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Collective action as a social exchange

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Abstract

Social interactions are frequently associated with social approval. Anticipation of social sanctions may have important economic consequences, in particular in the realm of collective action and voluntary cooperation. This paper investigates the impact and the limitations of social rewards on people's behavior in the provision of a public good. We examine whether the opportunity to receive social approval in exchange for participation in collective actions is capable of overcome free-riding. We find that approval incentives alone are not sufficiently strong to cause a reduction in free-riding. However, in combination with some minimal social familiarity approval incentives generate a significant rise in cooperation. Our results also suggest that approval incentives give rise to multiple equilibria. ©1999 Elsevier Science B.V. All rights reserved.

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"*People's behavior can largely be explained in terms of two dominant interests: economic gain and social acceptance*".
John Harsanyi (1969)

We are pleased to think that we have rendered ourselves the natural objects of approbation . . . and we are mortified to reflect that we have justly merited the blame of those we live with.
Adam Smith (1976)

1. Introduction

Social interactions frequently are associated with social approval or disapproval. The anticipation of such social rewards and punishments may have important economic conse-

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quences. It may affect the efficiency of team production and the decisions in diverse areas such as tax evasion, exploitation of the welfare state, criminal activities, union membership, and voting behavior. Understanding the impact and the limitations of such rewards on people's behavior is, therefore, of great interest to economists. The behavioral role of social rewards and punishments is stressed in social exchange theory (Blau, 1964). In contrast to pure economic exchanges social exchanges involve not only the exchange of economic rewards, but also the exchange of social rewards. The admiration or the contempt that is sometimes expressed by parents, teachers, professional colleagues and spectators are prime examples of a social reward. In general social rewards are not based on explicit contractual arrangements but are triggered by spontaneous positive or negative emotions which can be interpreted as approval and disapproval, respectively. According to Blau the defining characteristic of a social exchange is (i) that social rewards are involved and (ii) that rewards are not subject to explicit and enforceable obligations.

This paper deals with the question whether and under which conditions emotionally prompted social approval is capable of overcoming the free-rider incentives in collective action problems. Casual evidence suggests that social approval and disapproval play an important role in collective action. For example, in Japanese-managed auto factories in North America (transplants) team production is the norm and peer pressure against unwarranted absenteeism or tardiness is substantial. Rehder (1990, p. 91) reports that "the entire team suffers when one person is absent, and the returning team member can receive both formal sanctions and informal group pressures upon his or her return. The system is designed to function that way, and it works very well." However, peer pressure may not always be advantageous for firms. It may, instead, increase the bargaining power of workers during labor disputes. In such disputes strike-breaking and other forms of deviant behavior frequently trigger the contempt and aggression of conforming colleagues. A good example is the 1984 British miners' strike which lasted for many months: "To isolate those who supported the 'scab union', cinemas and shops were boycotted, there were expulsions from football teams, bands and choirs and 'scabs' were compelled to sing on their own in chapel services. 'Scabs' witnessed their own 'death' in communities which no longer accepted them." (Francis, 1985, p. 269). Similarly, rate busters who violate production quotas under a piece rate regime are frequently confronted with rather hostile reactions from their fellow workers (Roethlisberger and Dickson, 1947; Whyte, 1955; Marsden, 1986).

A further example for the potentially great importance of social (dis)approval is provided by governments' attempts at recruiting volunteer soldiers. During World War I an important tool of the British government to 'persuade' adult males to join the army were big posters. The posters made it clear that non-subscription constitutes free-riding and deserves the contempt of the British people. One poster showed, for example, a father with his two children and the subtitle was: "Daddy, what did YOU do in the Great War?" Some posters exerted social pressure by appealing to the girl friends of potential soldiers: "If you don't want to marry a whimp, send him to the army." Another technique to mobilize social disapproval was the free distribution of big red badges. They could be attached to a free rider's front door saying that the person living there was a dodger. Such government activities obviously only make sense if one assumes that social (dis)approval affects the behavior of potential subscribers.

The basic hypothesis that the expectation of emotionally prompted social approval motivates cooperative behavior in a collective action problem has a long tradition in the social sciences. It was applied, for instance, in de Mandeville's (1714) 'Fable of the Bees', in Smith's (1976) 'Theory of Moral Sentiments', and in Homans' (1961) 'Social Behavior.' The potential importance of social incentives for overcoming the free-rider problem has also been stressed in the pioneering contribution of Olson (1965). Since then several authors have written theoretical papers that model similar ideas in a more formal manner. Akerlof (1980) and Romer (1984), for example, argue that social customs are maintained by the social sanction imposed by loss of reputation when breaking the custom. From the perspective of social exchange theory the loss of reputation can be interpreted as a reduction in social approval or an increase in social disapproval. If a positive (negative) value is associated with approval (disapproval) then there is an incentive to obey the custom despite pecuniary incentives to the contrary. While Akerlof and Romer apply this idea to explain a stable norm that prevents workers from underbidding the prevailing wage, subsequent writers have applied it to questions of union formation (Booth, 1985; Naylor, 1989). More recently Holländer (1990), Kandel and Lazear (1992) and Barron and Gjerde (1997) have developed formal models that incorporate social incentives. Despite differences in details the basic approach is very similar in these three papers. The authors assume that voluntary cooperation in collective action problems provides additional benefits in the form of increased social approval or decreased social disapproval (peer pressure). As a consequence of these social incentives a stable norm of participation in collective action emerges.

Despite the increasing number of theoretical papers that recognize the importance of social rewards, we are not aware of any empirical work that examines the participation-enhancing force of social approval in collective action problems. This lack may be due to the problems inherent in measuring non-pecuniary incentives and their impact on behavior. For example, many collective action problems in the real world are embedded in a repeated interaction context. Union formation or the establishment of production quotas under piece rate systems again are good examples here. It is now well known (see, e.g. Axelrod, 1984; Fudenberg and Maskin, 1986) that collective action problems can, in principle, be solved without the assumption of social incentives. If there is a sufficiently high probability that there will be future interactions, and if these interactions offer opportunities for imposing pecuniary penalties on those who do not participate in collective action, individuals may have a *pecuniary incentive* to participate. It is, therefore, always possible to attribute the empirically observed success of collective actions fully to the fact that people are likely to have many future interactions that offer pecuniary punishment opportunities. Thus, even if one could measure the strength of social incentives it would be difficult to disentangle the effects of social rewards from purely pecuniary effects that are due to repeated interactions. The above example of the British miners' strike provides a good illustration of the empirical difficulties. If the majority of striking workers does not admit the minority of strike breakers back into the community there are two effects: Strike breakers will probably suffer non-pecuniary welfare losses that arise from the low social esteem they get from the rest of the community. In addition, however, their social isolation may also be associated with an economic isolation that gives rise to pecuniary losses.

Even more problems arise if one takes into account the plausible hypothesis that social approval becomes increasingly important with the decrease of social distance among people.

This view, for example, has been put forward by Adam Smith (p. 23) when he wrote: "We expect less sympathy from a common acquaintance than from a friend . . . . We expect still less sympathy from an assembly of strangers." Since the social distance among people is likely to be smaller the more often they interact with each other, the repeatedness of interactions is positively correlated with the importance of approval incentives. However, as argued in the previous paragraph, the repeatedness of interactions *also* is positively correlated with the importance of pecuniary punishment opportunities. Therefore, since the analysis of the usually available field data is connected with all the above-mentioned difficulties, it seems almost impossible to disentangle the effects of social approval from the purely strategic (pecuniary) effects that arise in repeated encounters.

For this reason we examined the effects of social approval on cooperation and free-riding in the context of a *finitely* repeated experimental collective action problem. As we will see, the experimental methodology allows true ceteris paribus changes with regard to social exchange opportunities. In addition, due to the finite horizon of the experiment, the behavior in the final period cannot be affected by the fear of future pecuniary punishments.

Our analysis proceeds in two steps. In a first step, in Section 2, we briefly report on questionnaire evidence that identified the existence and the nature of approval incentives. We confronted subjects with a description of a simple one-shot (i.e. only once played) collective action problem. Then they had to indicate the strength of their emotions and feelings towards cooperators and free-riders under a variety of different circumstances. These emotions and feelings can be naturally interpreted as indicators of subjects' approval of different kinds of behavior. The results of this procedure indicate that cooperation and free riding trigger strong approval or disapproval among the subjects. Moreover, rather robust regularities of social approval appear that shed light on the potential of approval incentives to overcome free-riding.

While the first step of our study establishes the existence and the nature of social approval in the context of a collective action problem, the second step, taken up in Section 3, looks more closely at the conditions under which social approval affects *behavior*. For this purpose we conducted a series of finitely repeated collective action *experiments*. To detect the impact of social approval on behavior we compared treatment conditions in which social approval was ruled out by design with conditions in which subjects could express approval and disapproval after they observed each other's actual behavior. It turns out that among complete strangers social approval has a weakly positive, yet insignificant effect on participation behavior. If, however, subjects have some minimal social familiarity with each other the opportunity to express social approval generates a strong increase in participation levels. Under appropriate conditions the exchange of approval for participation is thus capable of significantly weakening free-riding incentives.

2. Do cooperation and free-riding elicit approval?

It is well known that collective action problems have the structure of a public goods problem because those who do not participate in collective action are not excluded from the consumption of its outcome. Our experimental setup as well as our questionnaire study is, therefore, embedded in a simple public goods context in which each of n individuals has to

choose how much to contribute to the public good. Individual i's pecuniary payoff is given by

$$\Pi_i = y - g_i + \alpha \Sigma_j g_i \quad \text{with} \quad \left(\frac{1}{n}\right) < \alpha < 1 \text{ and } j = 1, \ldots, n \tag{1}$$

where y denotes the endowment, g_i represents i's contribution which is constrained by $0 \leq g_i \leq y$ and α denotes the marginal utility of the public good G. For simplicity, the public good is given by $G = \Sigma_j g_j$, $\alpha < 1$ ensures that irrespective of the contribution of others individual i is always better off by complete free-riding ($g_i = 0$). However due to $\alpha n > 1$ the welfare-maximizing solution is given by full cooperation ($g_i = y$).

In the context of this public goods problem the basic elements of the social exchange approach can be easily illustrated: [1]

1. Since positive contributions to G confer benefits upon others and are costly for the donor they constitute a gift which triggers positive emotional responses (i.e. approval) from the recipients of the gift.
2. Free-riding on the positive contributions of other members of the group is tantamount to not reciprocating the gift and will, hence, generate negative emotional responses (i.e. disapproval) from others.
3. Individuals anticipate the emotional responses that are associated with their contributions. In addition to their pecuniary payoff as defined in (1) they value approval positively and disapproval negatively.
4. Due to (i)–(iii) there are additional (approval) incentives for contributions which may give rise to a stable behavioral norm of participation in collective action.

If the social exchange approach to collective action is empirically valid we should be able to detect the assumed emotional responses. To solve this task we designed a questionnaire study that was embedded in the above public goods setting. Subjects who participated in the questionnaire study were given a neutrally framed description of the above public goods problem with $y = 20$, $n = 4$ and $\alpha = 0.4$. To answer the questionnaire, subjects had to indicate their emotions (feelings) toward several people who where described as contributing different amounts to G. An example of a typical question is the following: "*You decide to contribute 5 francs to the project. The second group member contributes 3 and the third contributes 7 francs. Suppose that the fourth member contributes 20 francs to the project. You now accidentally meet this member. Please indicate your feelings towards this person.*" The different questions varied the distribution of own and other contributions. Participants of the study then had to indicate the strength of their feelings on a scale between 1 and 9. The answers on that scale enable us to see the emotional responses towards cooperators and free-riders. The answers can, hence, be interpreted as indicators of social approval. [2]

In total 63 subjects participated in the questionnaire study (but not in the experiments reported below). Our results from the questionnaire study on the importance of social approval incentives can be summarized by the following three regularities:

[1] For a more extensive discussion see Holländer (1990, p. 1158). For a slightly different approach see Kandel and Lazear (1992, p. 804).

[2] For restrictions of space we cannot fully describe the questionnaire study. Details are available upon request, however.

1. Social approval increases in a person's own level of contribution to the public good. This establishes that there are approval incentives for those who are motivated by approval.
2. Social approval decreases in the average level of contributions of other subjects. This means that other subjects' participation imposes a negative externality on those who are motivated by approval.
3. The marginal gain in social approval that is provided by an increase in one's own contribution level is significantly higher if others choose a high- instead of a low-level of contribution. Thus, marginal approval gains are increasing in others' level of contribution. This means—in the language of game theory—that contribution levels are strategic complements, that is, the approval incentive is stronger the higher the level of other subjects' participation.
4. Subjects also anticipate regularities 1–3. They expect that they receive more approval if they contribute more, and less approval if others contribute more. In addition, they expect higher marginal approval gains if others contribute more.

The second regularity shows that approval incentives have a similarity with status incentives (see, e.g. Frank, 1985). If I value status, an increase in the status-seeking effort of other people will in general reduce my rank in the status hierarchy and, hence, lower my welfare. Teams and communities that are characterized by approval incentives may, hence, not necessarily achieve higher welfare levels. It seems difficult to find mechanisms that internalize approval externalities, and those who live with them may experience them as 'oppressive.' This may be the reason why in the above-mentioned Japanese-managed auto factories workers asked the management to provide "regular absentee replacement workers to reduce the costs of absenteeism on individual team members and thus reduce peer pressure" (Barron and Gjerde).

The third regularity suggests that in the presence of approval incentives there may be low- as well as high-participation equilibria for the same underlying preferences. If everybody chooses a low participation level the marginal approval gain is low and it may thus be in the interest of everybody to stick to that low level even if everybody cares about social approval. On the other hand, if everybody chooses a high contribution level, the marginal approval gain is high and it may thus be in everybody's interest to stick to the high level.

The above results provide a 'natural' interpretation for one of the most puzzling aspects of crime: Cities with seemingly identical economic conditions experience vastly different crime rates (see, e.g. Glaeser et al., 1996). To account for this fact, several authors have developed models that generate multiple equilibria (Sah, 1991; Murphy et al., 1993; Rasmusen, 1996). A key characteristic of these models is that a rise in aggregate crime rates decreases the incentives of an individual to remain non-criminal. Our results provide a neat foundation for such incentives if one takes into account that peer pressure or stigma, as in Rasmusen (1996), play an important role in the decision to become criminal. The more people in one's neighborhood are criminals the lower will be the social disapproval if a person becomes criminal and the weaker is the approval incentive to remain non-criminal. There is plenty of descriptive work on crime which shows that peer pressure is important (see, e. g. Jankowski, 1991 or Adler, 1995).

In summary, the first step of our analysis has shown that free-riding and cooperation can have important emotionally prompted approval consequences. This result constitutes evidence in favor of an important element of the social exchange approach. However, we

regard the impact on behavior as the ultimate test of the importance of approval incentives. Therefore, we turn in the next section to the second step of our analysis where we investigate approval incentives in the context of a public goods experiment.

3. Do approval incentives affect behavior?

There are two reasons why the existence of social approval may not affect behavior. First of all, the motivating force of social approval may not be sufficient to overcome the pecuniary incentives in favor of free -riding. If, for example, the pecuniary payoff (1) represents a person's true preference, social approval is for this person—though existent—behaviorally irrelevant. Secondly, and perhaps more interesting, social approval may be behaviorally irrelevant although everybody puts a non-trivial value on social approval. This possibility arises from the regularities we have uncovered in the previous section. Remember that the marginal approval gain turned out to be increasing in the contributions of others, that is, the approval incentive is stronger the more others contribute. It is thus easily possible that if others are expected to contribute only little the approval gain is too small to overcome the free-riding incentive while if others are expected to contribute a lot the approval gain is sufficient. As a consequence there may be no- or low-contribution equilibria as well as high contribution equilibria (see Appendix A for a more rigorous proof of this statement).

In case of multiple equilibria subjects face a coordination problem. Subjects' beliefs about other subjects' contributions will ultimately determine how much they contribute. In this context the notion of trust can, hence, become important. If subjects have trust in the sense that they believe that others will contribute much they will also have an incentive to contribute much. Experimental manipulations that increase or decrease the level of trust can thus have behavioral effects.

3.1. Experimental design

To examine the behavioral effects of social approval we implemented a public goods game that was embedded in four different treatment conditions:

1. An *anonymity treatment* (henceforth A-treatment) in which anonymous strangers interact in the public goods game.
2. A *social exchange treatment* (S-treatment) in which subjects who were ex ante, that is, before and during the public goods game, anonymous strangers, had the opportunity to express and receive social approval immediately after the game.
3. A *group identity treatment* (G-treatment) in which there were no opportunities for social exchange ex post. Instead subjects were made familiar with each other before the public goods game by a procedure described in more detail below.
4. A *combination of the group identity treatment and the social exchange treatment* (GS-treatment). In this condition subjects who had the same social familiarity as in the G-condition had, in addition, the opportunity for ex post social exchanges.

General features of all treatment conditions: In all treatment conditions we implemented the public goods game described at the beginning of Section 2. Subjects' pecuniary payoff was given by (1) with $y = 20$ and $\alpha = 0.4$. There were $n = 4$ members per group and $0 \leq g_i \leq 20$

had to be obeyed. Thus subjects in our experiment faced exactly the same public goods game as the participants of the questionnaire study described in Section 2. They received the same description of the game (see Appendix B for the instructions).

In the experiment, however, the public goods game was played for real money. In addition, the basic stage game as described above was repeated for 10 periods. Subjects' money earnings from the experiment were given by the sum of their earnings in each period. The earnings per period were given by (1). After each period the subjects were informed about the total contribution level $G = \Sigma_i g_j$ in their group. The main purpose of the ten-fold repetition was to allow subjects to learn and to become acquainted with the strategic environment. It has been argued (e.g. Plott, 1996; Palfrey and Prisbrey, 1996) that, particularly during the initial periods, subjects' behavior in experiments is characterized by a basic randomness. This randomness may be due to the fact that subjects are in an unfamiliar situation and that they have to learn through experience what is in their interest.

Further support for the usefulness of repetition comes from many market experiments (for a survey see Holt, 1995). These experiments show that outcomes rarely jump to the market equilibrium but that they gradually converge to the equilibrium. Similar results have been observed in many public goods experiments like ours (Ledyard, 1995; see also the discussion of these results below), that is, with repetition the dominant strategy Nash equilibrium of the stage game exerts a considerable drawing power. In addition to the above arguments it is also this strong drawing power of the free-riding equilibrium that motivated us to repeat the game 10 times. For, if we can show that in this 'tough' environment social exchange opportunities are behaviorally relevant, one can argue that in 'weaker' environments they are likely to play an even more important role. Moreover, since in all treatment conditions it was common knowledge that the public goods game is repeated exactly 10 times the game in Period 10 constitutes a true one-shot game. Actions in Period 10 certainly cannot be motivated by the expectation of future rewards or punishments *in the public goods game*. Of course, in those conditions in which ex post interaction provided an opportunity for social exchanges Period 10 decisions could well be affected by the expectations of future *social* rewards and punishments. For obvious reasons Period 10 decisions are, therefore, of special interest for us.

To be able to implement controlled changes in subjects' social familiarity we maximized the chances that subjects in a public goods group were initially, that is, when they entered the laboratory, complete strangers.[3] To achieve this we applied a very careful recruitment procedure. Potential participants from our large register of experimental subjects were invited by telephone calls. This allowed us to determine the composition of public goods groups. We ensured that each group member was a student from a different field. Moreover, in the S-, G-, GS-treatments we asked subjects at the very end of the experiment about their ex ante relations with other group members. 95 percent of the subjects had never seen any of the other group members in their lives. The rest had seen one other group member accidentally in the past. In our view, the fact that subjects are initially complete strangers may well decrease the behavioral effects of social approval. However, if we get such effects in our experiments we have a stronger result.

[3] We also ensured that at the very end of the experiment subjects were paid privately and left the university building separately. This procedure was known by the subjects before the experiment started.

The anonymity treatment (A-treatment): In this condition subjects never learned the identity of other group members. In addition to anonymity it was common knowledge that each member in a given group was a student from a different field.

The social exchange treatment (S-treatment): As in the A-treatment group members in the S-treatment were anonymous strangers from different fields of study. However, immediately after Period 10 of the public goods game the identity of each individual was revealed to other group members. This was implemented in the following way. Subjects had to sit together around a table and could discuss their decisions with other group members. Before this discussion started the contributions of each member in each of the 10 periods were made public to the other group members. Moreover, it was publicly known before the start of Period 1 that the revelation of identities and contributions, as described above, will occur after Period 10.

To render the ex post revelation of contributions and identities psychologically salient we implemented an additional design feature. Subjects had to write down the reasons for their decision in each period in a so-called report book. They were told that this report book would make it easier for them to remember their motives and to answer questions of other group members at the end of the experiment. While subjects knew that they will meet and that their decisions will become known to other group members after Period 10, their report book remained private information.

The basic rationale for the S-treatment was to provide opportunities for social approval and disapproval. In view of the strong approval consequences we reported in Section 2, the revelation of identities and contributions in combination with the ex post discussion provides plenty of opportunities for the expression of approval. Therefore, if social approval among strangers is behaviorally important it should show up in *higher* contributions in the S-relative to the A-treatment. Note that we do *not* expect no contributions in the A- and *positive* contributions in the S-treatment because, beyond social approval, there may also be other motives (like, e.g. altruism) which cause positive contributions. However, since these motives can be operative in both conditions while the approval motive can only be operative in the S-treatment, a higher contribution level in the S-treatment represents evidence in favor of the behavioral effectiveness of social approval.

The group identity plus social exchange treatment (GS-treatment): This treatment differs from the S-treatment in the following way: *Before* the 10-period experiment group members' identities are revealed. Subjects shake hands and tell other group members what they study and what their hobbies are. After that each subject plays a simple guessing game with each other subject in the group. In each instance of this sequence of bilateral games one subject, say Subject A, has to guess the color of a chip that is hidden in the right hand of Subject B. Subjects did not get paid for their activities in this game.

The purpose of this pre-experimental interaction was to establish some minimal social familiarity among group members. Note that before this interaction subjects were complete strangers. They had never seen other group members before. In our view it is thus fair to say that our pre-experimental interaction ensured only *minimal* social familiarity. Besides creating social familiarity, our pre-experimental guessing game may also enhance *group identity*. According to the 'minimal group paradigm' (see, e.g. Turner and Giles, 1981), feelings of group identity ('we') can be created already by the mere act of allocating subjects to groups. Consistent with these findings, Dawes et al. (1988) conclude on the basis of a

large number of experiments that group identity is indeed one of the most important factors in enhancing cooperation. It is effective even if there are no possibilities for side payments, social approval, reputation formation, reciprocity, punishments, and so on.

After the pre-experimental game groups were informed that they would participate in a further experiment and that the group composition would remain the same. The following 10-period public goods experiment was identical to the S-treatment. As in the S-treatment the experimental setup ensured that neither verbal nor non-verbal communication could take place among group members.

Note that if all subjects are money maximizers social familiarity and group identity are behaviorally completely irrelevant. Since subjects did not know that after the pre-experimental game there will be a public goods experiment, our familiarity manipulation does not even represent cheap talk (i.e. communication about non-binding promises). However, in the presence of subjects who are motivated by social approval familiarity and group identity may matter. It may, first of all, create some minimal trust among group members, which allows them to achieve a high- instead of a low-contribution equilibrium. Secondly, subjects who are familiar with each other may put a higher value on approval which strengthens its motivating force. Thirdly, a reduction in social distance among group members may increase the *expectation* of social approval.

The group identity treatment (G-treatment): The G-treatment served mainly as a control for the GS-treatment since, as the above-mentioned evidence suggests, familiarity and the induced group identity *alone* may already trigger higher contribution levels. This condition removes the social exchange part from the GS-treatment, that is, there was no report book, no revelation of contributions and group members' identities and no group discussion after Period 10. [4]

3.2. Predictions

If all subjects are *rational money maximizers* and if this is *common knowledge* the subgame-perfect equilibrium prediction for each of the four conditions is straightforward. Since every subject will play the dominant strategy $g_i = 0$ in Period 10 the actions in Period 9 can have no impact on the decisions in Period 10. Thus subjects will play $g_i = 0$ in Period 9 and, by further backward induction, in all earlier periods as well.

If *rational money maximization is not common knowledge* and if there is some probability that there are tit-for-tat players among the group members, full free-riding in all periods may no longer be the only (sequential) equilibrium. From the analysis of Kreps et al. (1982) it is known that under these circumstances even rational money maximizers have an incentive to cooperate. In the early periods they can build a reputation as a cooperative player to induce

[4] We are not aware of other experimental studies that tried to isolate the impact of approval motives on collective action. Dawes (1980) briefly mentions three studies (Bixenstine et al., 1966; Jerdee and Rosen, 1974; Fox and Guyer, 1978) that examine the impact of disclosure of choices on the frequency of playing cooperatively in a multi-person prisoner's dilemma. However, in the Bixenstine et al. and the Jerdee and Rosen study players' identities were not revealed so that subjects could not express or experience emotionally prompted approval. In the third study subjects did not know for how many periods the game would be played. In view of the fact that pure approval effects can only be isolated (in the final period) if the final period is common knowledge this study is also of limited interest for our purposes. Besides that, Dawes criticizes the extremely low stake level in all three studies.

tit-for-tat players to cooperate. Note that this reputation argument does not say that subjects derive a non-pecuniary value from a reputation as a cooperative player. It says, instead, that subjects have an incentive to establish a 'good' reputation in the early periods because this prevents tit-for-tat players from defecting and, hence, generates *pecuniary* gains in future periods. Towards the end, however, future pecuniary gains from a 'good' reputation decrease because of the lower number of remaining periods. Therefore, cooperation will tend to decline towards the end. In the extreme case in which every subject is in fact a rational money maximizer but everybody believes that there are some tit-for-tat players, contributions have to be zero for all subjects in Period 10.

If, in addition to the rational money maximizers, there is a fraction of subjects who is motivated by unconditional altruism, or an internalized norm of unconditional cooperation, we will observe the *same* positive average contribution in each treatment in Period 10. This follows because *unconditional* cooperators will not be affected by our treatment manipulations. The strong approval regularities in Section 2 indicate, however, that, in addition to the above motives, it is rather likely that the approval motive for contributions becomes effective in the social exchange treatments. As a consequence, cooperation levels in Period 10 may differ significantly across treatments. Whether approval motives give rise to higher contribution levels is an empirical question because, as we have argued, there may well be low- and high-participation equilibria in the presence of approval incentives. However, if we observe higher Period-10 contributions in the social exchange treatments we have evidence in favor of the behavioral effectiveness of social approval. The same argument applies in the case of systematic treatment differences between Period 1 and 9. If we observe in these periods higher contribution levels in the social exchange treatments they can be attributed to the behavioral effects of social approval.

Beyond the possibility that subjects who are motivated by social approval will generate higher cooperation levels in the S- relative to the A-treatment and in the GS-relative to the G-treatment, there is also the possibility that rational egoists will contribute more in the social exchange treatments. Remember that the approval data show that marginal approval gains are higher if others in the group give more and that subjects also expect this. This means that those who are motivated by approval are 'tit-for-tat' players in the sense that their contributions are higher the higher they expect the contributions of others to be (see Appendix A for a rigorous derivation of this claim). In the social exchange treatments the reasons for believing in the existence of such 'tit-for-tat' players are thus particularly strong. As a consequence, rational egoists have particularly strong reasons to play cooperatively in the non-final (or at least in the early) periods to induce the belief that high contributions will be provided. If the above reasoning is empirically valid even rational egoists should contribute more in the non-final periods of the social exchange treatments. In the final period, however, they will choose $g_i = 0$.

3.3. Experimental results

In total we conducted 11 experimental sessions between Fall 1994 and February 1995. With the exception of Session 1, where only five groups participated, in each session six independent groups of four individuals simultaneously took part in the experiment. In the

Table 1
Independent group average contributions in percent (SD) over all periods

Group no.	A-treatment	G-treatment	S-treatment	G and S-treatment
1	46.6 (40.5)	40.1 (35.3)	81.9 (30.2)	82.5 (25.2)
2	62.3 (34.1)	99.5 (3.2)	97.4 (7.2)	61.0 (33.8)
3	46.0 (28.3)	48.1 (37.3)	83.1 (34.2)	99.9 (0.8)
4	40.5 (33.1)	95.0 (22.1)	76.5 (40.8)	74.1 (19.0)
5	21.3 (23.6)	49.1 (35.2)	88.8 (23.3)	73.5 (25.3)
6	86.9 (22.4)	56.4 (33.6)	50.3 (29.1)	96.0 (17.5)
7	50.1 (26.8)	88.8 (24.0)	37.6 (31.4)	43.4 (38.2)
8	62.6 (27.6)	33.9 (36.1)	45.8 (30.4)	72.1 (39.3)
9	52.6 (38.3)	36.6 (25.1)	43.8 (36.8)	68.6 (35.5)
10	38.8 (32.9)	58.0 (34.1)	32.0 (38.4)	96.1 (16.2)
11	48.4 (26.7)	88.8 (26.5)	57.5 (35.5)	51.8 (36.5)
12		45.5 (30.3)	47.4 (36.2)	99.4 (4.0)
13		68.5 (34.4)	24.8 (27.4)	56.6 (36.9)
14		21.0 (26.8)	23.8 (16.9)	41.3 (17.3)
15		24.3 (22.1)	29.6 (25.5)	76.9 (32.3)
16		46.9 (29.0)	41.8 (40.5)	81.9 (36.7)
17		79.1 (24.6)	48.0 (33.9)	43.6 (31.0)
18		25.1 (28.4)	48.3 (24.1)	46.6 (35.6)
Total average contributions (SD)	50.5 (34.5)	56.0 (38.0)	53.0 (38.0)	70.5 (35.0)
Between group SD.	16.5	25.5	22.5	20.0
SD. between *individual average* contributions	21.5	28.0	27.0	25.0

A-treatment there were 11 independent groups while in each of the other three treatment conditions we had 18 independent groups. Thus, in total 260 subjects—who formed 65 independent groups—participated in our experiments. Subjects received US$ 7 for showing up on time plus their earnings in the experiment.

In all treatments, payoffs were denoted in 'points' during the experiment. At the end of the session the gains measured in points were summed up and exchanged to real money with an exchange rate of 8 cents for 1 point. This exchange rate was common knowledge. In all treatments, the minimal gain for an individual subject was 80 points ($6.4). The maximum possible gain for an individual was 440 points ($35.2). In the A-treatment subjects earned on average 245 points, in the S-treatment 250 points, in the GS-treatment 290 points and in the G-treatment 260 points. Since a session lasted about 2 hours these earnings were sufficient to cover the opportunity costs of time for our subjects.

Our main result is that neither the S- nor the G-treatment generate a contribution behavior that differs substantially from the A-treatment. If, however, the opportunity for social exchange is combined with some minimal social familiarity there is a substantial increase in contribution levels. In the following we present the evidence for this claim. We will first give descriptive evidence. Then we present the results of more rigorous statistical tests to isolate treatment effects.

Descriptive evidence: Table 1 lists the average contribution (as well as standard deviations) over all periods of all our 65 independent groups. On average, groups in the A-treatment contributed 50.5 percent of their endowment to the public good. In the G-treatment, contributions amount to an average of 56 percent of the endowment, whereas in the S-treatment groups invested on average 53 percent into the public good. Hence, com-

pared to the baseline contributions of the A-treatment, the G-treatment lead on average to a slight increase in contributions of 5.5 percentage points. In contrast, S-treatment increased contributions relative to the baseline by only 2.5 percentage points. Hence, familiarity and the associated group identity and opportunities for social exchange *alone* were not capable of substantially increasing contributions relative to what could already be achieved under conditions of complete anonymity. In combination, however, that is, in the GS-treatment, contributions increased to 70.5 percent *on average*. Put differently, familiarity plus social exchange led to a substantial increase in contributions.

Table 1 also lists the within-group and the between-group standard deviations. The average within-groups standard deviation was similar in all four treatments. It was lowest in the A-treatment and slightly higher in the GS-treatment. It was highest in the G- and in the S-treatment. This pattern is similar with regard to the between-groups standard deviation. The A-treatment was the most homogeneous one, followed by the GS-treatment, S-treatment, and the G-treatment, respectively. Interestingly, the same pattern holds for the variability of *individual* average contributions (calculated over all periods for each individual).

Fig. 1(a, b) contain information about the distribution of average contributions both at a group as well at an individual level. In Fig. 1(a) we show for each treatment condition the cumulative distribution of the groups' average contributions over all 10 periods as a percentage of their endowment. It is obvious from Fig. 1(a) that the distributions for the A-, S- and G-treatments are rather similar to each other. The GS-distribution is, however, very different from the other distributions. If we look, for example, at the percentage of groups that give less than 40 percent of their endowment we find the following. There are no such groups in the GS-treatment. In the other treatments between (roughly) 20 and 30 percent of the groups contribute less than 40 percent of the endowment. If we look at the percentage of groups which invest more than 70 percent of the endowment we find that in the GS-treatment roughly 55 percent of the groups contribute that much. However, in the other three conditions only between 10 and 30 percent of the groups contribute more than 70 percent of the endowment. Fig. 1(b) shows that it does not matter much whether we look at groups' or individuals' average contribution. The cumulative distributions of individual subjects' average contribution exhibit the same qualitative pattern.

Fig. 1(a, b) are based on group averages and individual averages over all ten periods. Similar results are, however, obtained if we examine the evolution of contributions over time which are presented in Fig. 2(a, b). These figures show that the average contribution as well as the median contribution is higher in the GS-treatment compared to the other three conditions. This difference is in sharp contrast to the closeness of average and median contributions in the other three treatment conditions. Moreover, what is interesting is that the difference between the GSa and the other treatments seems to be larger in the second half of the experiment. While between Periods 1 and 4 the gap seems to decline (see Fig. 2(b) in particular) the behavioral differences are larger between Period 5 and 10. While in the GS-treatment the median contribution in Period 10 reaches 50 percent (!) of the endowment it is zero or close to zero (!) in all other conditions.

Table 2 contains the results depicted in Fig. 2(a, b) also in tabular form. In addition, it documents the standard deviations of contributions for each period. A comparison of the standard deviations confirms the broad patterns observed in Table 1. Even over time the A-treatment exhibited the smallest standard deviation, followed by the GS-treatment. The

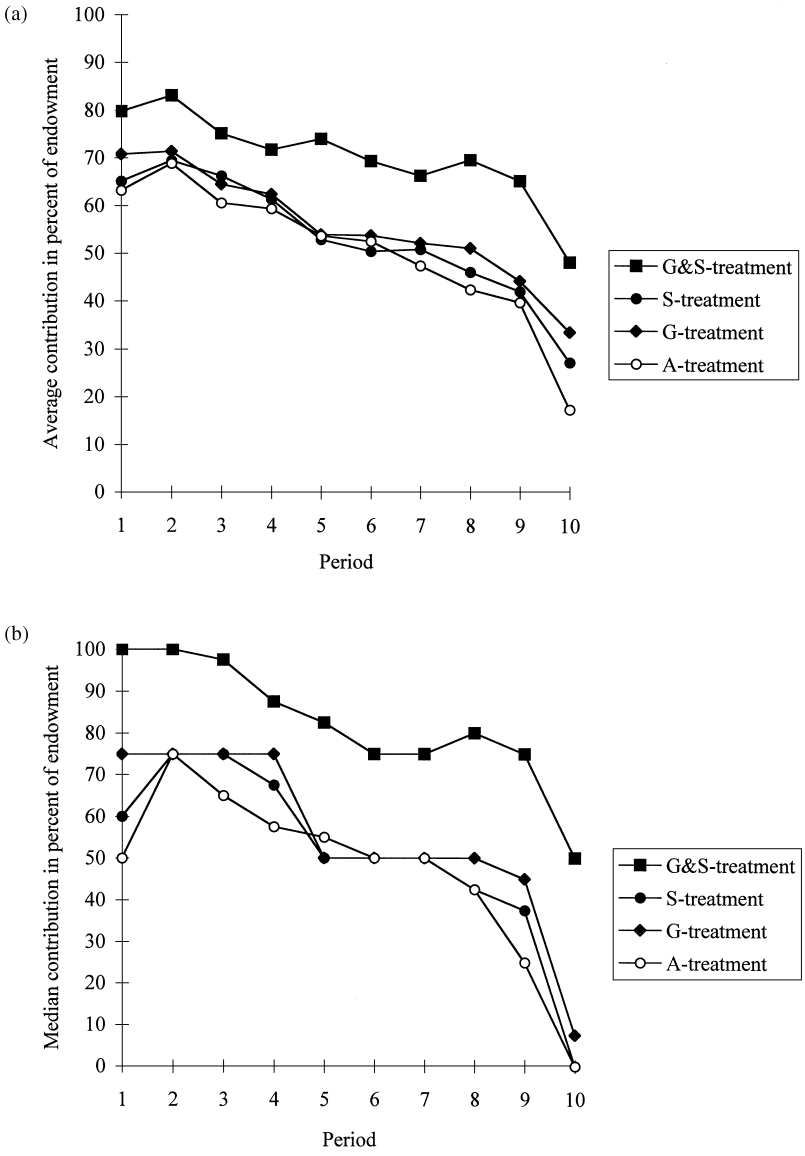

Fig. 1. (a) Percentage of groups which contribute on average less than *x* percent of their endowment (b) percentage of subjects who contribute on average less than *x* percent of their endowment.

GS-treatment had in almost all periods higher standard deviations than the A- and the GS-treatment, respectively. Over time the variability of contributions across treatments was, therefore, rather stable. The fact that contributions in the A-treatment exhibited the least heterogeneity is also compatible with evidence from the questionnaire data (reported in Section 2) and the analysis of the post-experimental discussions and questionnaires that

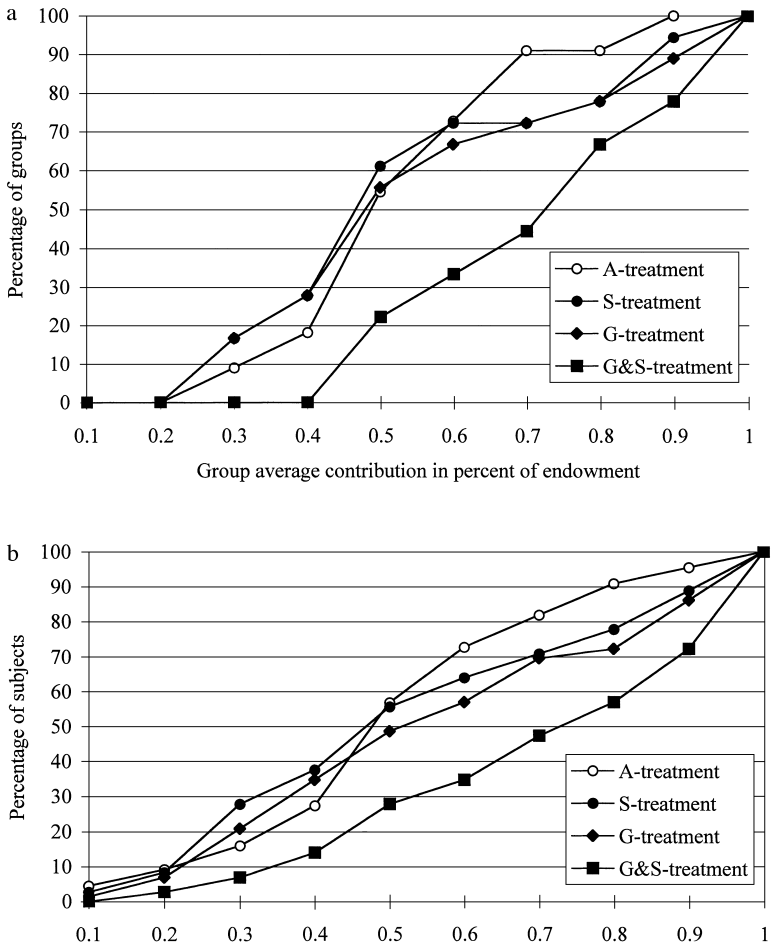

Fig. 2. (a) Average contributions over time (b) median contributions over time.

shows that people are differently motivated by approval incentives. Some people do not value them very highly.

Since people's motivations of making contributions to public goods (even under anonymity) are varied as well, the additional incentives in the non-anonymous treatments add further heterogeneity.

Before we turn to statistical tests that examine the treatment effects, it is worthwhile to briefly compare the data of our baseline treatment, the A-condition, to similar experiments reported in the literature. The A-treatment is just a very standard public goods experiment variants of which have been studied by many scholars by now. Experiments differed in parameters like group size, marginal rate of substitution between the private and the public good (which, in our case is 0.4), number of periods played, matching protocol applied (i.e. constant or changing group compositions), and so on. For an overview see Ledyard, 1995). Hence, direct and unambiguous *quantitative* comparisons are hard to achieve. Most exper-

Table 2
Contributions (in percent of the endowment) over time in the four treatments

Treatment:	Statistics:	Periods: 1	2	3	4	5	6	7	8	9	10	Total
A-treatment	median	50.0	75.0	65.0	57.5	55.0	50.0	50.0	42.5	25.0	0.0	50.0
11 groups	mean	63.2	68.9	60.6	59.3	53.6	52.5	47.5	42.5	39.9	17.5	50.5
44 subjects	std.dev.	29.5	27.3	30.5	33.6	34.1	32.0	32.4	34.1	34.9	28.0	34.4
G-treatment	median	75.0	75.0	75.0	75.0	50.0	50.0	50.0	50.0	45.0	7.5	50.0
18 groups	mean	70.8	71.5	64.5	62.4	54.0	53.8	52.2	51.1	44.3	33.6	55.8
72 subjects	std.dev.	30.5	30.7	35.7	36.6	38.1	37.8	37.1	37.7	38.2	41.1	38.0
S-treatment	median	60.0	75.0	75.0	67.5	50.0	50.0	50.0	42.5	37.5	0.0	50.0
18 groups	mean	65.1	69.5	66.3	61.4	52.9	50.4	50.9	46.2	42.2	27.4	53.2
72 subjects	std.dev.	33.0	29.7	34.2	35.1	36.4	36.9	37.9	40.0	39.3	38.0	38.0
GS-treatment	median	100.0	100.0	97.5	87.5	82.5	75.0	75.0	80.0	75.0	50.0	85.0
18 groups	mean	79.8	83.1	75.2	71.8	74.0	69.4	66.4	69.7	65.3	48.3	70.3
72 subjects	std.dev.	26.7	25.0	33.4	35.6	31.8	33.9	35.3	34.0	36.5	42.4	34.8

iments, however, share the prediction of full free -riding and the fact that full contributions would be welfare-maximizing.

The broad picture that emerges from experiments that are similar to ours with respect to the parameters is the following. First, average contributions in our A-treatment are probably at the upper end of what is reported in the literature. Isaac and Walker (1988), for example, report in one of their experiments that is closest to ours initial contributions of about 35 percent of the endowment. By the tenth and final period contributions approached about 9 percent. Most studies report initial contributions of between 40 and 60 percent of the endowment. Contributions then decline to about 10–30 percent of the endowment (see Dawes and Thaler, 1988; Ledyard, pp. 134–142 and the studies summarized there; but also, e.g. Brown-Kruse and Hummels, 1993; Nowell and Tinkler, 1994; Laury et al., 1995; Burlando and Hey, 1997). For example, Andreoni (1988) reports an average contribution of 33.2 percent in the ten times repeated public goods game of his 'Partner'-condition. Contributions started out at about 48 percent and declined by the last period to about 12 percent of the endowment. In Keser and van Winden (1998) subjects initially contributed about 56 percent and ended up contributing about 15 percent of the endowment. Croson (1996) has similar findings. Weimann (1994) reports results of his 'Partner'-experiments that are close to our findings. Second, our data not only have the declining pattern of contributions in common with almost all repeated public good experiments, they also exhibit some 'pulsing' (i.e. temporarily increasing contributions) that is observed in almost all experiments (at different points in time, though). Third, many 10 times repeated public goods games exhibit an 'endgame effect', that is, a considerable drop in contributions in the last period. In our experiments this endgame effect is particularly pronounced. In summary, the results of our A-treatment are within keeping of the results of similar experiments. To the extent that contributions in our A-treatment are at the 'upper end' of the distribution of contributions in similar experiments, the results of our subsequent comparisons can be seen as lower bounds for the effectiveness of our treatment manipulations.

Table 3
Period-wise median tests for each pair of treatments[a]

Period: Comparisons:	1	2	3	4	5	6	7	8	9	10	Total
G vs A	0.316 (0.043)	0.812	0.812	0.812	0.597	0.812	0.597	0.316	0.474	0.011	0.812
S vs A	0.668 (0.535)	0.411	0.812	0.597	0.597	0.192	0.812	0.474	0.812	0.077	0.597
GS vs A	0.024 (0.002)	0.077	0.474	0.077	0.024	0.077	0.077	0.011	0.011	0.001	0.077
G vs S	0.505 (0.503)	0.738	0.738	0.317	0.505	0.505	0.317	1.0	0.738	0.505	0.505
G vs GS	0.182 (0.060)	0.317	0.182	0.182	0.008	0.046	0.182	0.046	0.046	0.505	0.046
S vs GS	0.046 (0.046)	0.008	0.502	0.046	0.008	0.046	0.095	0.008	0.046	0.095	0.046

[a] Entries are *p*-values (two-tailed) of median tests with group averages as the independent units of observation. In the first period numbers in brackets indicate *p*-values of median tests with all independent individual contribution decisions as observations.

Testing for treatment effects. Since we have four treatment conditions, six pair-wise comparisons are possible. Table 3 reports the results of median tests (i.e. the *p*-values of two-tailed tests) with independent group averages per period as observations. The first three rows compare A-treatment to the three other treatments. The second three comparisons concern testing the differences between the non-anonymous treatments. The results show that only the GS-treatment is significantly different from the A-treatment in most periods. In nine out of 10 periods (with the exception of Period 2) contributions in the GS-treatment are significantly *higher* than in the A-treatment (at least at the 5 percent level for one-tailed tests). In the last period, however, contributions in all non-anonymous treatments are higher than in the A-treatment. Interestingly, this effect is of least significance in the S-treatment (where the group discussion took place immediately afterwards), followed by the G-treatment and the GS-treatment, respectively (see also Table 2). In the first period, with group averages as observations, only the GS-condition is significantly different from the A-treatment. In Period 1, however, all individual decisions are independent, and, hence, can be used for a statistical test. The numbers in brackets in Table 3 are the *p*-values of Median tests conducted with individual first-period data. The tests reveal that contributions in the first period of the G-, as well as of the GS-treatment are significantly higher than contributions in the A-treatment, whereas individual contributions in the S-treatment are not significantly different from those in the A-treatment.

The other treatment comparisons confirm that the GS-treatment significantly increased contributions both relative to G-treatment as well as relative to the S-treatment. On the basis of one-tailed median tests the GS-treatment causes significantly *higher* contributions (at the 10 percent level) in eight periods relative to the G-treatment, and in nine periods relative to the S-treatment. Overall tests, that is, using independent group averages over all 10 periods as observations, also show that only the GS-condition was capable of significantly increasing contributions relative to any other treatment condition. [5]

[5] This result contrasts with the findings of Dawes, van de Kragt, and Orbell who find a significant impact of group identity. It is also not in line with the findings of Bohnet and Frey (1999) who found significant effects of mere 'identification', that is, knowledge of, opponent players on cooperation rates in a Prisoner's dilemma game. (In both studies, however, the experiment was only played once.) Brown-Kruse and Hummels, however, also get no effect of a 'community treatment' that is similar to our group identity treatment. The exception, as in our experiment, is Period 1.

Table 4
Number of periods in which average contributions in treatment *j* (columns) are higher than in treatment *i* (rows) and significance according to a sign test[a]

	Treatment *j*		
	G	S	GS
Treatment *i*:			
A	10 (0.001)	8 (0.055)	10 (0.001)
G	–	1 (0.011)	10 (0.001)
S	–	–	10 (0.001)

[a] Numbers in brackets are *p*-values (one-tailed). Observations are taken from Table 2.

The results of Tables 2 and 3 suggest that the direct effect of group identity and social familiarity on contributions relative to A-treatment is slightly bigger than the direct effect of opportunities for social approval among strangers. In nine out of 10 periods the difference between the G- and the A-treatment is bigger than the difference between the S- and the A-treatment (see Table 2). Moreover, the pair-wise median tests between G- and A- and between S- and A-treatments in Periods 1 and 10 also indicate a bigger role for the G-treatment. To investigate this issue further we conducted Sign-tests reported in Table 4.

Table 4 documents the number of periods in which contributions in treatment *j* (columns) were different from treatments *i* (rows). *p*-values (two-tailed) are in parentheses. The Sign tests confirm the impression that group identity and familiarity have a bigger direct impact on contributions relative to the A-treatment than opportunities for social exchange among strangers. This is, for example, indicated by the significant difference between the G-treatment and the S-treatment in Table 4.

The major result indicated by Tables 3 and 4 is, however, that there is an important interaction effect between group identity and social familiarity on the one hand and social approval on the other hand. While the GS-treatment and the S-treatment alone are not capable of raising contributions significantly (at the 10 percent level) relative to the A-treatment in more than two periods, the GS-treatment generates a significant increase in nine periods (see Table 3). Moreover, Table 4 also shows that the GS-treatment causes significantly higher contributions than all other treatments. In our view this interaction effect may be due to the following factors: (i) Note that the presence of approval incentives is likely to give rise to multiple equilibria. In this environment trust in other group members' contributions is crucial for the coordination on high-contribution equilibria. Group identity and social familiarity are likely to create some minimal trust among group members, which allows them to coordinate on a high-contribution equilibrium. (ii) Subjects who are familiar with each other may put a higher value on approval, which strengthens its motivating force. (iii) Reduction in the social distance among group members may increase the *expectation* of social approval. Each of these factors alone may be sufficient for the 'success' of the GS-treatment in raising contributions. However, they may, of course, also be jointly operative.

Table 5
Spearman rank correlation between the social approval motive and average contributions

	S-treatment	GS-treatment
[a]corr (A,g)	0.194 (0.054)	295 (0.006)
[b]corr (B,g)	0.117 (0.168)	266 (0.013)

[a] corr(A,g) denotes correlation between degree of agreement to question A and average contribution g over all 10 periods.
[b] corr(B,g) is calculated analogously for question B. *p*-values (one-tailed) are in parentheses.

3.4. Motives and behavior

The fact that free-riding and cooperation cause strong (expected) emotional responses in combination with the observation that social exchange opportunities among somewhat familiar subjects increase cooperation significantly is evidence in favor of the social exchange approach. It seems that if there is some minimal social familiarity a significant number of subjects is motivated to participate in collective actions because they anticipate the approval that is associated with their actions. Subjects' responses to the questionnaire after the end of the S- and the GS-treatment provide further support for this interpretation. In this questionnaire subjects could express their degree of agreement with the following two statements:

(A) "*It would have been inconvenient for me to be considered by the group as a person who contributes rather little to the project. For this reason I tended to contribute more to the project*".

(B) "*I contributed more to the project because I wanted to be considered by the group—in the subsequent discussion—as a cooperative person*".

In our view the answer to Questions A and B may well be biased against the social exchange approach because of a 'social undesirability bias.' To be viewed or to view oneself as someone who is dependent on the opinion of others is generally not seen as a desirable characteristic. If we nevertheless get meaningful correlations between openly expressed approval motives and behavior we have a further piece of supportive evidence. In Table 5 we have computed the Spearman rank correlation between the degree of agreement with the above statements and the average contribution of the subjects. As we can see the correlations have always the expected sign and are significant at the 6 percent level in three of four cases. Both correlations for the GS-treatment are highly significant and they are also higher than the corresponding correlation for the S-treatment. These results suggest that approval motives played a bigger role in the GS-treatment. This is compatible with the behavioral evidence.

Another piece of evidence for the relevance of approval motives comes from the tape-recorded group discussions after Period 10 of the public goods game. Although details of these discussions are difficult to report there were two salient features: Those groups which converged towards the free-rider equilibrium did not have heated arguments. Subjects of such groups tended to make cool remarks about their behavior. In contrast, in those groups in which free-riders as well as cooperative players were present players who contributed a lot tended to criticize free-riders in rather emotional ways. For example, an accused free-

rider asked: *"Is this a judicial hearing or what?" "Yes, because I am very upset"* the 'suckered' subject replied. This behavior in the discussion is compatible with our approval results in Section 2. Remember that on the basis of the approval results we would expect significantly less disapproval if everybody free-rides compared to a situation were free-riders and cooperators coexist. The fact that approval incentives cause a significant rise in cooperation should not make us overlook the fact that even in the GS-treatment we observe a considerable drop in cooperation in Period 10. This drop is caused by those 31 percent of the subjects who choose $g_i = 0$ in the last period of the GS-treatment. In principle, free-riding in Period 10 is no unambiguous indicator for the absence of approval motives. If a subject expects other group members to free-ride in Period 10 it may also choose to free-ride because approval incentives may then not be sufficiently strong. However, in view of the fact that contribution rates between Periods 1 and 9 were very high in the GS-treatment subjects did not have much reason to believe that others will free-ride in the final period.[6] In view of the strong approval responses described in Section 2, and in view of the high contribution rates until Period 9, we find it remarkable that roughly 30 percent of the subjects chose $g_i = 0$—although they knew that immediately afterwards their identity and their actions would be revealed to the other group members. Thus, it seems that a non-negligible fraction of subjects in the GS-treatment does not seem to be motivated by social approval. In addition, the choice of $g_i = 0$ in Period 10 indicates that these subjects are neither altruistic nor are they motivated by an internalized norm. These subjects seem to be truly selfish. This interpretation is confirmed by questionnaire evidence that we collected after the experiment. In this questionnaire subjects indicated their disagreement or agreement with several statements by choosing a number between 1 (complete disagreement) and 5 (complete agreement). One statement was the following: *"Above all I wanted to make a high profit for me."* It turns out that the Spearman rank correlation between the agreement score for this statement and contributions in Period 10 is -0.253 ($p < 0.016$), that is, the more subjects agreed with this statement the less they contributed in Period 10 of the GS-treatment.

The fact that the existence of approval motivates many but not all subjects raises interesting questions regarding interaction among differently motivated subjects. To investigate this issue we distinguished between those who chose $g_i = 0$ ('egoists') and those who chose $g_i > 0$ ('non-egoists') in Period 10. It turns out that 'egoists' are significantly more cooperative in Periods 1–9 of the GS-treatment compared to Periods 1–9 of the other three treatment conditions (Mann–Whitney test, $p < 0.001$).[7] Note that this behavior of egoists in the GS-treatment may be quite rational. Since the combination of social familiarity with social exchange opportunities creates effective approval incentives it becomes rational for 'egoists' to 'exploit' the approval motive. By being cooperative in the non-final periods they can foster the expectation that high contributions will be forthcoming in the future which induces approval-motivated subjects to choose high contributions.

[6] For 60 percent of the subjects who chose $g_i = 0$ in Period 10 the change in the average contribution of the other three group members from Period 8 to Period 9 was positive or zero. Thus, other group members provided no indication that their cooperativeness would decrease.

[7] Their behavior does not differ across the A-, S-, and G-treatment (Kruskal–Wallis test, $p = 0.609$).

4. Summary

Social approval and peer pressure are potentially very important determinants of behavior in a wide variety of collective action problems. Descriptive evidence suggests that they play an important role in team production (Rehder), in union formation (Francis), in the establishment of social norms under piece rate incentives (Whyte), in voting decisions (Knack, 1992) and in decisions to become criminal (Adler). Social incentives have already been stressed in the work of Olson. In recent years an increasing number of economists has developed formal models of such incentives (e.g. Akerlof; Romer; Jones; Holländer; Kandel and Lazear; Barron and Gjerde). On the empirical side, however, we are not aware of much progress. This fact seems to be due to the inherent difficulties of measuring social rewards like approval and the fact that social rewards are in reality frequently associated with pecuniary rewards. This makes it very difficult to disentangle the effects of social rewards from those of purely economic rewards.

To investigate whether emotionally prompted social approval is capable of overcoming free-rider incentives in collective action we first examined the regularities of social approval. After that we analyzed the conditions under which social approval is behaviorally important. Regarding the regularities of social approval it turns out that the approval that is received by a person, *first*, increases in that person's participation level and, *second*, decreases in the participation level of others. Approval incentives are thus intertwined with negative externalities because if others become more cooperative they reduce the approval for an individual. They are, therefore, similar to status incentives because if others increase their status-seeking effort they reduce in general an individual's rank in the status hierarchy and impose an externality on that individual (Frank). A *third* regularity we have uncovered is related to marginal approval gains. They tend to be higher if the average participation level of other people is higher.

The third regularity implies that there may be no- or low-participation equilibria as well as high-participation equilibria for the same underlying preferences. Therefore, even if everybody is motivated by social approval, approval incentives do not necessarily have behavioral effects. If subjects are not capable of coordinating at a high-participation equilibrium approval incentives may have no behavioral effects. That peer pressure may well give rise to multiple equilibria provides a potential explanation for one of the most puzzling aspects of crime — the vast differences in crime rates across cities with similar economic conditions. This characteristic of peer pressure may, however, also be relevant in many other contexts. It has been found, for example, that the probability that a worker fraudulently claims unemployment benefits is higher the greater the frequency of fraud in the occupational group of the worker (Hessing et al., 1993). This is exactly what one would expect in the presence of approval incentives that generate multiple equilibria. In team production or under profit–sharing arrangements similar phenomena may be important so that firms with identical incentive systems may experience very different effort levels. For this reason it becomes important for future research to examine the conditions which favor one equilibrium over the other.

With regard to the conditions under which approval incentives have behavioral effects we find the following: Social approval has a rather weak and insignificant positive effect

on participation in collective actions if subjects are complete strangers. Yet, if the social distance between subjects is somewhat reduced by allowing the creation of a group identity and of forming weak social ties, approval incentives give rise to a large and significant reduction in free-riding. It seems that group identity is like a 'lubricant' that makes social exchange effective.

In our experiments approval incentives were, however, in neither condition, sufficiently strong to eliminate free-riding completely. This was also due to the existence of a minority of subjects who do not seem to be motivated by approval and who behaved completely selfishly in the last period. A different interpretation is that our familiarity manipulation in our group identity treatment was too weak to induce these selfish subjects to pay attention to the approval of their group members. Remember that our group identity treatment induces only a rather weak form of social familiarity and group identity. It may thus well be the case that stronger manipulation enhances the role of approval incentives.

The interaction between social distance, or the degree of familiarity, respectively, and the effectiveness of approval incentives suggests that approval incentives are the more important the greater the density of social interaction among people. This is compatible with casual evidence that indicates that approval driven norms are particularly important in families, schools, the work place and the social neighborhood in general and less so in anonymous competitive markets. The interaction effect also suggests that changes in a society's social structure that diminish the density of social interactions are likely to increase free-riding.

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Appendix A

In this Appendix we show that the regularities of emotionally prompted (dis)approval imply that contribution levels are strategic complements and that, as a consequence, approval

incentives may well give rise to low- and high-contribution equilibria. Individual preferences are given by

$$U_i = \Pi_i + \sigma_i(g_i, g_{-i}) = y - g_i + \alpha \Sigma_j g_j + \sigma_i(g_i, g_{-i}), \quad i = 1, 2, \ldots, n \tag{A1}$$

where Π_i measures the pecuniary payoff and $\sigma_i(g_i, g_{-i})$ measures the approval payoff. Π_i is given by Eq. (1) in the main text. σ_i is a continuous and bounded function of one's own contribution g_i and the (for simplicity) average contribution of the other group members g_{-i}. The approval regularities uncovered in Section 2 imply that (i) social (dis)approval σ_i increases in g_i, (ii) decreases in the average contribution of the others g_{-i}, and (iii) that $(\partial\sigma_i/\partial g_i)$ increases in g_{-i}. To ensure that second−order conditions are met we assume that $(\partial\sigma_i/\partial g_i)$ increases in g_i. The first-order conditions for an interior maximum with respect to $g_i \in [0,y]$ is given by

$$\frac{\partial \sigma_i}{\partial g_i} = 1 - \alpha \quad \text{for} \quad i = 1, 2, \ldots, n \tag{A2}$$

Eq. (A2) characterizes an equilibrium in which each individual chooses g_i such that the marginal approval gain $\partial\sigma_i/\partial g_i$ equals the marginal pecuniary cost of contributing $(1 - \alpha)$. Since the strategy space for each player is compact and convex and since the utility function is bounded and strictly concave in g_i there exists at least one equilibrium (Friedman, 1986, Theorem 2.4). To show that contribution levels are strategic complements we differentiate Eq. (A2). This yields

$$\left(\frac{\partial g}{\partial g_{-i}}\right) = -\frac{[\partial^2\sigma_i/\partial g_i \partial g_{-i}]}{[\partial^2\sigma_i/\partial g_i \partial g_i]} > 0 \tag{A3}$$

Due to strategic complementarity there may easily exist low- and high contribution equilibria for the same underlying preferences. Fig. 3 illustrates this possibility for the two-player case. $g_1(g_2)$ and $g_2(g_1)$ are the reaction functions of Players 1 and 2, respectively. In Fig. 3 there are three equilibria: A stable equilibrium at zero contributions, an unstable one at relatively low contribution levels, and a stable equilibrium at relatively high contribution levels for both players.

Appendix B

B.1. Instructions

These instructions were originally written in German. Here we document the translation of the instructions used in our baseline, the Anonymity-treatment. The instructions used in our other treatment conditions were adapted accordingly (see the description of our treatment conditions in the text). Except the necessary changes in the instructions for a particular treatment, instructions were of course identical in all treatments.

Your are now taking part in an economics experiment which is financed by the Swiss National Science Foundation. If you carefully read the following instructions you can earn — depending on your decisions during the experiment — a considerable amount of money

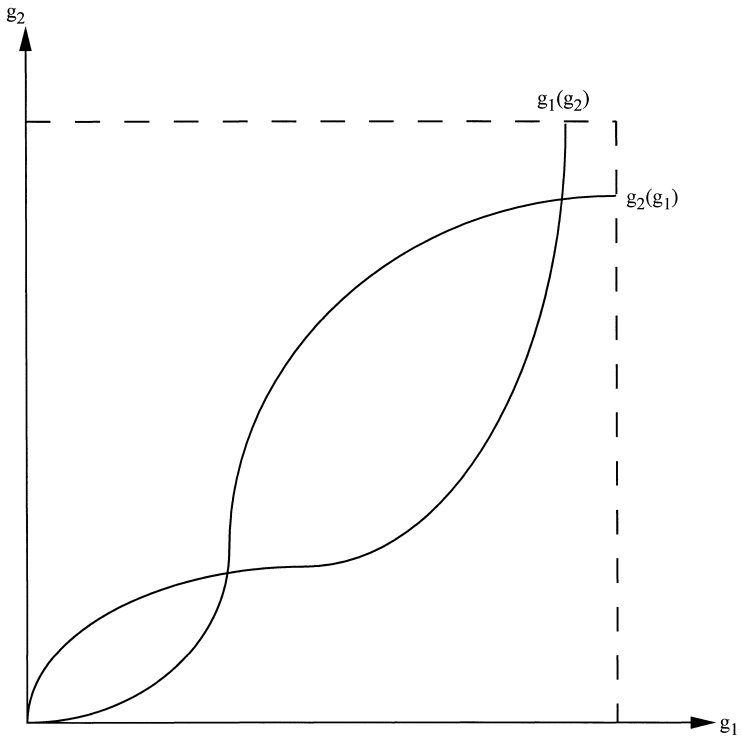

Fig. 3. Best response functions and equilibria with approval incentives in case of two players.

which will, together with the show-up fee of CHF 15.-, be paid out to you immediately after the experiment. It is very important to read these instructions very carefully.

During the experiment we do not talk of 'Francs,' but instead of 'points.' Your total income will first be calculated in points. At the end of the experiment the total amount of points you make during the experiment will be exchanged in Swiss Francs according to the following exchange rate:

1 point = 10 Rappen

The experiment is divided into periods. In each period you have to make a decision which we ask you to fill in the documentation sheet distributed together with these instructions. In total, this experiment consists of 10 periods. During the 10 periods the group composition will be unchanged. **That is, in your group are the same people for 10 periods. You will never learn with whom you formed a group** [*this sentence was of course omitted in all other treatments and replaced by an appropriate statement for the respective treatment*].

In this experiment there are in total 24 participants who are divided into six groups with four subjects each. **Except us, that is the experimenters, nobody knows who is in which group.**

These instructions are for your private information only. **During the experiment, communication is strictly forbidden**. If you have questions, please ask us. If you are not going to follow this rule you will be excluded from the experiment and all payments.

B.2. Detailed information about the experiment

At the beginning of each period each participant is endowed with **20 tokens**. Your task is to decide how to spend your tokens. There are two possibilities:

1. Put your tokens into the **PROJECT** of your group.
2. Put your tokens into your **PRIVATE ACCOUNT**.

In making your decision, you have to take into account that you have to spend all 20 tokens you are endowed with in a respective period. Hence, in each period, the tokens you are putting into the project and your private account must sum up to 20.

When you made your decision in a period you have to fill it into your documentation sheet of the respective period. The amount you are putting into the project has to be filled **in column (b) of the decision sheet. The rest of the points must be filled in column (a)**.

When all participants made their decisions in a period, an experimenter collects everybody's contribution to their project. Then we will calculate for each of the six groups how large the **sum of contributions** to the project actually is. Then every participant will learn the total amount of tokens contributed to the project. The experimenter will inform you about this amount by inserting it in column (c) of your decision sheet. During the experiment no participant will learn how much the **individual** group members have contributed to the project. **Everybody will only be informed about the total sum of tokens contributed to the project.** Then each participant calculates her income in points for the respective period. This ends a period. In total there are ten periods.

How is your income in points calculated in a period?

Your income in points in a period is calculated as follows:

income in points from your private account in this period

+income in points from the project in this period

= income in points in this period

At the beginning of each period — that is, before you make a decision about how to spend your endowment — there are **zero** tokens on both accounts.

Your income in points is **exactly** the amount of tokens you have put into your private account. For example, if you have put 20 tokens into your private account, your income in points from your private account is 20 points. If you have put in 6 tokens, your income from your private account is 6. Nobody except you has an income from your private account.

Your income from the project is calculated differently. It depends not only on your contribution to the project but also on the contributions of all other group members. Your income from the project is calculated according to the following formula:

Your income in points from the project = sum of contributions to the project × 0.4

The other group members' income from the project is calculated in the same way. That is, every group member has the same income from the project.

If, for example, the sum of contributions of all group members to the project is 60 tokens, you and all your group members get an income from the project of $60 \times 0.4 = 24$ points. If the four group members contributed in total 10 tokens to the project, you and all other group members get $10 \times 0.4 = 4$ points as income from the project.

Every token you put on your private account earns you an income of 1 point. If you put instead one point of your endowment into the project, the sum of contributions to the project increases by 1 token, and your income from the project increases by $1 \times 0.4 = 0.4$ points. However, the income of all group members has increased by 0.4 points, that is, the total income of your group increased by $4 \times 0.4 = 1.6$ points. With your contribution to the project the other group members' income also increases. Conversely, you also profit from your group members' contributions to the project. Every token another group member puts into the project earns you $1 \times 0.4 = 0.4$ points. You now have to calculate your income from the project and to insert it in column (e) of your decision sheet.

Here is an overview of your tasks in a period:

1. You make a decision about the allocation of 20 tokens. You have to insert your decision on your decision sheet (columns „private account" and „project").

1 token on the private account gives you an income of 1 point for you and zero for the other group members.

1 token to the project gives you and all your group members 0.4 points.

Your token allocation has to add up to 20 tokens!

After that an experimenter collects all decisions to calculate the sum of contributions to the project. Every participant then will be informed how many tokens actually are on her project.

2. You now have to calculate your income from the project and add it to your income from the private account. This gives you your current periods' income. Except for period 10, a new period starts now.

Appendix C. Control questionnaire

All questions have to be answered. Missing answers exclude you from all payments. Wrong answers have no consequences. Please write always down the formula according to which you made your calculations. If you have questions, please ask us.

1. Every group member has an endowment of 20 tokens. Nobody (including you) puts something into the project. What is
   - Your income in this period:
   - Your group members' income in this period?
2. Every group member has 20 token at his or her disposal. You put 20 tokens into your project. All of your group members do the same. What is
   - Your income in this period:
   - Your group members' income in this period?
3. Every group member has 20 tokens at his or her disposal. The other three group members together put 30 tokens into the project.
   (a) What is your income this period if you put, in addition to the 30 tokens, another 0 tokens into the project?
   - Your income in this period:

   (b) What is your income this period if you put, in addition to the 30 tokens, another 8 tokens into the project?
   - Your income in this period:

   (c) What is your income this period if you put, in addition to the 30 tokens, another 15 tokens into the project?
   - Your income in this period:
4. Each group member has an endowment of 20 tokens. You put 8 tokens into the project.
   (a) What is your period income if the other group members, in addition to your 8 tokens, together put another 7 tokens into the project?
   - Your income this period:

   (b) What is your period income if the other group members, in addition to your 8 tokens, together put another 12 tokens into the project?
   - Your income this period:

   (c) What is your period income if the other group members, in addition to your 8 tokens, together put another 22 tokens into the project?
   - Your income this period:

Participant No:

Appendix D. Decision sheet

DECISION SHEET

period	token endowment	Your decision: private account (a)	project (b)	sum of tokens to project (c)	income from project (d)	period income (a)+(d)
1	20					
⋮	⋮					
10	20					

10 periods in total

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