and could be used as a proxy for performance in the intelligence test.[10]

5.2 Descriptive Evidence

Figure 1 shows average relative contributions over all eight periods. Because individual and aggregate endowments vary between periods we look at relative contributions to facilitate comparison between periods. It is apparent from Figure 1 that social approval is effective in raising contribution level. As expected, contributions are lowest in the Control Treatment, declining from 39 to 24 percent. These results are in line with what is reported in Ledyard (1995). In Treatments 1 and 2 in which subjects expressed social approval after observing contributions, average contributions are higher than average contributions in the Control Treatment. Surprisingly, the highest average contributions are observed in Treatment 1, where average contributions are above 50 percent in the first six periods and drop to 32 percent in the last period. Average contributions in Treatment 2 are above 40 percent in the first five periods but drop to 34 percent in the last period.

The increase in relative contributions from period three to period four could be explained by the drop in total endowment from 24 to 14 tokens (see Table 2). Subjects reduce their absolute contributions, but since the drop in endowment is larger, relative contributions increase.

[9] Additional regressions revealed that subjects' personal characteristics (Male, Econ, Semester) had no significant effect on the expression of social approval.

[10] The regressions are available upon request.

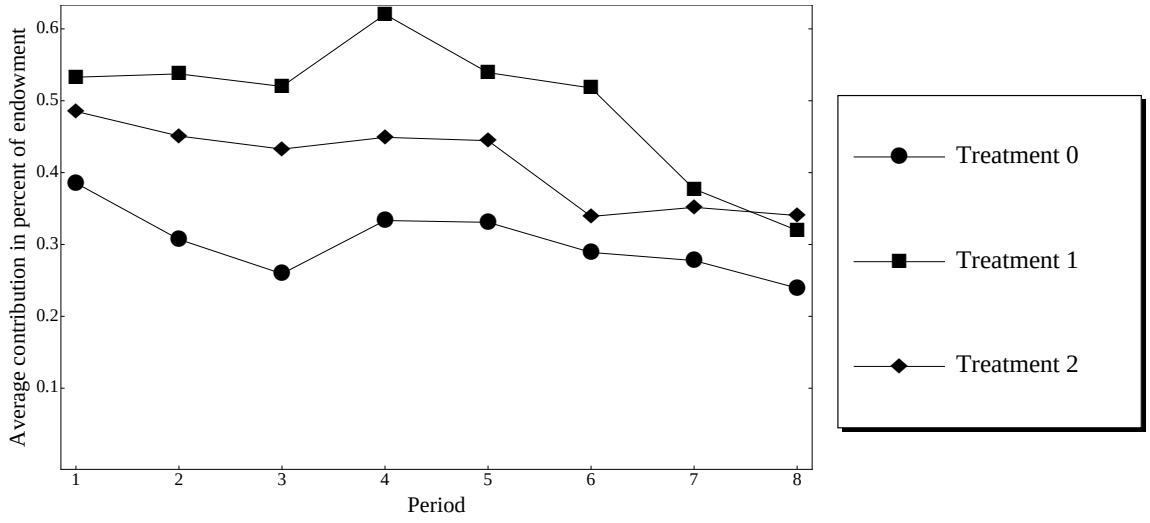

Figure 1: Average contributions over time.

The conclusion that we can draw from the descriptive evidence is formulated in the following two results. Result 2 is surprisingly clear and supports Hypothesis 1; Result 3 was unexpected and does not support Hypothesis 2. In the next section we provide statistical evidence and discuss both results.

Result 2: The expression of social approval induces higher contributions to the public good. In both treatments in which social approval was expressed average contributions are significantly higher than in the Control Treatment. Hypothesis 1 is supported.

Result 3: The effect of social approval on contributions is stronger in Treatment 1 compared to Treatment 2. Giving subjects information about others' absolute contributions induces higher contributions than giving subjects information about others' absolute contributions and endowments. Hypothesis 2 is rejected.

5.3 Statistical Tests for Treatment Effects

Table 4 reports the results from regression analyses. Support for Result 2 (social approval induces higher contributions in Treatments 1 and 2) comes from regressions 3 to 8, showing that the coefficients for the treatment dummies are positive and significant. The magnitude of each coefficient of the treatment dummies represents the difference in absolute contributions compared to the Control Treatment. In regression 3 we use absolute and in regression 4 we use relative contributions as dependent variable. Since relative contributions are bounded between 0 and 1, we employ a

Regression No.	3	4	5	6	7	8
Dependent variable	c_i	c_i/e_i	$\ln\left[\frac{c_i/e_i}{1-(c_i/e_i)}\right]$	z-score	c_i	c_i/e_i
Constant	2.060***	0.708***	1.997***	-0.180	0.243	0.426***
	(0.234).(0	061).(0	614).(0	103).(0	629).(0	105).
e_i	0.243***	-0.026***	-0.220***	0.107***	0.279***	-0.020***
	(0.029)	(0.005)	(0.042)	(0.013)	(0.032)	(0.005)
Treatment 1	1.399***	0.211***	1.665***	0.615***	1.059***	0.158***
	(0.203)	(0.029)	(0.222)	(0.089)	(0.191)	(0.032)
Treatment 2	0.868***	0.124***	0.831***	0.382***	0.663***	0.090**
	(0.107)	(0.014)	(0.127)	(0.047)	(0.182)	(0.030)
Period	-0.157***	-0.027***	-0.222***	-0.069***	-0.149***	-0.025***
	(0.022)	(0.004)	(0.033)	(0.010)	(0.029)	(0.005)
K	-0.220***	-0.023**	-0.200*	-0.097***	0.025	0.016
	(0.027)	(0.007)	(0.083)	(0.012)	(0.972)	(0.016)
Male	-0.489***	-0.056**	-0.523**	-0.215***	0.073	0.030
	(0.144)	(0.018)	(0.164)	(0.063)	(0.142)	(0.024)
Econ	0.040	-0.013	-0.151	-0.0178	-0.049	-0.034
	(0.190)	(0.026)	(0.235)	(0.084)	(0.152)	(0.025)
Semester	0.067***	0.007***	0.054**	0.029***	0.056***	0.005
	(0.007)	(0.001)	(0.010)	(0.003)	(0.016)	(0.003)
Own Payoff (z-score)	.	.	.	.	-0.163*	-0.022
	.	.	.	.	(0.182)	(0.012)
Utilitarian (z-score)	.	.	.	.	0.886***	0.143***
	.	.	.	.	(0.075)	(0.013)
Stars (z-score)	.	.	.	.	0.555***	0.063*
	.	.	.	.	(0.119)	(0.020)
Not minimum (z-score)	.	.	.	.	-0.284*	-0.036
	.	.	.	.	(0.123)	(0.021)
Approval (z-score)	.	.	.	.	-0.192*	-0.045*
	.	.	.	.	(0.090)	(0.015)
Evaluation fair (z-score)	.	.	.	.	-0.078	-0.002
	.	.	.	.	(0.088)	(0.015)
Strategy (z-score)	.	.	.	.	0.091	0.026
	.	.	.	.	(0.083)	(0.014)
N	816	816	816	816	816	816
$\bar{R}^2$	0.159	0.093	0.085	0.159	0.360	0.289
F	20.18***	11.45***	10.45***	20.18***	31.62***	23.03***
AIC	1.482	-2.135	2.172	-0.162	1.216	-2.369
χ^2	118.225***	134.724***	150.624***	118.225***	379.89***	292.91***

Table 4: Determinants of contributing behavior including individuals' characteristics. OLS regressions with panel corrected standard errors in parentheses. Significance codes: $0 \leq$ p-value < 0.001 : ***, $0.001 \leq$ p-value < 0.01: **, $0.01 \leq$ p-value < 0.05: *.

logit transformation and use $\ln\left[\frac{c_i/e_i}{1-(c_i/e_i)}\right]$ as the dependent variable in regression 5.[11] Because contributions are skewed, we use z-scores as dependent variables in regression 6. All four regressions arrive at similar results. The coefficient for the Treatment 1 dummy is larger compared to the coefficient for the Treatment 2 dummy, supporting Result 2. The differences are statistically significant, as Wald F-tests reveal. For the restricted model in regression 3 a Wald-F of 7.459 with $p = 0.007$ results. Wald-F of 8.4621 with $p = 0.0037$ in regression 4; Wald-F of 10.822 with $p = 0.001$ in regression 5; Wald-F of 7.4596 with $p = 0.006447$ in regression 6. We also observe that, on average, subjects with higher endowments contribute absolutely more but relatively less.

For a more detailed analysis of treatment effects we compare differences of means. Since in our experiment we employ the stranger-matching protocol, we generate independent observations. Looking at pairwise comparisons of mean values over all periods we find significant treatment effects using parametric two tailed t-tests and non-parametric Mann-Whitney tests. The treatment effects are significantly different between all three treatments (T0 vs. T1: -0.193, $t = -6.536$ ($p \leq 0.0001$), $Z = -6.482$ ($p \leq 0.0001$); T0 vs. T2: -0.11, $t = -3.610$ ($p \leq 0.0001$), $Z = -3.173$ ($p = 0.002$); T1 vs. T2: 0.084, $t = 2.761$ ($p = 0.006$), $Z = -2.838$ ($p = 0.005$)).

Also noteworthy is that the coefficient of the variable *Period* (regressions 3-8 in Table 4) is negative and significant, confirming that contributions decline over time, reaching a minimum in the last period, known as end-game effect. The significant effect of *Period* could be explained by learning or strategies (Andreoni, 1988).

According to Hypothesis 2 we expect the effect from social approval on contributions to be stronger in Treatment 2. Our data, however, cannot corroborate Hypothesis 2. By looking at the coefficients of the treatment variables in regressions 3 to 8 (Table 4), we see that the effect from social approval on contributions is larger in Treatment 1 compared to Treatment 2. Contrary to Hypothesis 2, more information allowing for a more accurate judgment does not lead to a stronger effect of social approval. This difference between Treatments 1 and 2 can be explained if subject's relative contributions are understood as signals for generosity. If relative contributions are observed the signal emitted by a subject's relative contribution is more informative (less noisy) than the signal emitted by a subject's absolute contribution. If subjects are extremely averse to negative feedback (i.e., not appearing generous), Result 3 can be explained.[12]

5.4 The Consumption Value of Social Approval

In this section we show that the treatment effects are due to the consumption value of social approval by ruling out alternative explanations. To do so, we distinguish two effects of social ap-

[11] Before the linearization zeros and ones were replaced by 0.001 and 0.999 respectively.

[12] Note that this explanation differs from an explanation in which contributions result from the signaling value of social approval (as defined at the beginning) because the former requires only that subjects have a preference for appearing generous while the latter requires that subjects have a preference not for appearing generous but for its monetary consequences.

proval on contributions, called the intra-period and the inter-period effects.

intra-period effect:	$\phi_i(t)$	$\rightarrow$	$\mathrm{c}_i(t)$
inter-period effect:	$\phi_i(t-1)$	$\rightarrow$	$\mathrm{c}_i(t)$

Figure 2: Intra-period effect (top) and inter-period effect (bottom).

Figure 2 depicts two possible explanations for why subjects contribute more in treatments in which social approval is expressed (Result 1). First, it can be the case that subjects contribute more because they anticipate social approval. This effect operates within a period (intra-period effect). Subjects with a preference for the consumption value of social approval will increase contributions (in period t) in order to attract social approval (in period t). Second, it is possible that subjects increase contributions after having received social approval. This effect operates across periods (inter-period effect). Suppose a subject has received a large amount of social approval in period $t-1$. This subject could increase contributions in period t in order to reciprocate, build-up a reputation, or because of the motivational and signaling value of social approval. Because of the design of our experiment reputation building, signaling and direct reciprocity are impossible and social approval has no motivational value. Indirect reciprocity, however, could, in principle, explain higher contributions, for example if each subjects' strategy is to make a high contribution if her previous action was rewarded by high social approval and to make a low contribution otherwise.

Support for the intra-period effect comes from the regressions summarized in Table 4 in which the coefficients of the treatment dummies are positive and statistically significant. In order to examine the inter-period effect we regress changes in relative contributions, $\frac{c(t)}{e(t)} - \frac{c(t-1)}{e(t-1)}$, on a constant, the number of stars received in period $t-1$, $\phi_i(t-1)$, and the deviation from average relative contributions, $\frac{c(t-1)}{e(t-1)} - \frac{\bar{c}(t-1)}{\bar{e}(t-1)}$.

$$\left(\frac{c(t)}{e(t)} - \frac{c(t-1)}{e(t-1)}\right) = \alpha_0 + \alpha_1 \phi_i(t-1) + \alpha_2 \left(\frac{c(t-1)}{e(t-1)} - \frac{\bar{c}(t-1)}{\bar{e}(t-1)}\right) \tag{11}$$

If the inter-period effect is present, we expect to find a positive effect from stars received on relative contributions. We estimated equation 11 separately for subjects who contributed more and less than the average relative contribution. Table 5 presents the results. We find that if we control for the deviation from the average relative contribution the number of stars received has no significant effect on changes in relative contributions. For both treatments and for both low contributors and high contributors the receipt of stars does not cause a change in contributions. Since there is no evidence for the inter-period effect higher contributions are not driven by indirect

reciprocity but by the consumption value of social approval.[13]

5.5 Motivations

At the end of the experiment we ask for motivations using a questionnaire. The answers in the questionnaire are scaled by using a 5-point scale $(-2, -1, 0, 1, 2)$ and transformed into z-scores. Regressions 7 and 8 in Table 4 are based on regressions 3 (contributions) and 4 (relative contributions) and include the answers from the questionnaire. The coefficient *Own Payoff* indicates that participants who evaluate their own payoff as important contribute less. The coefficient *Utilitarian* asks for the importance of the payoffs for all players. The stronger the utilitarian welfare preference is, the higher are absolute and relative contributions to the public good. Both findings are in line with expected behavior. The coefficient *Stars* asks for the importance of stars and can be interpreted as the incentive for contributing more in order to get more stars. The positive and significant coefficient underlines the role of social approval as an incentive. However, the coefficient *Approval*, asking if stars are perceived as expressing social approval, is negative. This finding seems to be contradictory to the previous result because it indicates that subjects who pay high attention to stars contribute less to the public good. A possible explanation could be that some subjects are reluctant to reveal that they pay high attention to stars because they obey a norm of modesty which constrains the explicit pursuit of social approval (Brennan and Pettit, 2000). We also asked the participants if the evaluation could be characterized as fair. The coefficient is not significant which is not surprising because the evaluation of a non-monetary approval system as being fair or not is very subjective. The last question asked whether the expression of social approval was used for strategic purposes. The question's coefficient (*Strategy*) is insignificant, showing that subjects did not expect to influence others through the expression of social approval. This finding confirms that the expression of social approval is an emotionally prompted reaction, as it is assumed in our model, and that our experimental design tests the consumption value of social approval.

6 Conclusion

We presented a model of three heterogneous players playing a linear public good game. Assuming that players have a preference for social approval our model, which is a modified version of Holländer's model (1990), predicts voluntary contributions to the public good. The experiment presented in this paper is designed in order to test our model, that is, we test the hypothesis that social approval induces higher contributions to a public good. More precisely, we are concerned

[13] One could argue that it is not the absolute number of stars that matters since there is a comparative effect. Regressions, in which we substituted a dummy variable for having received more stars than both other subjects for the absolute number of stars, confirm that there is no inter-period effect.

Regression No.	9	10	11	12
	Low Contributors, $\frac{c(t-1)}{e(t-1)} - \frac{\bar{c}(t-1)}{\bar{e}(t-1)} \leq 0$		High Contributors, $\frac{c(t-1)}{e(t-1)} - \frac{\bar{c}(t-1)}{\bar{e}(t-1)} > 0$	
	T1	T2	T1	T2
Dependent variable	$\frac{c(t)}{e(t)} - \frac{c(t-1)}{e(t-1)}$	$\frac{c(t)}{e(t)} - \frac{c(t-1)}{e(t-1)}$	$\frac{c(t)}{e(t)} - \frac{c(t-1)}{e(t-1)}$	$\frac{c(t)}{e(t)} - \frac{c(t-1)}{e(t-1)}$
Constant	-0.020	0.031	-0.101	0.161
	(-0.073)	(0.049)	(0.084)	(0.090)
$\phi_i(t-1)$	-0.004	0.009	0.009	-0.011
	(-0.007)	(0.005)	(0.006)	(0.007)
$\frac{c(t-1)}{e(t-1)} - \frac{\bar{c}(t-1)}{\bar{e}(t-1)}$	-0.821***	-0.398**	-0.793***	-0.662***
	(0.204)	(0.150)	(0.164)	(0.171)
N	114	139	117	113
$\bar{R}^2$	0.163	0.044	0.177	0.187
F	11.96***	4.19*	13.10***	13.91***

Table 5: Determinants of changes in contributing behavior; standard errors in parentheses. Significance codes: $0 \leq$ p-value $<$ 0.001 : ***, $0.001 \leq$ p-value < 0.01: **, $0.01 \leq$ p-value < 0.05: *.

with the consumption value of social approval, i.e., we test if social approval is valued even if it does not lead to higher payoffs in the future. This is different from the idea of reputation, according to which it makes sense to build up a reputation because good reputation will lead to higher payoffs in the future.

Our experiment is a linear public good game with real effort and stranger matching. We chose stranger matching in order to avoid any reputation effect and isolate the consumption value of social approval. In each period subjects were randomly and anonymously paired and subjects' identities were never revealed, making it impossible for subjects to build up a reputation. Each session consisted of a public good game which was played for eight periods. At the beginning of each period subjects engaged in a real effort task in order to earn their endowments. In Treatment 1 (Partial Information Treatment) subjects observed the absolute contributions of all other group members before they had to assign social approval (on a scale between zero and ten stars) to each group member. In Treatment 2 (Full Information Treatment) subjects observed group members' endowments in addition to their contributions.

The results are surprisingly clear and provide solid evidence for the hypothesis that the expression of social approval induces higher contributions to the public good. In all periods contributions to the public good were higher in Treatments 1 and 2 compared to the Control Treatment in which social approval could not be expressed. Contrary to our hypothesis, we observed lower contributions in Treatment 2, in which subjects have additional information about each others' endowments, compared to Treatment 1, in which subjects did not have this information. Subjects' behavior cannot be explained by signaling since any strategic considerations are absent. Positive contributions as well as changes in behavior in response to receiving social approval are both inconsistent with a subgame-perfect equilibrium in a non-cooperative game where players maximize their monetary payoffs. Warm glow, fairness, reciprocity, and inequality aversion can explain positive contributions in the Control Treatment, but they cannot explain the increase in contributions in Treatments 1 and 2 in which subjects expressed social approval. Hence, our results show that subjects' have a preference for the consumption value of social approval.

Regarding the expression of social approval we found that higher relative contributions to the public good receive more stars. In expressing social approval for another subject's contribution, a subject compares the other subject's contribution to his own contribution.

Our experiment suggests that the opportunity to express social approval is a policy for inducing pro-social behavior. Moreover, we showed that the size of the increase in contributions to the public good depends on the information subjects have about each other. An important avenue for further research concerns the robustness of our results. In general, the decision to express approval and the strength of approval as an incentive depend on how subjects perceive each other and the situation. Further research should investigate how subjects' perception is influenced not only by information but also by social distance and framing effects.

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