Testing for Team Spirit[1]

- An Experimental Study -

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Abstract

Team spirit is often suggested as a counter-balancing power to free-riding. Testing for team spirit with field data is difficult, however, due to an inherent identification problem. In this paper we use experimental methods to identify team spirit against potential confounding factors. In a team work task we vary subjects' information about relative team performance while we leave unchanged the structure of explicit incentives. We find that subjects contribute more to their team's project when teams observe each others' performance. We discriminate team spirit as implication of mutual peer pressure between teams as cause for this result.

Keywords: team spirit, peer effects, organization of work, public goods experiments

JEL-Codes: C92, H41, J2

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1. Introduction

"If one could enhance a common interest in nonshirking in the guise of team loyalty or team spirit the team would be more efficient."
Alchian and Demsetz (1972: 790)

Team work can have important benefits.[1] However, as individual contributions to team output cannot be fully enforced, team work is susceptible to free-riding (e.g., Alchian and Demsetz 1972). Since free riding hampers productivity, firms can be expected to avoid team work whenever possible. Quite on the contrary, business organizations make heavy use of teams. For example, Osterman (1994) finds that 55 percent from a 1992 survey of American establishments employ teams. According to Lawler (2001), even 72 percent of Fortune 1000 companies make use of work teams.

How can we explain that free riding in teams is not overwhelming? Modern work organizations commonly evaluate and reward teams according to the joint performance of team members. Yet, under standard economic assumptions these group incentives would have no effects to motivate workers (Kandel and Lazear 1992). A way to circumvent the basic incentive problem is the use of competitive schemes which reward teams according to their relative output (Lazear and Rosen 1981). Unfortunately, the implementation of the right relative scheme may be demanding. For instance, relative rewards may be inappropriate if contesting teams are asymmetric (Che and Gale 2003), or they may not be feasible practically, for example, when there are adverse effects on work morale that foil the intentions of the management and sometimes even cause sanctions of peers against high performers (for a discussion see Che and Yoo 2001).

In this discussion peer effects are often suggested to prevent excessive free riding and to explain why team compensation can lead to productivity improvements (e.g., Ichniowsky,

[1] Such benefits arise, for instance, when there are efficiency gains due to knowledge transfer or specialization, or when the technology generates complementarities between the work of individuals.

Shaw, and Prennushi 1997, Boning, Ichniowsky, and Shaw 2001). There is now a growing number of theoretical studies which try to explain how peer effects possibly interplay with economic incentives (Kandel and Lazear 1992, Barron and Gjerde 1997, Che and Yoo 2001, and Huck, Kübler, and Weibull 2001). By peer effects this literature means that members of a team – apart from other motives – choose their efforts towards team production according to some standard set by peers.

Despite its importance, our knowledge about the empirical relevance of peer effects is limited. The reason for this is that peer effects are typical examples of social interactions who are generally difficult to identify at the presence of confounding factors (Manski 1993). Such confounds arise, first, if it cannot be excluded whether members of a team join relevant individual characteristics. For example, teams may improve productivity regardless of peer pressure if highly skilled workers can self-select into teams and in this way signal their abilities relative to low skilled co-workers. A second source of confounds is that a team may be exposed to unobserved exogenous factors that influence people's behavior. This case would apply, for example, if teams improve the opportunities to monitor and sanction free-riders for purely organizational reasons (Knez and Simester 2001).

In this paper we propose an experimental test for "team spirit". We define team spirit as an outflow of mutually enforcing peer effects between teams. To be precise, team spirit arises from peer pressure if a team chooses as standard for the own effort the effort of another team.[2] By means of experimental methods we are able to unambiguously identify team spirit against possible confounding factors.[3] In our main treatment condition subjects performing a

[2] Team spirit also is well acknowledged in social psychology where it is regarded as a sense of collective responsibility for the team's success, a mentality of team members to go beyond themselves, an expression of positive group identity, and enthusiastic loyalty towards the team (e.g., De Cremer and Van Dijk 2002). Moreover, human resource management invests considerable resources in team spirit building activities (e.g., Heermann 1997)

[3] For related experimental work on social interaction see Falk, Fischbacher, and Gächter (2003), Bardsley and Sausgruber (2003)

team work task are informed about the relative output of their team. In two control conditions subjects (i) observe another team's success without being observed and (ii) are observed by another team without observing this team. The intuition is to see whether mutual effects of peer pressure between teams trigger a sense of team spirit that strives subjects to outperform or not to fall behind the respective other team. If this is the case, team spirit will have strong effects in the main treatment when teams are able to observe each other. In contrast, such effects will be weak in the control conditions in which the observed team cannot observe the own team.

Existing empirical studies have made important steps towards solving the identification problem with regard to peer effects (see Sacerdote 2001, Ichino and Maggi 2000, Kremer and Levy 2003, and the literature cited by these authors). But these studies are not fully convincing due to an inherent impurity of field data. Recently, Falk and Ichino (2003) in field experiment to a great extent can exclude potential confounds. The main result is that in a work environment efforts of individual workers react on the observed output of other workers. Their study aims at assessing the existence of peer pressure between individual agents. In contrast, in our study we test for team spirit as an implication of peer pressure between teams. In Falk and Ichino (2003) another important difference with regard to our study is that subjects interact only once. In our study interaction is repeated.

We find that subjects exert more effort when teams can mutually compare each other's performance. We identify team spirit as cause for this finding: peer pressure induces higher contributions in team X whose members observe the output of team Y. If team Y can also observe team X, effects of peer pressure enforce each other and give rise to team spirit. We also observe that the effects of team spirit increase as the experiment proceeds and that low contributors are more sensitive to team spirit than high contributors are. The paper proceeds

as follows. In section 2 we describe the experimental procedures. In section 3 we discuss our hypotheses. Section 4 reports the results and section 5 concludes.

2. Experimental Design

Subjects participate in a standard linear public goods game. This game constitutes a typical team dilemma, since every team member profits from the team output regardless of whether he or she bears the cost of individual effort. Subjects are randomly organized into teams. There are $n = 4$ people in each team and each subject is endowed with 20 experimental points. The points can either be kept or invested into a joint team project that generates a payoff for everyone in the team. Payoffs are determined according to

$$\pi_i = 20 - x_i + 0.4 \sum_{j=1}^{4} x_j. \qquad (1)$$

Here, π_i is subject i's payoff in points, x_i is i's contribution to the team project, and $\alpha = 0.4$ is the marginal per-capita return of contributing to the team project.

The game was repeated for 20 periods with constant composition of teams. In any period, at the time a new decision has to be made, subjects learn the total sum of contributions of their team as well as their private earnings in the previous period. In addition, we provide information about the average team earnings accumulated over all previous periods (see appendix for a complete set of instructions).

Teams are randomly matched into pairs such that for every team X in the experiment there exists a team Y. A team's matched team remains the same throughout the experiment. Team projects are technologically independent from each other. There are four treatment conditions. The treatments exclusively vary the flow of information between teams. Everything else remains exactly the same. The structure of the treatment variation is illustrated in table 1. In this table X and Y refer to teams within a pair.

Our *main treatment* is labeled "MUTUAL" (upper left cell): In this treatment paired teams are mutually informed about their performance. In addition to the information available on the own team, subjects of team X learn last period's overall contribution to the team project and accumulated average team earnings in team Y, and vice versa. Subjects know this. By this means subjects are enabled to evaluate the relative team performance in the previous period as well as in the experiment as a whole.

Table 1: Illustration of treatment conditions (team X is paired with team Y)

		Team Y receives information about team X	
		Yes	**No**
Team X receives information about team Y	**Yes**	MUTUAL MUTUAL	OBSERVER OBSERVED
	No	OBSERVED OBSERVER	BASE

As a *control treatment*, we implement a mixed-information condition where the flow of information between paired teams is one-sided. This produces two types of teams/treatments (upper right cell): An X-team ("OBSERVER") sees how it performs relative to a Y-team, just as in MUTUAL. What is different now is that the Y-team ("OBSERVED") does not see how it compares to its paired X-team; OBSERVED-subjects know that there is another team learning their overall contributions and accumulated average team earnings. The conditions that prevail in the lower left cell of table 1 generate the same OBSERVER- and OBSERVED-treatments.

Finally, we run a *baseline*, labeled "BASE" (lower right cell), which implements the standard version of the public goods game. In this treatment no team is informed about another team.

3. Hypotheses

By standard assumptions in economics no one should contribute to the team project in the last period. Since our experiment has a finite and known number of periods, by backward induction no one should contribute in any period. Our design leaves unchanged the incentives to contribute to the team project and this prediction applies independent of our treatment conditions.

A large number of experiments has revealed undeniable evidence that people exhibit substantial cooperativeness in typical public goods situations where cooperation is not supported by explicit incentives (Ledyard 1995). To illustrate how we expect team spirit to operate in our design consider the following equations to describe subject *i*'s contribution at period *t*:

$$x_{it} = \alpha \overline{X}_{(t-1)} + \beta \overline{Y}_{(t-1)} + \omega_i, \; i = 1,...,m. \qquad (2)$$

Here, $\overline{X}_{(t-1)}$ and $\overline{Y}_{(t-1)}$ denote the average contributions to team production in the own team X and the observed team Y in period (*t*-1). ω_i is a time-invariant type variable that captures differences in individual characteristics. By equation (2), we assume that a subject responds to other subjects' behavior on two accounts. First, with $\partial x_{it} / \partial \overline{X}_{(t-1)} = \alpha > 0$, people contribute the more to their team's project the higher is the average contribution of the own team. This pattern of behavior is highly robust and known as "conditional cooperation" (see,

Croson 1998, Keser and van Winden 2000, Fischbacher, Gächter, and Fehr 2001, Falk, Fischbacher and Gächter 2003).

Second, we assume that others will affect a subject's behavior even if individual welfare is independent of the behavior of others, i.e., $\partial x_{it} / \partial \overline{Y}_{(t-1)} = \beta > 0$. This effect accounts for peer pressure as discussed, e.g., by Falk and Ichino (2003). Peer pressure will show to be an essential ingredient for team spirit to develop in our design. For this reason we formulate our first hypotheses with respect to peer pressure:

Peer Pressure Hypothesis I: *If peer pressure exists, the higher the average contribution of team Y, the higher is a subject's contribution to the team project in team X, i.e.,* $corr[\overline{x_i}, \overline{Y}] > 0$.

In treatment MUTUAL, with the opportunity of team Y to also observe team X , subject *j* of team Y contributes according to $y_{jt} = \alpha \overline{Y}_{(t-1)} + \beta \overline{X}_{(t-1)} + \omega_j$, $j = m+1,..., (m+n)$. For (*t*-1), we can evaluate $\overline{X}_{(t-1)} = 1/m \sum_i^m x_{i(t-1)} = \alpha \overline{X}_{(t-2)} + \beta \overline{Y}_{(t-2)} + \overline{\omega}_X$ and likewise $\overline{Y}_{(t-1)} = 1/n \sum_{j=m+1}^{m+n} y_{j(t-1)} = \alpha \overline{Y}_{(t-2)} + \beta \overline{X}_{(t-2)} + \overline{\omega}_Y$, where $\overline{\omega}_X$ and $\overline{\omega}_Y$ denote the average type characteristic of subjects in the respective teams X and Y.

We can use these averages to illustrate a first implication of peer pressure. To simplify, for a moment we neglect the time index and calculate the differences between average contributions. This gives for treatment MUTUAL $(\overline{X} - \overline{Y})_M = (\overline{\omega}_X - \overline{\omega}_Y)/(1 - \alpha + \beta)$, and for the OBSERVER-OBSERVED condition $(\overline{X} - \overline{Y})_O = (\overline{\omega}_X - \overline{\omega}_Y + \beta \overline{Y})/(1 - \alpha)$. Consequently, for any value $\beta > 0$ the difference of average contributions between paired

teams will be smaller in treatment MUTUAL than in the OBSERVER-OBSERVED condition.

Peer Pressure Hypothesis II: *If peer pressure exists, the difference between average team contributions within a pair will be smaller in treatment MUTUAL than in the OBSERVER-OBSERVED condition.*

We now turn to the notion of team spirit in our design. Inserting the expressions for average contributions of teams into equation (2) and iterating the time subscript one step further gives:

$$\text{MUTUAL:}\quad x_{it} = (\alpha^2 + \beta^2)\overline{X}_{(t-2)} + 2\alpha\beta\,\overline{Y}_{(t-2)} + \alpha\overline{\omega}_X + \beta\overline{\omega}_Y + \omega_i \qquad (3a)$$

$$= (\alpha^3 + 3\alpha\beta^2)\overline{X}_{(t-3)} + (\beta^2 + 3\alpha^2\beta)\overline{Y}_{(t-3)} + (\alpha^2 + \beta^2 + \alpha)\overline{\omega}_X + (2\alpha\beta + \beta)\overline{\omega}_Y + \omega_i.$$

The same procedure applied for treatment BASE gives:

$$\text{BASE:}\qquad x_{it} = \alpha^2\overline{X}_{(t-2)} + \alpha\overline{\omega}_X + \omega_i = \alpha^3\overline{X}_{(t-3)} + (\alpha^2 + \alpha)\overline{\omega}_X + \omega_i. \qquad (3b)$$

By comparison of (3*a*) and (3*b*), with both, $\alpha > 0, \beta > 0$, contributions in MUTUAL will exceed those in treatment BASE. The intuition is that in MUTUAL a team Y imposes peer pressure on a team X and members of this team will react by contributing more. Such contributions raise the output of team X and in turn impose peer pressure on team Y. Conditional cooperation will crowd in further contributions of the respective own teams, which again increases the peer pressure on the respective other team. Based on this discussion we provide the following definition:

Definition: *Team spirit is an outflow of mutually enforcing effects of peer pressure between teams. In generating team spirit, the effects of peer pressure interact with those of conditional cooperation within the respective own teams.*

Treatment OBSERVER provides an essential tool to isolate team spirit in our design. According to the above definition, team spirit will have weaker effects in treatment OBSERVER than MUTUAL. To see this, again insert $\overline{X}_{(t-1)}$ and $\overline{Y}_{(t-1)}$ into equation (2) and account for the fact that in treatment OBSERVER a Y-team has no opportunity to observe an X-team, so that $\overline{Y}_{(t-1)} = 1/n \sum_{j=m+1}^{m+n} y_{j(t-1)} = \alpha \overline{Y}_{(t-2)} + \overline{\omega}_Y$. This gives:

$$\text{OBSERVER: } x_{it} = \alpha^2 \overline{X}_{(t-2)} + 2\alpha\beta \overline{Y}_{(t-2)} + \alpha\overline{\omega}_X + \beta\overline{\omega}_Y + \omega_i \qquad (3c)$$

$$= \alpha^3 \overline{X}_{(t-3)} + 3\alpha^2\beta\overline{Y}_{(t-3)} + (\alpha^2 + \alpha)\overline{\omega}_X + (2\alpha\beta + \beta)\overline{\omega}_Y + \omega_i.$$

Comparing equations (3a) and (3c) reveals that contributions will be higher in treatment MUTUAL. Intuitively, in the OBSERVER-OBSERVED condition, the chain of mutual reactions between X- and Y-teams is weaker because the observed Y-teams are not exposed to peer pressure from their paired X-teams.[4] We state this as:

Team Spirit Hypothesis I: *If team spirit exists, contributions will be highest in treatment MUTUAL, and the treatment effect between OBSERVER and OBSERVED will be weaker than the one between MUTUAL and BASE.*

[4] Notice that equation (3*b*) for treatment BASE is equivalent to that of treatment OBSERVED.

In equations (3*a*) to (3*c*), by iteration of the time index the effects of peer pressure increase relative between treatments. For this reason, a second hypothesis shall be formulated with respect to the time pattern of contribution behavior:

Team Spirit Hypothesis II: *If team spirit exists, its effects grow larger as the experiment proceeds.*

4. Experimental Results

Experiments were run between May and June 2002, at the Faculty of Social and Economic Sciences at the University of Innsbruck. We conducted 9 experimental sessions with a total of 212 undergraduate students from various majors as participants. We had 72 subjects participating in MUTUAL, 64 in the mixed information treatments, i.e., 32 each in OBSERVED and OBSERVER; and 76 in BASE. The average subject earned € 8 (≈ US$ 8) within approximately 30 minutes. The experiments were programmed and conducted using the software z-Tree (Fischbacher 1999).

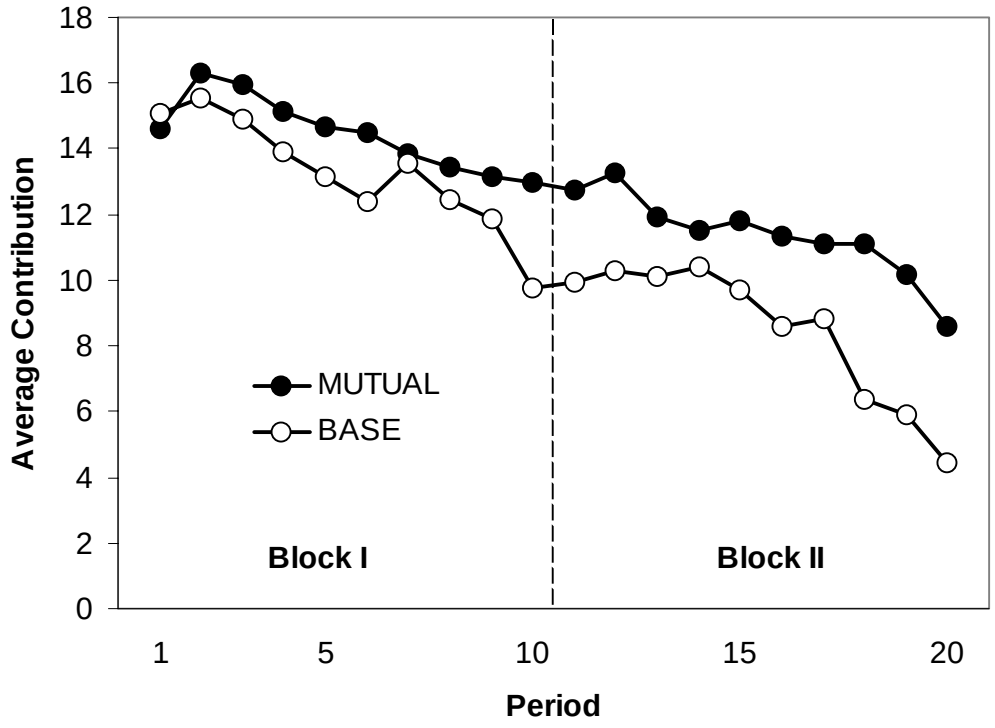
Mutual observation: We first compare treatments MUTUAL and BASE. Recall that the former provides information between paired teams into both directions: Team X sees how it performs relative to team Y, and vice versa. In contrast, the baseline does not comprise any information about another team (see Table 1).

Figure 1 gives an overall impression of contribution behavior. The figure shows the time series of average contributions. To better illustrate the dynamics, contributions are decomposed into two blocks consisting of 10 periods each. Contributions under MUTUAL start out at the same level, but depart from BASE in repeated interaction. In the first block subjects on average contribute 9 percent more in MUTUAL than in BASE (14.5 vs. 13.3

points). This difference yet is not significant (p = 0.151, Mann-Whitney test).[5] However, in the second block of periods average contributions in MUTUAL (11.3 points) exceed those in BASE (8.5 points) already by 33 percent (p = 0.045). These findings are line with our hypotheses regarding team spirit. We state our first result as:

Result 1: *In treatment MUTUAL, subjects contribute more to their team's projects. The difference of average contributions between treatments MUTUAL and BASE grows larger as the experiment proceeds.*

Figure 1 Time Series of Average Contributions (MUTUAL & BASE)



Effects of observing: To judge whether result 1 is due to team spirit we compare treatments MUTUAL and OBSERVER. Participants in OBSERVER operate under identical

[5] All tests are one-sided. We use as unit of observation the average contribution in independent teams or pairs of teams in BASE and all other treatments, respectively. Here, for instance, we have used mean contributions of 9 independent pairs of teams in MUTUAL and those of 19 independent teams in the BASE.

conditions than in MUTUAL except for one difference: people from the paired team do not observe the own team. Although the information is qualitatively the same, the difference is essential since it removes the possibility for mutually enforcing effects of peer pressure.

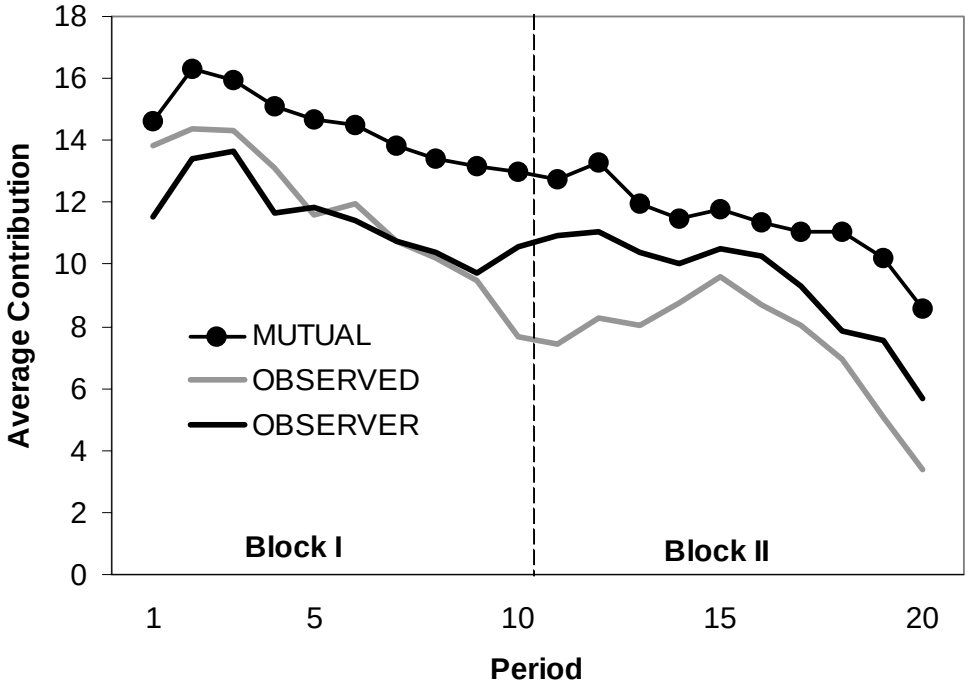
As can be seen form figure 2, contributions in MUTUAL tend to be higher than in OBSERVER. In the first block of rounds average contributions are 14.5 vs. 11.5 points (p = 0.134). A similar picture prevails in the second block of round (11.3 vs. 9.35 points; p = 0.168). To further explore potential effects of observing the figure also draws average contributions in treatment OBSERVED. There are no effects of observing in the first block of rounds (11.5 vs. 11.7 points in OBSERVED and OBSERVER, respectively; p = 0.5). In the second block of rounds contributions in OBSERVER slightly outstrip those in OBSERVED. The differences are, however, not significant (9.4 vs. 7.4 points, p = 0.264). In line with our hypothesis regarding team spirit, we conclude that bilateral observation between teams has pronouncedly larger effects on contributions than just unilateral observation.

Effects of being observed: Members of an OBSERVED-team operate under identical conditions than in BASE except for one difference: they know that another team observes their average team contributions and earnings. This fact may influence peoples behavior. For instance, some people are more likely to refrain from jaywalking or littering on the sidewalk when they are observed by others. The literature discusses such behavior, e.g., under the notion of esteem (Brennan and Pettit 2000). We do not observe any such effect in our design. In both blocks of rounds the difference between average contributions between treatments OBSERVED and BASE is negative and insignificant according to standard non-parametric tests (block 1: 11.7 vs. 13.3 points, p = 0.157; block 2: 7.4 vs. 8,5 points, p = 0.255). As a consequence, contributions in OBSERVED stay markedly behind those in MUTUAL (see, figure 2). Average contributions in these treatments are 11.7 vs. 14.5 points (p = 0.145), and 7.4 vs. 11.3 points (p = 0.034) in block 1 and 2, respectively. We conclude that the

motivating effects of mutual observation cannot be reduced to single-sided effect of being observed. We summarize this discussion as:

Result 2: *The effects of mutual observation are not separable into effects of observing and being observed.*

Figure 2 Time Series of Average Contributions (OBSERVED & OBSERVER)



Team correlation and between-team variance: If peer pressure exists, contributions on OBSERVER-teams will correlate with those of their paired teams, which they observe. If mutual peer pressure between teams causes team spirit, the correlation between average contributions of paired teams should be stronger in treatment MUTUAL.

Figure 3 plots the average contributions of each team in treatment OBSERVER dependent on the mean contribution of the respective OBSERVED-team. The figure shows that higher contributions of the observed team go along with higher contributions of the own

team. This observation is in line with our peer pressure hypothesis I. In the first block of rounds (left panel of figure 3) the correlation is strong. A linear regression of subjects' contributions (N = 32) on the mean contributions of the respective observed team reveals a significant p-value on the slope coefficient.[6] The Spearman rank correlation is $\rho = 0.34$, which is significant at p = 0.026. Notice, however, that this correlation decreases during the course of the experiment (right panel of figure 3): in the second block, the correlation becomes less pronounced and insignificant (Spearman: $\rho = 0.06$, p = 0.754).

Figure 3 Mean contributions of OBSERVER-teams after observing of their paired OBSERVED-team. Trend line of linear regression.

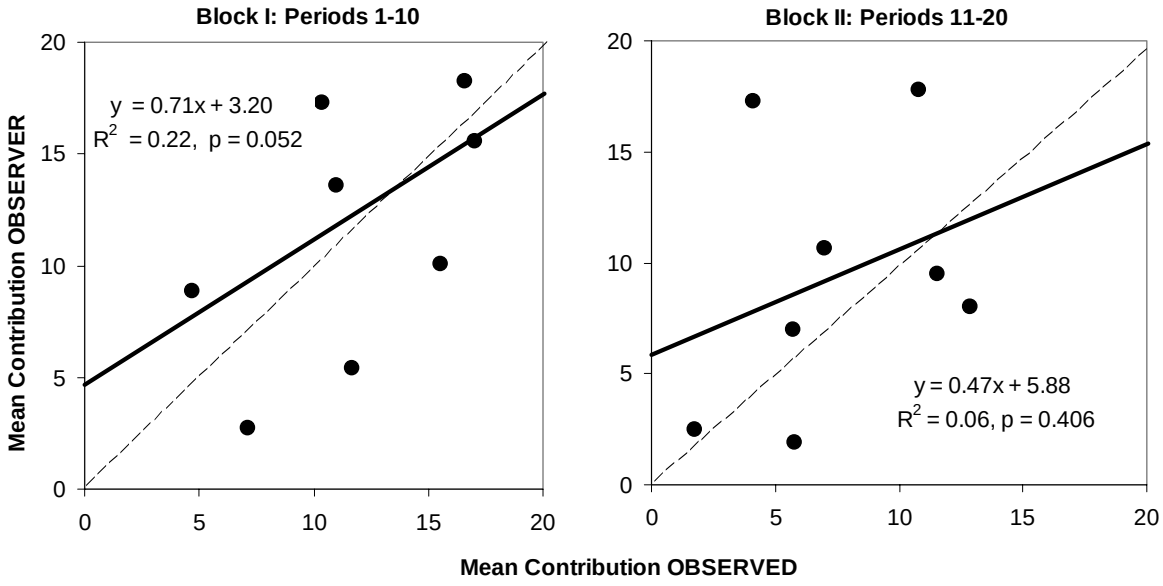


Figure 4 shows the mean contributions of each team X as compared to the mean contributions of the paired Y-teams in treatment MUTUAL. Again, we observe a positive correlation. In this treatment, the correlation initially is rather weak (see first block of periods, left panel of figure 4, Spearman: $\rho = 0.22$, p = 0.198) but increases as the experiment proceeds: in the second block of rounds the slope of the regression (N = 36) is almost one

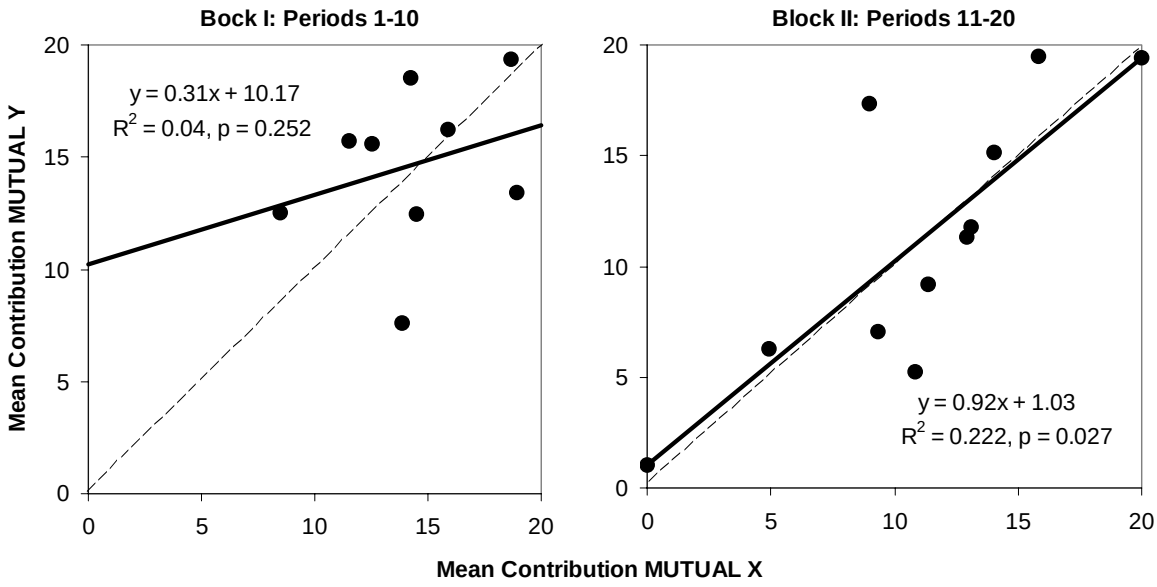
[6] p-values are calculated from robust standard errors adjusted for clustering on independent units of observation.

(right panel of figure 4, Spearman: $\rho = 0.48$, $p = 0.006$). Again, this is exactly what we would expect if team spirit exists.

Figures 3 and 4 allow us to observe another implication of peer pressure between teams: If peer pressure exists, the difference of average contributions between paired teams should be smaller in treatment MUTUAL than in the OBSERVER-OBSERVED condition. Indeed, the mean squared error of average contributions between paired teams is smaller in MUTUAL than in the OBSERVER-OBSERVED condition (12.1 vs. 23.8 points, $p = 0.074$). We state this as further result:

Result 3: *Peer pressure exists , i.e., $corr[\overline{x}_i, \overline{Y}] > 0$. In treatment MUTUAL, peer pressure grows stronger as the experiment proceeds.*

Figure 4 Mean contributions of MUTUAL-Y-teams after observing and being observed by their paired MUTUAL-X-teams. Trend line of linear regression.



Regression analysis: To further establish our results we run an OLS regression with all data. In the experiment subjects are matched into teams. For this reason we calculate robust standard errors adjusted for clustering on independent units of observation, i.e., teams in

BASE and pairs of teams in all other treatments, respectively. Individuals' own contributions in period *t* are regressed on several explanatory variables in period *t*-1. The results are summarized in the following equation:

$$x_{it} = \underset{(1.043)\,***}{6.68} + \underset{(0.066)\,***}{0.55}\ \overline{X}_{-i(t-1)} - \underset{(0.031)\,***}{0.21}\ t - \underset{(0.718)}{0.56}\ Observer - \underset{(0.952)}{0.02}\ Observed + \underset{(0.604)\,*}{1.09}\ Mutual \quad (4)$$

Number of obs. = 4028
F(5, 35) = 116.7***
R-squared = 0.251

According to equation (4), subjects contribute significantly more in period *t* the higher has been the average contribution excluding their own, $\overline{X}_{-i(t-1)}$, within their team in period (*t*-1). This is consistent with findings from previous experimental research on conditional cooperation (for references, see section 3). The negative coefficient on variable *t* captures that cooperation decays as the experiment proceeds from one period to the next. Again, this finding is well established in the literature (Ledyard 1995).

Regarding our treatments, the variables *Observer, Observed*, and *Mutual* are dummies that capture our treatment conditions. We find no evidence for effects of observing as compared to BASE: the coefficient of the variable *Observer* is negative and insignificant. The same result obtains for variable *Observed.* In contrast, as revealed by the coefficient on variable *Mutual*, the condition of mutual payoff observation is significantly associated with more contributions in treatment MUTUAL. This reaffirms our previous result 2.

Finally, if our second hypothesis regarding team spirit holds true, a subject *i*'s contributions x_{it} should respond more strongly to the past of average contributions $\overline{X}_{(t-1)}, \overline{X}_{(t-2)}, \ldots$ and $\overline{Y}_{(t-1)}, \overline{Y}_{(t-2)}, \ldots$ in treatment MUTUAL than in OBSERVER. The following equation (5) shows the regression of contributions on first and twice lagged average contributions in these treatments.

$$x_{it} = \underset{(1.568)^{**}}{4.07} + \underset{(0.089)^{**}}{0.25}\,\overline{X}_{-i(t-1)} + \underset{(0.075)^{**}}{0.20}\,\overline{X}_{-i(t-2)} + \underset{(0.078)}{0.12}\,\overline{Y}_{(t-1)} + \underset{(0.067)^{**}}{0.16}\,\overline{Y}_{(t-2)} - \underset{(0.039)^{**}}{0.11}\,t$$
$$+ \underset{(0.125)^{***}}{0.39}\,I_{X(t-1)} - \underset{(0.118)}{0.05}\,I_{Y(t-1)} - \underset{(0.111)}{0.15}\,I_{X(t-2)} - \underset{(0.094)^{**}}{0.22}\,I_{Y(t-2)} \qquad (5)$$

Number of obs. = 1872
F(9, 16) = 72.8***
R-squared = 0.243

The outcomes are, first, that contributions are positively and significantly associated with lagged average contributions of the own team, $\overline{X}_{-i(t-1)}$ and $\overline{X}_{-i(t-2)}$. As previously, this is a clear indication of conditional cooperation. Second, regarding peer pressure, the coefficient on variable $\overline{Y}_{(t-1)}$ is small and insignificant, but it grows larger and becomes significant for variable $\overline{Y}_{(t-2)}$.

Third, to see how peer pressure and conditional cooperation interact with our treatment conditions we include the variables $I_{Xt} = Observer \times \overline{X}_t$ and $I_{Yt} = Observer \times \overline{Y}_t$. With one time lag, contributions are *positively* associated with $I_{X(t-1)}$; there is no effect of variable $I_{Y(t-1)}$. This means that subjects in treatment MUTUAL are *less sensitive* to average contributions of the own team from the previous period. However, with two lags the coefficients on variables $I_{X(t-2)}$ and $I_{Y(t-2)}$, both, turn *negative*, i.e., in treatment MUTUAL subjects *respond more strongly* to past information about the observed team. In other words:

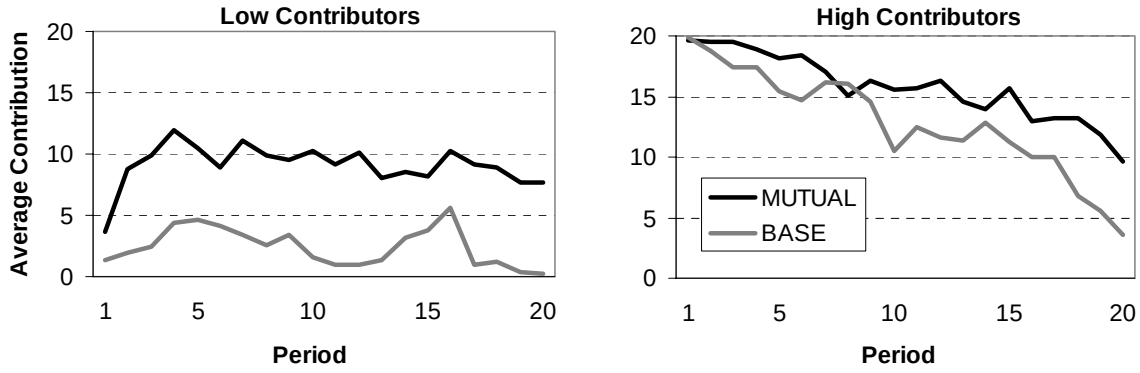
Result 4: *In treatment MUTUAL, the effects of peer pressure and conditional cooperation gain momentum from period to the next.*

Team spirit and types: A final question we pose is whether different types respond differently to team spirit. We classify as "low contributors" those subjects who in period one

of the experiment have contributed five points or less to the team project. In contrast, "high contributors" are those who in period one have contributed 15 points or more.[7]

Figure 5 shows the time series of average contributions of these types in treatments MUTUAL and BASE. Average contributions of low contributors (left panel) boost by 279 percent between treatments BASE and MUTUAL (2.4 points vs. 9.1 points on average, p = 0.019). Team spirit also has significant effects on the behavior of high contributors (right panel, 15.8 vs. 12.8 points in BASE and MUTUAL, p = 0.047). To test whether the treatment effect is stronger for low than for high contributors we regress subjects' contribution on the variable t (period), dummies each for *LowContributors* and *HighContributors*, and two interaction variables *LowContributors* × *Mutual* and *HighContributors* × *Mutual,* which evaluate the treatment effect between MUTUAL and BASE.

Figure 5 Time Series of Average Contributions (Low and High Contributors)



Not surprisingly, low contributors contribute less (coefficient = -7.9, p = 0.000) and high contributors more than all others (coefficient = 2.5, p = 0.028). Regarding the treatment effect, both low contributors (coefficient = 6.7, p = 0.001) and high contributors contribute

[7] We abstain from calling low contributors "free riders", since conditionally cooperative types may not contribute if they hold a belief that others will not contribute.

more in treatment MUTUAL than in BASE (coefficient = 2.9, $p = 0.034$). Notice, however, from the coefficients that the treatment effect is more than twice as large for low than for high contributors. We summarize:

Result 5: *Low contributors are more sensitive to team spirit than high contributors.*

5 Conclusion

We test whether the opportunity of teams to compare each others' performance stirs a spirit of teams towards greater effort. We have argued that testing for team spirit is difficult in the field because it is hardly possible to find a setting in which the effects of both, endogenous and exogenous characteristics of a team can be controlled for simultaneously. To avoid this problem of identification we propose an experimental design in which team members contribute to independent team projects. Apart from varying the information regarding the relative team performance, the incentive structure is held constant across all treatments. By this means we disentangle the motivating effects of team spirit against alternative accounts.

The main result is that subjects contribute more to their team's project when they can observe relative team output. In contrast, we do not find enhanced contributions under conditions of unilaterally observing or being observed by another team. To explain these findings we provide a detailed account that team spirit is an implication of mutual peer pressure between teams. Our results 1 to 4 provide ample evidence that team spirit exists. Team spirit evolves if the effects of peer pressure interact with those of conditional cooperation and enforce each other under conditions of mutual observation between teams.

Result 5 finally shows that team spirit motivates low contributors more than cooperative types of workers.

Our design is novel in various respects. First of all, a subjects' welfare is independent of relative team performance and there are no stakes for rivalry between teams. The paper, therefore, differs fundamentally from a growing number of studies about the motivating effects of tournament-based, competitive pay-schemes (Nalbantian and Schotter 1997), or the effects of between-group competition on within-group cooperation (for a survey see Bornstein 2003). These studies impose incentives on individuals to compete between teams, removing the opportunity to isolate implicit motivating effects of team spirit. We also do not add anything to ease monitoring or sanctioning that could explain more cooperation in teams, for instance, due to a social norm of reciprocity (Carpenter and Matthews 2001).

For the purpose of our study it is furthermore important that subjects are not provided with any clues which would allow for social identification of teams. The design ensures this by the use of neutral wording and complete anonymity of interactions. In this respect, our design is conceptually different from studies on in- and outgroup phenomena, which investigate whether and why people cooperate more with members of a socially identified in-group (Yamagishi and Kiyonari 2000, De Cremer and van Dijk 2002).

Another important reason to keep all interaction anonymous is that this removes incentives to meet with social approval. For instance, in the setup of Falk and Ichino (2003), although payment is independent of output, the possibility cannot be excluded that subjects fear social sanctions from the employer (i.e., the experimenter) if the own output negatively deviates from others'. Moreover, the authors find large effects on productivity in a treatment where workers can freely communicate in pairs. Such communication may have effects apart from pure peer pressure. In the laboratory we can exclude these confounds. Finally, in our study the team task is simple and subjects have complete knowledge about the quality of

team production, i.e., learning does not apply to explain differences in team performance under varying information regarding another team.

Our study suggest that already a little information may go a long way, i.e. the public announcement of relative performance measures can trigger a spirit of teams towards greater efforts. In the introduction to this study we have pointed out that this finding is of great importance for practical as well as theoretical reasons. Finally, previous experimental studies by Schotter and Weigelt (1992) and Bornstein and Ben-Yossef (1993) have found that relative compensation results in higher efforts even if this is not supported by the solution of a non-cooperative game. We think that the prevalence of team spirit provides an intuitive explanation for these findings.

References

Alchian, A.A. and H. Demsetz (1972): Production, Information Cost, and Economic Organization. *American Economic Review* 62: 777-95.

Bardsley, N. and R. Sausgruber (2003). *Social Interaction Effects in the Laboratory and Society: Conformism and Reciprocity in Public Good Provision.* Mimeo. University of Nottingham.

Barron, J.M. and K.P. Gjerde (1997): Peer Pressure in an Agency Relationship. *Journal of Labor Economics* 15: 234-54.

Boning, B., C. Ichniowsky, and K. Shaw (2001): *Opportunity Counts: Teams and the Effectiveness of Production Incentives.* NBER Working Paper No. 8306.

Bornstein, G. (2003): Intergroup Conflict: Individual, Group, and Collective Interests. *Personality and Social Psychology Review* 7: 129-45.

Bornstein, G. and M. Ben-Yossef (1994): Cooperation in Intergroup and Single-Group Social Dilemmas. *Journal of Experimental Social Psychology* 30: 52-67.

Brennan G. and P. Pettit (2000): The Hidden Economy of Esteem. *Economics and Philosophy* 16: 77-98.

Carpenter, J., P. Matthews (2001): *Social Reciprocity.* Working Paper. University of Middlebury.

Che Y.-K. and S.-W. Yoo (2001): Optimal Incentives for Teams. *American Economic Review* 91: 525-41.

Che, Y.-K. and I. Gale (2003): Optimal Design of Research Contests. *American Economic Review* 93: 646-71.

Croson, R.T.A. (1998): *Theories of Altruism and Reciprocity: Evidence from Linear Public Goods Games.* Working Paper. The Wharton School. University of Pennsylvania.

De Cremer, D. and E. Van Dijk (2002): Reactions to Group Success and Failure as Function of Identification Level: A Test of the Goal-Transformation Hypothesis in Social Dilemma. *Journal of Experimental Social Psychology* 38: 435-442.

Falk, A. and A. Ichino (2003): *Clean Evidence of Peer Pressure*. IEW Working Paper No. 144. Institute of Empirical Research in Economics. University of Zurich.

Falk, A., U. Fischbacher, and S. Gächter (2003): *"Living in Two Neighborhoods" Social Interactions in the Lab.* IEW Working Paper No. 150. Institute of Empirical Research in Economics. University of Zurich.

Fischbacher, U. (1999): *z-Tree: Zurich Toolbox for Readymade Economics Experiments*. IEW Working Paper No. 21. Institute of Empirical Research in Economics. University of Zurich.

Fischbacher, U., S. Gächter, and E. Fehr (2001): Are People Conditionally Cooperative? Evidence from a Public Goods Experiment. *Economics Letters* 71: 397-404.

Heermann, B. (1997): *Building Team Spirit – Activities for Inspiring and Energizing Teams*. Mc Graw Hill. New York et al.

Huck, S., D. Kübler, and J. Weibull (2002): *Social Norms and Incentives in Firms*. Working Paper. University College London.

Ichino, A., and G. Maggi (2000): Work Environment and Individual Background: Explaining Regional Shirking Differentials in a Large Italian Firm. *Quarterly Journal of Economics* 104: 1057-90.

Ichniowski, C.; K. Shaw, and G. Prennushi (1997): The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines. *American Economic Review* 87: 291–313.

Kandel, E. and E.P. Lazear (1992): Peer Pressure and Partnership. *Journal of Political Economy* 100: 801-17.

Keser, C. and F. van Winden (2000): Conditional Cooperation and Voluntary Contributions to Public Goods. *Scandinavian Journal of Economics* 102: 23-39.

Knez, M. and M. Simester (2001): Firm-Wide Incentives and Mutual Monitoring at Continental Airlines. *Journal of Labor Economics* 19: 743-72.

Kremer, M. and D.M. Levy (2003): *Peer Effects and Alcohol Use among College Students.* NBER Working Paper No. 9876.

Lawler E.E. (2001): *Organizing for High Performance. Employee Involvement, TQM, Re-Engineering, and Knowledge Management in the Fortune 1000.* Jossey-Bass. San Francisco.

Lazear, E. P. and S. Rosen (1981): Rank-Order Tournaments as Optimum Labor Contracts. *Journal of Political Economy* 89: 841-64.

Ledyard, J. (1995): Public Goods: A Survey of Experimental Research. In: J. Kagel and A. Roth (Eds.). *The Handbook of Experimental Economics*. Princeton University Press. Princeton: 111-94.

Manski, C.F. (1993): Identification of Endogenous Social Effects: The Reflection Problem. *Review of Economic Studies* 60: 531-42

Osterman P. (1994): How Common is Workplace Transformation and Who Adopts it? *Industrial and Labor Relations Review* 47: 173-88.

Sacerdote, B. (2001): Peer Effects with Random Assignment: Results form Dartmouth Roommates. *Quarterly Journal of Economics* 116: 681-704.

Schotter, A. and K. Weigelt (1992): Asymmetric Tournaments, Equal Opportunity Laws, and Affirmative Action: Some Experimental Results. *Quarterly Journal of Economics* 107: 511-39.

Yamagishi, T. and T. Kiyonari, (2000): The Group as the Container of Generalized Reciprocity. *Social Psychology Quarterly* 63: 116-32.

Appendix: Experimental Instructions

Original Instructions were given in German. These are the instructions for treatment MUTUAL. Those for all other treatments are available on request.

Thank you for participating in the experiment. If you read these instructions carefully and follow all rules, you can earn money. The money will be paid out to you in cash immediately after the experiment. During the experiment we shall not speak of Euro but rather of points. Points are converted to Euro at the following exchange rate:
100 Points = 1.50 Euro
It is forbidden to speak to other participants during the experiment. If you have any question, please ask us. We will gladly answer your questions individually. It is very important that you follow this rule. Otherwise, we shall have to exclude you from the experiment and from all payments.

Participants of this experiments are randomly assigned into groups of 4 members, i.e., there are three more persons forming a group together with you. The composition of groups will remain the same during the whole experiment, i.e. there will always be the same persons in your group. The identity of your group members will not be revealed to you at any time.

At the start of each period, each participant gets 20 points. We will refer to these points as your endowment. Your task is it to decide, how many of your 20 points you want to contribute to a project or to keep for yourself.

Your income consists of two parts:

(1) Points that you keep

(2) Your "income from the project". This income is calculated as follows:

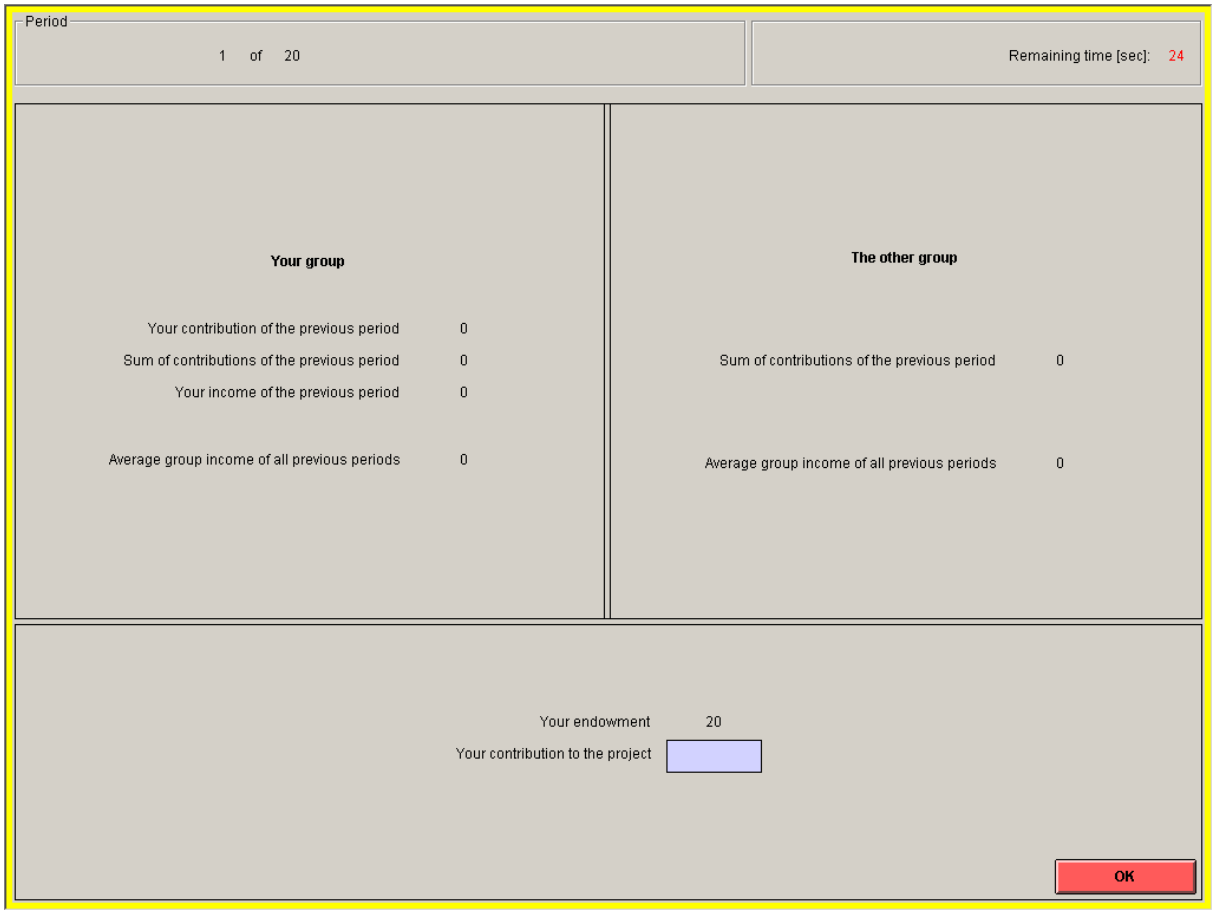
Your income from the project =
0.4 × Sum of contributions of all group members to the project

The income of the other members of your group is determined in the same way, i.e. each group member receives the same income from the project. Suppose, for example, that the total contributions to the project by all members in your group sum up to 60. In this case you and every other member of your group receives 0.4 × 60 = 24 points as income from the project. Suppose that you and the other 3 members of your group in total contribute only 10 points to the project. In this case every group member receives 0.4 × 10 = 4 points as income from the project.

For each point that you keep for yourself you earn an income of one point. If you contribute that point to the project, instead, the sum of contributions to the project would rise by one point, and your income from the project would rise by 0.4 × 1 = 0.4 points. However, the income of the other group members would also rise by 0.4 points, such that the total income of the group would rise by 4 × 0.4 =

1.6 points. Your contribution to the project, therefore, raises the income of the other members of your group. On the other hand, you earn from each point that other members of your group contribute to the project. For each point that another group member contributes, you earn 0.4 × 1 = 0.4 points.

You take your choice via the computer. At the beginning of every period you see a decision screen:



In the area at the bottom you enter how many of your 20 points you want to contribute to the project.

The main area of the screen above consists of two parts:
On the left you find the information concerning **your group**. First you see your contribution of the previous period. Below you find the sum of contributions to the project of all members in your group. The next line below shows your income of the previous period. Your income is determined as the sum of points that you have kept for yourself and the income from the project.

A bit further down you see the "average group income of all previous periods". This number shows the average income of your group added over all previous periods together.

Remark: In the first period (as here in the figure of the screen) there are no previous periods yet. For this reasons all numbers in the figure show zero yet.

On the right side of the screen you find information regarding **another group**. Just as you group, this other group consists of four participants. The four participants forming the other group will be the same during the whole experiment. The income of these four participants is determined in the same way as yours, i.e. all members of the other group decide how many of their 20 points they want to contribute to a project. The project of the other group is completely independent of your project.

The first line shows the sum of contributions to the project of all members in the other group. The second line a bit below shows the average income of the other group added over all previous periods.

Please note: Members of your and the other group mutually observe each other, i.e. the other group sees the same information regarding your group as you see regarding the other group.

After all participants have made their contributions a new period starts, in which you decide again how many of your 20 points you want to contribute to the project. In total there will be 20 periods.