On the Benefits of Control in Teams*

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Abstract

In this study we analyze the relevance of control defined as an employer's decision to impose a minimum required effort of each employee in a team situation. We investigate whether the negative behavioral consequences of control as shown in a single-agent situation by Falk/Kosfeld (2006) also hold in an extended multiple-agents context. But instead we observe benefits of control in teams. We show that control is more effective when the number of agents increases because agents' effort decreases systematically with an increasing group size.

Keywords: Crowding-out, Motivation, Teams

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1 Introduction

The conflicting interests between principal and agent are the most frequently mentioned reason why a typical principal-agent relationship fails to reach an efficient solution. Looking for example at employer-employee relations, the employer wants the employee to work as much and as hard as possible for a moderate wage, while the employee expects a high wage without exerting too much effort. These discrepancies have been investigated in lots of studies from different disciplines of research. Based on the neoclassical theory, economists recommend to motivate agents extrinsically by rewards or close monitoring (e.g. piece rates (Lazear 2000, Paarsch/Shearer 2000), tournaments (Lazear/Rosen 1981, Bull/Schotter/Weigelt 1987) or efficiency wages (Shapiro/Stiglitz 1984, Acemoglu/Newman 2002))[1]. Agents do what they are supposed to because of an expected reward. In contrast to this kind of motivation that is based on regulations, psychologists moreover focus on intrinsic motivation. An agent who is intrinsically motivated spends time on an action because of the action itself and not because he is forced to. Psychologists often claim the negative effects (e.g. Deci 1971) of extrinsic motivation because extrinsic motivation critically depends on the existence and the choice of the right incentive scheme. Moreover, extrinsic and intrinsic motivation are mostly seen as combined components where the intrinsic motivation might be undermined by extrinsic incentives. The so called crowding-out effect or corruption effect of intrinsic motivation (e.g. Deci 1975, Greene/Lepper 1978, Frey 1997a) has been shown in a couple of studies (e.g. Frey/Jegen 2001, Fehr/Gächter 2002a, Kunz/Pfaff 2002, Fehr/Rockenbach 2003, Irlenbusch/Sliwka 2005). All of these studies have in common that they concentrate on the relationship between individuals. Yet, many important relations occur between groups of people. Decisions in firms are most often made by groups instead of individuals and team work is usually claimed as an important factor of success. However, there are also some team-specific problems such as free-riding. Hence it is a well known

[1] A review of the provision of incentives is given by Prendergast (1999).

issue in psychological and economic literature that findings from individual behavior cannot be appropriately translated into group behavior regularities (e.g. Davis 1992, Kerr et al. 1996, Bornstein/Yaniv 1998, Kugler et al. (forthcoming), Kocher et al. 2006, Kocher/Sutter 2005, Kocher/Sutter 2007).

In a recent contribution Falk and Kosfeld (2006) describe the results of a simple experimental design between one principal and one agent in order to study the impact of control on agents' motivation. A principal is called to control an agent if he forces the agent to give him at least a minimum amount of 10 points of his initial endowment of 120 points. Thus, the principal has to decide whether he wants to control the agent by setting a constraint or whether he forgoes control by setting no constraint. Falk and Kosfeld show that most agents voluntarily give a higher transfer if the extrinsic incentive tool (control) is missing. They interpret that agents are more likely to react kindly when they feel trusted by their principal instead of being forced by control.

Inspired by these results, the aim of our study is to check whether the negative impact of control also holds when the principal restricts the choice set not only for a single agent but for a group of agents. We predict agents to perceive the principal's decision to control differently if it is directed towards a team of agents and not exclusively towards one agent.

Using a variant of Falk/Kosfeld's base treatment, we look at one principal and several agents, running one treatment with three and another treatment with nine agents per group. In order to avoid any typical free-riding problem, neither treatment allows for any interaction between the agents. The principal has to offer the same type of contract to all of his three (nine) agents. Hence, he has no choice to differentiate between the agents. In the end, the principal's payoff depends on the given amount of one randomly selected agent of his group. As shown in Hagemann (2007), the significant impact of control is partly due to the specific wording used in the instructions by Falk/Kosfeld (henceforth FK). Therefore we run our team treatments with our own instructions as well as with the original FK-instructions which are slightly adapted to the group context.

In the team treatments, we expect to observe the phenomenon of *social loafing* between the agents. Average transfers should decrease with an increasing number of group members, because participants may feel that they can "hide in the crowd" (Davis 1969). Furthermore, as we think that the principal's decision to control is no longer be seen as a signal of distrust if it is directed towards a whole team and not exclusively to one agent, the observed transfers should be higher when the principal controls as if he does not. Hence, control should become more important in bigger groups. The results support our hypotheses: We observe benefits of control in teams. In the team treatments, we find a positive instead of negative impact of control. Control can no longer be interpreted as a signal of distrust towards an individual agent. Furthermore, average transfers decrease in the number of team members. These findings are also robust with respect to the wording used in the instructions.

The paper is organized as follows. In section 2 we generally discuss the theoretical background. In section 3 we derive our hypotheses and we describe the details of the experimental design and procedure in section 4. The experimental results are shown in section 5. Section 6 controls for the impact of the instructions. Section 7 concludes.

2 Theoretical Background

2.1 Motivation Crowding-Out

Economic Theory

Two kinds of behavioral predictions on agents' behavior in an experimental set-up discussed above are in line with economic theory. First, pure neoclassical theory assumes that agents are selfish and try to maximize their own payoff. Therefore they try to maximize their own payoff giving the lowest possible transfer. Second, economic models incorporating the impact of social preferences in agents' behavior (e.g. Fehr/Schmidt 1999, Bolton/Ockenfels 2000, Fehr/Gächter 2000, Fehr/Gächter 2002b, Charness 2004, Falk/Fischbacher, 2006) predict that agents are not completely selfish but do care for other people's utility. According to these assumptions the agents' behavior should not be affected by the principal's decision to control or not. A completely inequity averse agent should give the same transfer in both cases, with and without control in order to equalize the principal's and his own payoff, irrespective of the number of agents per group. As there is no change in profit and cost functions there should also be no change in agents' behavior between the treatments.

But the question is how to explain agents' behavior if they give different transfers in both conditions that exceed the lowest possible transfer, a reaction which might be due to a change in agents' motivation. Even though there are some approaches to implement the differentiation between intrinsic and extrinsic motivation in economic theory, the effect of motivation crowding-out cannot be economically explained. In particular, Frey (1997b: Chapter 4) incorporates this effect in a simple economic model, where the agent's utility depends on his own effort as well as on an intervention (reward or sanction) by the principal. The agent maximizes his utility for a given intervention. If the effort's marginal utility decreases with an increasing value of the intervention, Frey calls this the effect of motivation crowding-out. However, the model cannot endogenously explain the reasons for this effect, it just shows the consequences of the crowding-out effect.

Bénabou and Tirole (2003) explicitly describe the process of motivation crowding-out in a signaling model. Their central assumption is that the agent's effort costs for a certain task are only imperfectly known by the agent but that the principal has additional information on these costs. The principal can offer a reward to motivate the agent. By choosing the appropriate level of reward (which should be higher the higher the agent's costs of effort) to motivate the agent he automatically sends a signal concerning the difficulty of the task. Hence, the agent gets some information about his own preferences. Even though higher incentives might cause higher efforts, they also might diminish future motivation because of the revealed unattractiveness of the task. Nevertheless, the effect of motivation crowding-out is not set off via a direct causality between incentive and effort. It is caused due to the simultaneous influence of the difficulty of the task on both, reward and effort.

Another approach is offered by Sliwka (2006). Based again on a simple principal-agent model, Sliwka assumes that there is at least a substantial part of agents always behaving fair, i.e. committing oneself to an agreement, even if this agreement is not verifiable. Furthermore, Sliwka assumes that this willingness to be fair is influenced by a social norm or by other individuals' behavior. Apart from agents who are always fair or unfair, there are also some agents who are fair if and only if they think that the part of fair agents is sufficiently large. These agents are called the conformists. By setting high incentives, the principal gives a signal that there are apparently lots of agents who are not fair, because if not the principal could save costs by offering a fixed wage contract. This signal, however, can influence the conformists' behavior. Hence, the motivation crowding-out effect arises if agents think that unfairness is a common way to behave. But still, it is not the agents' intrinsic motivation to engage in a task that is undermined by extrinsic motivators, but the agents' willingness to behave fairly.

Cognitive Evaluation Theory

Psychologists already have started analyzing the effect of the "hidden costs of reward" in the 1970s (Deci 1976, Lepper/Greene 1978a). One of the possible explanations derives from the "Cognitive Evaluation Theory" (CET). The CET assumes that people need to feel autonomous and competent. External factors that seem to constrain these needs tend to undermine intrinsic motivation (e.g. Amabile et al. 1976, Greene/Lepper 1975, Deci/Porac 1978). Therefore, external factors enhancing the feelings of autonomy might even help to increase intrinsic motivation (Zuckerman et al. 1978). A review with 128 laboratory experiments that try to confirm the CET is given by Deci (Deci et al. 1999). However, CET performs poorly in explaining work motivation. Maybe the most important problem is that the CET implies that managers have to select between intrinsic and extrinsic motivation. They have to decide whether they want to use external motivators neglecting intrinsic motivation or whether they try to maximize the intrinsic motivation forgoing the use of external rewards (Deci/Gagné 2005). Even though in the experiment of this study the CET might help to explain why agents voluntarily give a higher transfer if they are not controlled, it can not serve as an explanation why transfers with control could exceed transfers without control. Furthermore, as the experimental design implies an abstract instead of a real effort, the assumption that intrinsic motivation could be a driving factor of subjects' behavior is critical in the context of our experiment. Maybe one could argue that agents are intrinsically motivated to participate in the experimental game or to react reciprocally to their partner, but the definition of intrinsic motivation as an interest and enjoyment of a task does not fit in an experiment including an abstract effort decision.

Self-Determination Theory

In 1985 Edward L. Deci and Richard M. Ryan presented a concept of internalization of extrinsic motivators. The theory describes how extrinsically motivated behavior can become intrinsically motivated. This approach was the beginning of the "Self-Determination Theory" (SDT) (Deci/Ryan 1985, Deci/Ryan 2000, Ryan/Deci 2000, Gagné/Deci 2005). The SDT is a meta-theory constituted by four theories: the "cognitive evaluation theory", "organismic integration theory", "causality orientations theory" and the "basic needs theory". SDT concerns the development and functioning of personalities in social contexts and focuses on the degree to which human behavior is volitional and self-determined. First, the SDT differentiates between *amotivation* and *motivation*. *Amotivation* means a lack of motivation or no intention to work at all. In our experiment, an amotivated agent should give a transfer of 0 if he is not controlled and a transfer of 10 if he is controlled.

A central point of the SDT is the classification of motivation in *controlled* and *autonomous motivation*. Whereas the CET just differentiates between extrinsic and intrinsic motivation, the SDT assumes an *autonomy continuum* with several stages between fully extrinsic and fully intrinsic motivation. *Controlled motivation* can be divided into *external and introjected regulation*. The *external regulation* corresponds to the typical extrinsic motivation depending on reward and punishment of an action. *Introjected regulation* means that a rule has been taken in but not accepted, so the individual is controlled via the regulation. Translated in the context of the experiment, agents who are controlled motivated dishonor the given constraint of at least 10 points. In the control-case, they just give the minimum transfer of 10 because they are forced to.

Autonomous motivation can be divided into *identified regulation*, *integrated extrinsic motivation and intrinsic motivation*, where intrinsic motivation represents the highest level of autonomous motivation. As mentioned above, this kind of motivation as an interest and enjoyment of the task hardly can exist in an experiment with an abstract effort decision. Identified and integrated regulation both mean that a rule has been accepted and taken in and therefore it is not seen as an exogenously set constraint. The identification with a regulation is reached if individuals identify with the value of a certain behavior for their own self-selected goals, whereas the integration of a regulation means that the behavior is an integral part of the individual itself and therefore self-determined. Again, translated in our experimental context, agents who are autonomous motivated have taken in the regulation. Probably an autonomous motivated agent himself would have decided to control if he had been in the principal’s position. So, in contrast to a controlled motivated agent who feels being forced by the principal’s decision to control, an autonomous motivated agent who can identify with the given regulation should not have the negative feeling of being restricted in his transfer choice.

Whether an individual is controlled or autonomous motivated first depends on aspects of the social environment like job or work climate and second on individual differences in *causality orientation* which can be more *autonomous, controlled* or *impersonal oriented*. Furthermore, there are three basic psychological needs that are important for the internalization of extrinsic motivation, namely the *need for autonomy*, the *need for competence* and the *need for relatedness*. People need to feel self-determined and to be effective, and they also need to feel connected to others in their social environment. These needs "provide the basis for predicting which aspects of a social context will support intrinsic motivation and facilitate internalization of extrinsic motivation" (Deci/Gagné 2005: 338). The higher a person's entitlements to satisfy his basic psychological needs the more *autonomous oriented* the person. In contrast, a *controlled oriented* person's needs will be more quickly satisfied whereas an *impersonal oriented* individual tends to be amotivated.

As mentioned in the introduction, we used two different kinds of instructions in our experiment, the original instructions used by FK and our own instructions. While in the FK-instructions the principal "is able to force[2] the agent to give him at least 10 points or to decide not to limit the agent and to leave him completely free to decide" in our own instructions "the principal has to offer a contract to the agent and can choose between two different types of contract. The agent has to offer a transfer from the range [0; 120] or a transfer from the range [10; 120]". Obviously the two instructions promote two different social contexts. However, as the instructions exactly describe the same rules of game, the needs for competence and relatedness should be quite equally satisfied by both instructions. But the need for autonomy which is the most crucial need in the general causality orientation might be differently touched by both instructions. Using the FK-instructions, the wording "not to limit the agent and to leave him completely free to decide" implies an accentuation on choice and freedom rather than on control and therefore clearly addresses an individual's need for autonomy.[3] So the agents' need for autonomy seems to be more satisfied if the principal does not ask for a transfer of at least 10 points. As the wording in our own instructions is more unemotional, the need for autonomy is not activated in the same way. Hence, the principal's decision to control appears in a more neutral and rational manner.

The SDT can help to explain why agents voluntarily give a higher transfer if they are not controlled. These agents are controlled motivated

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[2] Original instructions are in German, translation by the author. The expression used in the German version is "zwingen".

[3] The "emphasis on choice rather than control" has been detected as one of three specific factors leading to greater internalization of extrinsic motivation (Deci et al. 1994).

having not taken in the regulation. But even more, the SDT can help to explain why agents give a higher transfer in the control-case and why this transfer is higher than the minimum transfer of 10 points. Those agents are autonomous motivated who have identified with the regulation.

2.2 Social Loafing

The approaches mentioned above might help to explain the impact of control on agents' behavior, but they do not serve as theoretical background to explain agents' motivation in the team treatments. Therefore we have to extend our theoretical framework. Due to the experimental design that eliminates any interaction between the agents, we have to distinguish groups who work collectively from those who work coactively. Working coactively also means working in the presence of others, but in contrast to collectively working agents whose inputs are connected within their group, coactively working agents' inputs are not combined with the inputs of the other agents of their group (Karau/Williams 1993). For this reason we do not expect free riding as mentioned in the introduction, because it presumes the existence of collectively working groups.[4] To analyze the impact of increasing groups on agents' behavioral reaction to the restriction of the choice set, we therefore focus on the psychological phenomenon called *social loafing*. "Formally, social loafing is the reduction in motivation and effort when individuals work collectively compared with when they work individually or coactively" (Karau/Williams 1993: 681). There are several theoretical accounts for social loafing. In the following, we concentrate on three main causes that seem to be the most appropriate for our design.

First, one reason for the effect of social loafing is the *lack of identifiability* of people's performance (Latané et al. 1979, Harkins/Jackson 1985, Williams et al. 1981). People feel that they can "hide in the crowd" (Davis 1969) and therefore do not risk to be blamed when being detected withholding effort. In the context of our experiment, agents should feel less

[4] A differentiation between *shirking*, *social loafing* and *free riding* from psychological and economic points of view is given by Kidwell/Bennett (1993).

motivated in the team treatments. They know that their transfer cannot be assigned to them by the principal because first, the agent whose transfer decision will be responsible for the principal's payoff is randomly chosen and therefore the probability to be chosen decreases to one out of three respectively one out of nine in the team treatments. And second, even if an agent is the selected one in the end of the experiment, due to the anonymity of the lab experiment the principal will never get to know him face-to-face.

A second reason could be the so called "effort matching" (Latané et al. 1979, Kerr 1983, Harkins/Jackson 1985). According to this, people match their effort for equity or fairness reasons. When one's partner is hardly working, one would be a "sucker" to work hard himself reducing one's own payoff (Kerr 1983). Thus, in our experiment, if agents believe that the other agents will loaf and only give small transfers to the principal, they give small transfers themselves. In comparison to the other agents none of the agents might want to be the only one giving a lot of points to the principal which immediately reduces the agent's own payoff. Again, this effect might be intensified by the anonymity and the stranger matching in the experimental procedure, because "there is no reason for them to have faith in the group" (Harkins/Jackson 1985: 1200).

A third reason for the social loafing could be the "dispensability of effort" (Karau/Williams 1993, Kerr/Bruun 1983, Kerr 1983). People's motivation might be reduced if they feel that their effort is not essential for the whole group product. Even though there is no group product in our experiment, agents might feel that their transfer is of little value (i.e. dispensable) because, once again, the probability to be the selected agent whose transfer decision applies for the principal's payoff decreases in the team treatments. Even more, agents could feel that giving a high transfer is like wasting money, because the probability that no one will benefit from a generous transfer is quite high.

3 Hypotheses

In line with the theoretical background of the Self-Determination Theory we derive our first hypothesis. Apart from amotivated agents who only give the minimum amount of 0 without control and 10 with control, there should be a substantial amount of motivated agents. Controlled motivated agents have not taken in the given constraint. They dishonor the distrust implied by the restriction of the choice set and therefore would give a higher transfer if they are not controlled. Corresponding to this, agents who are autonomous motivated have identified with the given regulation. They would give a higher transfer if the principal decides to control.

Hypothesis 1:
In all treatments, there should be a substantial amount of agents who voluntarily give a transfer superior to the minimum amount of 0 respectively 10.

Regarding the differences between the single-agent and the team treatments, we refer to the phenomenon of social loafing. We expect the agents to feel less responsible for the principal's payoff in the team treatments which might reduce their motivation to give high transfers. Adapted from the theoretical considerations from section 2.2, we derive our next hypothesis:

Hypothesis 2:
We expect lower average transfers in the team treatments as in the single-agent treatment. Transfers decrease with an increasing size of group.

Hypothesis 2 just concerns the differences between the single-agent and team treatments. In the next step we focus on differences within the team treatments, because the main issue of our study affects agents' behavioral reaction to the restriction of the choice set in the team treatments. Therefore we have to combine the self-determination theory with the phenomenon of social loafing. As already mentioned, the effect of social loafing is a well-known issue which might occur due to a change in the context between the treatments. Hence, the principal might expect the agents to loaf in the team treatments and decides to control them in order to get at least 10 points. On the other side, the agents might expect the principal to anticipate the social loafing in teams because they know that they will loaf themselves. Presumably, most of the agents would have decided to control, too, if they had been assigned to the role of a principal. Thus, they understand the principal's decision. The restriction of the choice set appears in a different light to the agents if it is directed towards a team of agents and not to a single agent. In line with the self-determination theory, one could argue, that agents who would be controlled motivated in the single-agent treatment might become autonomous motivated in the team treatments. In other words, agents who might perceive the restriction of the choice set as a kind of distrust in the single-agent treatment and therefore decide to give a lower transfer in the case with control might change their point of view in the team treatments giving a higher transfer in the case when the principal controls.

Hypothesis 3:
In both team treatments, we expect the agents' average transfer to be higher if the principal decides to impose a lower bound to the transfer actions of the agent.

4 Experimental Procedure

The experiment was conducted at the Laboratory of Experimental Economics at the University of Cologne in May and December 2006 and January 2007. 176 participants had been recruited via the online recruitment system ORSEE (Greiner 2004), all of them students of different faculties of the University of Cologne. 60 participants took part in the base treatment with one principal and one agent, 56 participants in the team treatment consisting of one principal and three agents and 60 participants in the team treatment with one principal and nine agents per group. None of the students took part in more than one session. The experiment was programmed and conducted with the software z-tree (Fischbacher 1999). All sessions were played one-shot and lasted about thirty minutes. Students left the laboratory with an average payoff of 11€.

Our control treatment which is exactly the same as the base treatment of Falk/Kosfeld is a two-stage game with one principal and one agent. While the principal has no endowment, the agent starts with an endowment of 120 in the experimental currency "Taler" which is converted into Euro at the end of the game with an exchange rate of 0.1 €/Taler.

In the beginning the participants are randomly assigned to the role of a principal or an agent or – according to the neutral formulation in the experimental design – player A or player B. The principal has to decide which type of contract he wants to offer to the agent. In the first contract the agent has to choose a transfer x between [0, 1,…, 120] while in the second contract he has to give a transfer x between [10, 11,…, 120]. Thereby, with the choice of contract 2 the principal can minimize his risk by forcing the agent to give at least a transfer of $x=10$. The principal's payoff-function is given by $\pi_P = 2x$ and the agent's by $\pi_A = 120 - x$. As we used the strategy method, the agent chooses simultaneously to the principal's decision making the amount of x he wants to give for each contract type. When all participants have made their choices, the principal's decision is announced and the game is finished. After this, the students have to answer some questions concerning their age, gender or field and state of study.

In two further treatments we look at one principal and several agents, running one treatment with three and another treatment with nine agents per group. Now the principal has to decide for the whole group whether he wants to control or not. Neither treatment allows for any interaction between the agents. Every agent makes his own transfer decisions for both cases, being controlled or not. In the end of the experiment, one agent per group is randomly chosen to realize the principal's payoff. The principal gets twice the amount the randomly chosen agent decided to offer while the agents' payoffs depend on each agent's individual transfer decisions.

As mentioned above, the negative effect of control as shown by Falk/Kosfeld is at least partly due to the framing in the instructions. In order to control for the impact of the framing we therefore repeated the team treatments with both instructions.[5]

5 Experimental Evidence

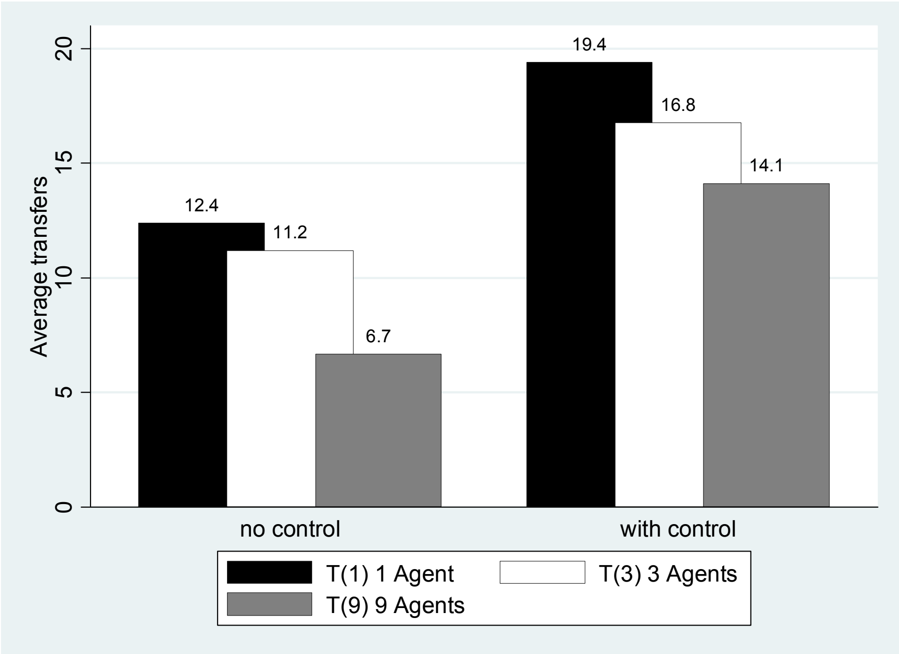
In the following section we focus on the results obtained by using our own instructions. Therefore we start our investigations by regarding the average transfers. As shown in figure 2, obviously in all treatments and in both conditions the transfers exceed the required minimum level of 0 respectively 10 Taler.

Result 1:
In all treatments, there is a substantial number of motivated agents who voluntarily offer a higher transfer as the required minimum.

In the next step we concentrate on differences between the single-agent and the multiple-agents settings. Therefore we call the single-agent treatment T(1), the team treatment with three agents T(3) and the team treatment with nine agents T(9).

[5] A comparison of the major differences between the instructions is shown in appendix A.

Figure 1: Average transfers per treatment



Average transfers decrease with an increasing number of team members in both conditions, with and without control. In the no-control case this is significant between T(1) and T(9) and between T(3) and T(9) (Mann-Whitney U-test, one-tailed, exact, both p=0.037) while in the control case the difference is only significant between T(1) and T(9) (Mann-Whitney U-test, one-tailed, exact, p=0.019). While in T(1) and T(3) in both conditions agents give in average a transfer above the threshold of 10 Taler, in T(9) average transfer in the no-control condition even falls down to 6.67 Taler. Hence, the impact of the size of group is essentially seen by comparing T(1) and T(9) where the number of agents per group arises from one to nine agents. Furthermore, we find a significant order in the medians between the three treatments (Jonckheere-Test, two-tailed, exact, p=0.039 without control and p=0.033 with control). Median transfers are highest in T(1) and lowest in T(9).

<u>Result 2</u>:

Average transfers are lower in the team treatments as in the single-agent treatment. The bigger the group, the lower are the given transfers.

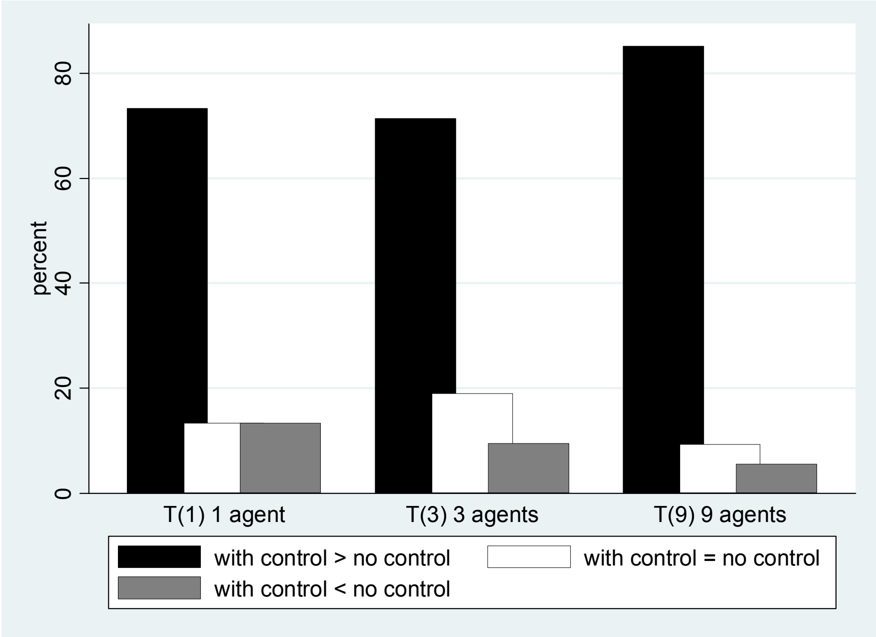
To analyze the impact of control within treatments we compare the averages between the control and no-control conditions. Figure 1 shows that in each treatment the average transfers with control exceed average transfers without control. These differences are highly significant in all treatments (Wilcoxon signed rank test, two-tailed, exact, $p<0.001$ in all treatments).

However, it might be necessary to control for the constrained nature of the choice set. In the constrained choice set, agents have to give at least 10 Taler, but in the unconstrained choice set they are allowed to give less than 10 Taler. It might be interesting to check whether the differences between the two conditions just appear for mathematical reasons. Therefore, we truncate the unconstrained choices to 10 by setting all transfers smaller than 10 equal to 10. If agents only give higher transfers in the control condition because they are forced to, there should be no difference in the distribution between the truncated unconstrained choices and the constrained choices. In fact, we cannot reject the null hypothesis of no difference between both conditions in all treatments (Wilcoxon signed-rank test). This leads to our third result:

<u>Result 3</u>:
We observe benefits of control in each treatment. Average transfers with control exceed average transfers without control.

Next, we want to investigate whether the influence of the restriction of the choice set on agents' behavior changes between the treatments. We examine the differences in transfers between the control and no-control condition by subtracting the transfer without control from the transfer with control per subject. The resulting variable should be negative if the agent's reaction to control is negative, i.e. the agent would be willing to offer a higher transfer if he was not controlled. According to this, if an agent gives a higher transfer with as without control, the resulting variable is positive. Figure 2 shows that in each treatment most of the agents give a higher transfer in the control condition.

Figure 2: Agents' reaction to the restriction of the choice set



The fraction of agents who are willing to give voluntarily more if they are not controlled is quite small and decreases from 13.33% in T(1) up to 5.56% in T(9). In contrast, the fraction of agents who offer higher transfers in the control condition increases from 73.33% in T(1) up to 85.19% in T(9). In each treatment, there are highly significant more agents giving higher transfers in the control condition compared to those who give less or equal transfers without control. (Binomialtest, two-tailed, p=0.016 in T(1), p=0.008 in T(3) and p=0.000 in T(9)). However, the distribution of agents' reaction does not significantly differ between the treatments (Fisher's test, exact).[6]

<u>Result 4</u>:

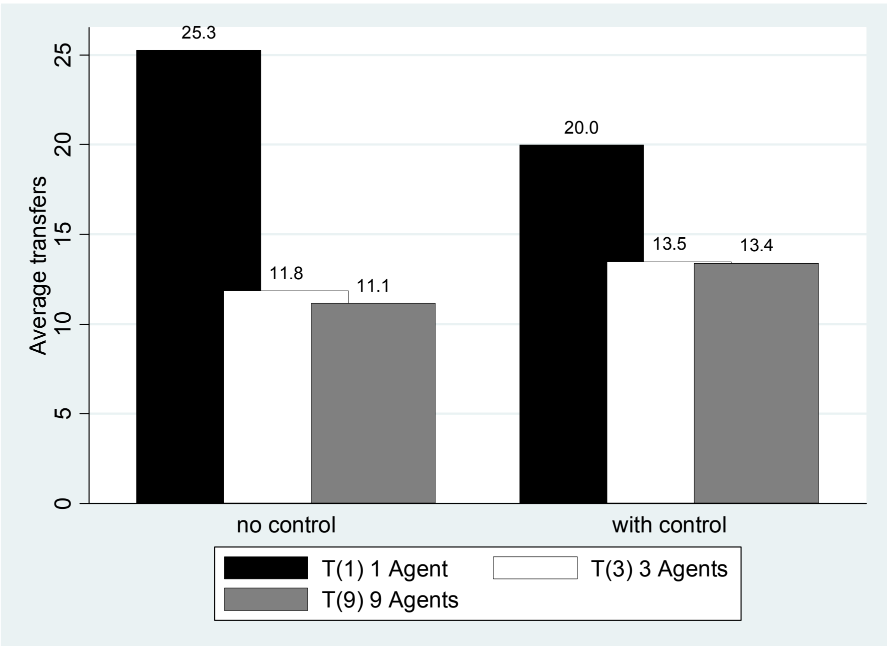
We observe no change in the influence of control on agents' behavior in bigger groups.

[6] A detailed overview of agents' reaction to control is given in appendix B.

6 Robustness of Results

As mentioned in the introduction the results of the single-agent treatment using our own instructions contradict those of FK's base treatment. We were not able to replicate the negative effect of the principal's decision to restrict the agent's choice set on agents' motivation. As this effect is at least partly due to the specific wording used in the instructions (Hagemann 2007), we also run both team treatments with the original FK-instructions which were slightly adapted to the team context. In the previous section we presented our experimental results disregarding the impact of the instructions. Now we analyze the results from the team treatments obtained by using the FK-instructions. Figure 3 gives an overview of the average transfers.

Figure 3: Average transfers per treatment using FK-instructions



Again, average transfers decrease with an increasing number of team members in both conditions. This time, with and without control these differences are significant between T(1) and T(3) (Mann-Whitney U-Test, one-tailed, exact, $p<0.01$ with and without control) and between T(1) and

T(9) (Mann-Whitney U-Test, one-tailed, exact, p<0.01 with and without control), but there are no significant differences between the two team treatments. We find the same order in the medians between the three treatments as by using our own instructions. Median transfers are highest in T(1) and lowest in T(9) with as well as without control (Jonckheere-test, two-tailed, exact[7], p=0.006 without control and p=0.015 with control).

Result 5:

Even with the FK-instructions, we observe social loafing in the team treatments.

Next, we analyze within treatment differences between the control and no-control condition. In contrast to the single-agent treatment, in both team treatments, the constrained choices exceed the unconstrained choices (T(3): 13.5>11.8, T(9): 13.4>11.1). But the only difference which is weakly significant is seen in T(9) (Wilcoxon signed-rank test, two-tailed, exact, p=0.059). Controlling for the constrained nature of the choice set, again we set all transfers smaller than 10 equal to 10 in the no-control condition which addresses 33.33% of the agents in T(1), 50.00% in T(3) and 53.70% in T(9). Interestingly, checking the differences with the truncated dates in the no-control condition, the differences between the two conditions are highly significant in all treatments (Wilcoxon signed-rank test, two-tailed, exact, p<0.01 in all treatments). Furthermore, there is a change in the relation of the transfers between the two conditions. In all treatments, average transfers are now significantly higher in the truncated no-control condition than in the control condition, as shown in table 1:

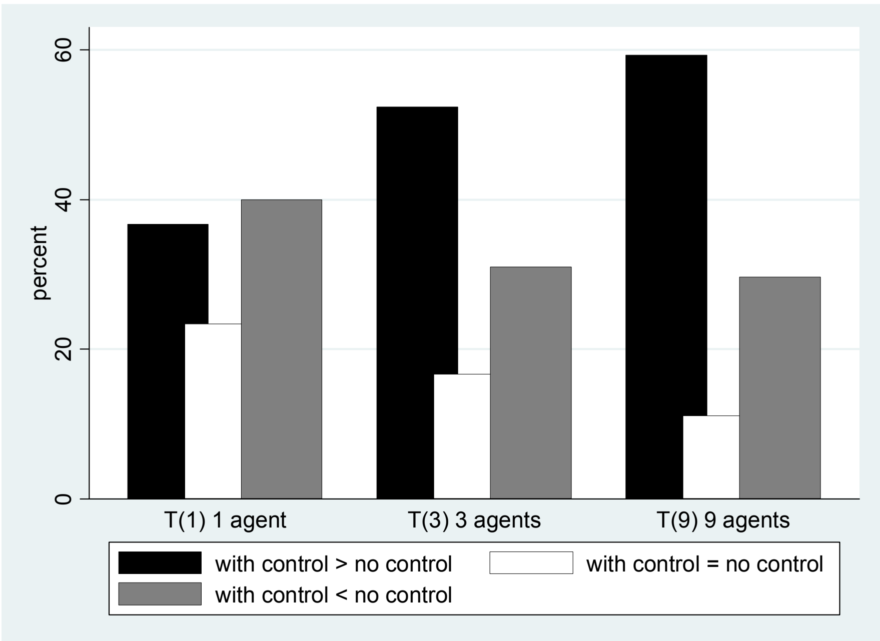
[7] In the no-control condition, we were just able to compute an asymptotic Jonckheere-test.

Table 1: Average transfers per treatment with
truncated transfers using FK-instructions

	no control [*10*, 1,…, 120]	with control [10, 11,…,120]
1 agent	**28.23**	**19.97**
3 agents	**16.02**	**13.48**
9 agents	**16.00**	**13.39**

To learn more about the relevance of this effect it might be helpful to regard agents' reaction to control by subtracting transfers without control from transfers with control per subject which is shown in figure 4: [8]

Figure 4: Agents' reaction to the restriction of the choice set
using FK-instructions



[8] A detailed overview of agents' reaction to control using the FK-instructions is given in appendix C.

This time, the fraction of agents who give higher transfers without control decreases from 40.00% in T(1) up to 29.63% in T(9), while the fraction of those agents willing to give a higher transfer in the control condition increases from 36.67% in T(1) to 59.26% in T(9). But in none of the treatments the part of agents giving a higher transfer with control significantly exceeds the part of agents giving more or equal in the no-control condition (Binomialtest). However, using the same test while dropping those agents who react indifferently in both conditions leads to a significant difference in T(9) (Binomialtest, two-tailed, p=0.029). Furthermore, we only observe one significant difference between the treatments, namely the part of agents giving higher transfers with control between T(1) and T(9) (Fisher's test, one-tailed, exact, p=0.039). But despite of the weak significances, in T(1) the share of agents with a negative behavioral pattern with respect to control exceeds the share of agents with a positive behavioral pattern, while this relation changes in the team treatments. Now there are more agents who are willing to give higher transfers in the control condition as in the no-control condition, which is comparable to result 2 from section 5.

However, in all treatments, more than 90% of those agents who give higher transfers with control also give a transfer that is lower than 10 in the no-control condition. Hence, the part of positively reacting agents to control is drastically reduced by truncating the distribution.[9] Now there are more agents who give higher transfers without control compared to those who give higher transfers with control which leads to higher average transfers in the no-control condition. These differences are highly significant in all treatments (Binomialtest, two-tailed, p<0.01 in all treatments). Dropping again those agents who react equally in both conditions after the truncation still leads to significant differences (Binomialtest, two-tailed, p=0.035 in T(1), p=0.021 in T(3) and p=0.027 in T(9)).

[9] Most of those agents who give a transfer below 10 in the no-control condition choose a transfer equal to 10 in the control condition. In particular, there are 93.44% in T(1), 95.24% in T(3) and 96.30% in T(9). Hence, most of the agents who react positively to control (giving 10 points in the control condition and lower than 10 in the no-control condition) give 10 points in both conditions after the truncation.

Result 6:

Using the FK-instructions, we observe a tendency of hidden costs of control in the single-agent treatment, because agents dishonor the principal's decision to restrict their choice set. However, this motivational effect disappears with an increasing group size. We observe benefits of control in teams.

7 Discussion

In this study we analyze the influence of control on agents' motivation in a team situation. Therefore we designed a simple experimental game following Falk/Kosfeld (2006) where the treatments differ in the size of the group of agents. We conducted one treatment with one agent (which is a replication of FK's base treatment), one with three agents per group and one with nine agents. As we did not implement a team-based compensation we avoided any free-riding problem. While the principal's profit was realized by selecting the decision of one randomly chosen agent per group, each agent's payoff just depended on his own decision-making.

The major objective of our study was to test whether the relevance of control defined as the principal's decision to set a minimum required transfer to the agents also holds in a team situation. The results show that agents in a team do not reduce their transfers as an effect of a loss in motivation which might be due to the principal's decision to control. Furthermore, we show that control is even more effective in larger groups because agents' transfer decreases systematically with an increasing group size.

As described in section 2, we try to explain agents' behavioral reaction in the team treatments with the phenomenon of *social loafing*. Thus, drawing on the psychological literature a loss in motivation and effort might occur because of a *lack of identifiability* of agents' performance, a *dispensability of their effort* or because of the so called *effort matching* where agents reduce their effort for equity or fairness reasons. While the differences between the treatment with one agent and the team treatment with three agents are not statistically significant, differences are significant between the extreme treatments with one and nine agents. Using the FK-instructions, we even find significant differences between one and three agents as well as between one and nine agents. This shows that indeed the size of group significantly influences agents' motivation. Even more, there seems to be no influence of the kind of instructions on agents' behavioral reaction in the multiple-agents treatments.

The findings in the present paper offer a rationale for the presence of control by supervisors. Even if there are approximately as many agents giving higher transfers with control as those giving higher transfers without control, the majority of agents in our experimental study just give the minimum required transfers. Nearly 45% of all agents give a transfer of 0 in the no-control condition and a transfer of 10 in the control condition. Even more, a loss in effort as a consequence of a loss in agents' motivation in teams seems to be avoidable by setting extrinsic motivators. Control as a mechanism to make team performance more efficient seems to be indispensable.

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Appendix

A: Comparison of instructions

Instructions used by Falk/Kosfeld	Own instructions
Before participant A decides how many points he wants to give to B, B can set a minimum transfer. Concretely, participant B is able to force participant A to give him at least 10 points. But he can also decide not to limit participant A and to leave him completely free to decide. So there are two cases:	Player A offers a contract to player B. He can choose between two different types of contract.
Case 1: Participant B forces participant A to transfer at least 10 points. In this case, participant A can transfer any amount between 10 and 120 to B.	Contract 1: Player B has to offer a transfer from the range of [0; 120].
Case 2: Participant B leaves participant A free to decide and does not force him to transfer at least 10 points. In this case, participant A can transfer any amount between 0 and 120 to B.	Contract 2: Player B has to offer a transfer from the range of [10; 120].

[Note: Original instructions are both in German, translation by the author].

B: Agents' reaction to control using own instructions

	1 Agent			3 Agents			9 Agents		
	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative
Number of agents	**22**	**4**	**4**	**30**	**8**	**4**	**46**	**5**	**3**
Relative share	**0.73**	**0.13**	**0.13**	**0.71**	**0.19**	**0.10**	**0.85**	**0.09**	**0.06**
Average x if controlled	**18.73**	**23.75**	**18.75**	**14.30**	**21.25**	**26.25**	**10.80**	**30.00**	**38.33**
Average x if not controlled	**7.59**	**23.75**	**27.50**	**4.50**	**21.25**	**41.25**	**1.20**	**30.00**	**51.67**

C: Agents' reaction to control using FK-instructions

	1 Agent			3 Agents			9 Agents		
	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative
Number of agents	**11**	**7**	**12**	**22**	**7**	**13**	**32**	**6**	**16**
Relative share	**0.37**	**0.23**	**0.40**	**0.52**	**0.17**	**0.31**	**0.59**	**0.11**	**0.30**
Average x if controlled	**12.91**	**36.43**	**16.83**	**11.95**	**21.43**	**11.77**	**11.28**	**22.50**	**14.19**
Average x if not controlled	**4.18**	**36.43**	**38.08**	**3.14**	**21.43**	**21.38**	**2.34**	**22.50**	**24.50**

D: Experimental Instructions (own version)

[Note: Original instructions are in German. Expressions in brackets are just shown in the team treatments.]

Periods and Parts

- The experiment takes one period.
- You will form a group with another player [with three (nine) other players], so that every group consists of two [four (ten)] players. However you will not know the identity of the other group member[s].
- The members of one group will adopt different parts: There is one Player A and one [three (nine)] Player[s] B. These parts will be randomly assigned to each participant at the beginning of the experiment.

Course of Period

Decision of Player A

- Player A offers a contract to [each] Player B. He can choose between two different types of contracts:
  - Contract type I: [Each] Player B has to offer a transfer from the range of [0;120]
  - Contract type II: [Each] Player B has to offer a transfer from the range of [10;120]

Decision of Player B

- At the same time, [each] Player B will specify his transfer for each type of contract depending on Player A's decision of choosing contract type I or II. So [every] Player B will specify his possible transfers within the given interval of each type of contract, before he will be informed about Player A's decision on contract type I or II.

  Transfers may only be specified in form of whole numbers.
- The pay-outs will only be determined by Player B's transfer for the type of contract, which is actually chosen by Player A.

Realization of Profits

- Only after [all] Player[s] B has [have] specified his [their] individual transfers for each type of contract, Player A's actual decision on the type of contract will be announced.
- [Each] Player B's profit will consist of his starting capital of 120 Taler minus his transfer for the type of contract previously chosen by Player A.
  - Profit for [each] Player B= 120-transfer
- [Player A's profit will be determined by the decision of one randomly chosen Player B of the same group]. Player A will receive the double amount of [this randomly chosen] Player B's transfer for the type of contract previously chosen by Player A.
  - Profit for Player A = 2 x transfer of [one random] Player B [of the same group]

Starting Capital and Final Pay-out

- At the beginning of this experiment every Player B will be provided with a starting capital in form of the experimental currency of 120 Taler. Players A will not receive any starting capital. At the end of this experiment every participant will receive his achieved profit converted into Euros with an exchange rate of 0,10 € for one Taler. Additionally, every participant will receive a show up fee of 2,50 €.

Important Instructions:

- No communications will be allowed except via the experimental software.
- All decisions will be anonymous, so that no other participant will be able to link a decision to any other participant.
- The pay-out will also be anonymous, so that no participant will find out the pay-out of any other participant.
- The instructions will be collected after the experiment is finished.

Good luck.

E: Experimental Instructions (Falk/Kosfeld version)

[Note: Original instructions are in German. Expressions in brackets are just shown in the team treatments.]

You are about to take part in an economic experiment, which is financed by the Deutsche Forschungsgemeinschaft.

Please read the instructions carefully. Everything you need to know for this experiment will be explained to you. In case you have any questions, please notify so. Your questions will be answered at your desk. All other communication is strictly forbidden throughout the whole experiment.

At the beginning of the experiment, every participant will receive a show up fee of 2,50€. You will be able to earn additional points during the experiment. All points earned during the experiment will be converted into Euros at the end of the experiment. The exchange rate is the following:

1 point = 10 Cent

At the end of the experiment you will receive your income, which you have earned during the experiment, plus the 2,50€ show up fee in cash.

The Experiment

In this experiment one [three (nine)] participant[s] A and one participant B will form a group of two [four (ten)]. No participant will know the other member[s] of his group, so all decisions will be made anonymously.

You are participant A (B).

At the beginning of the experiment every participant A will receive 120 points.

Participant B will not receive any points.

Decision of participant A:

[Every] participant A can choose, how many points he wants to transfer to participant B. Every point transferred from A to B will be doubled by the experimenters. Every point transferred from A to B therefore decreases A's income by one point and increases B's income by two points. [To determine participant B's earnings the decision from one participant A out of the group of four (ten) will be randomly picked.]

The formula for the earnings look like this:

Earning of participant[s] A: 120 – transfer

Earnings of participant B: 0 + 2*transfer [of one randomly picked participant A of the same group]

The following examples will clarify the formulas for the earnings:

Example 1: [The randomly picked] A transfers 0 points to B. The earnings will be 120 for A and 0 for B.

Example 2: [The randomly picked] A transfers 20 points to B. The earnings will be 100 for A and 40 for B.

Example 3: [The randomly picked] A transfers 80 points to B. The earnings will be 40 for A and 160 for B.

Decision of participant B:

B can determine a minimum transfer, before [every] participant A has chosen, how many points he wants to transfer to participant B. In particular, participant B could force [all of his] participant[s] A to transfer at least 10 points to B. But participant B can also choose not to force [his] participant[s] A to any minimum transfer and thus to leave the decision completely free to participant[s] A.

There are two possible cases:

Case 1: Participant B forces participant[s] A to transfer at least 10 points to B. In this case [each] participant A may transfer any whole numbered amount **between 10 and 120** to B.

Case 2: Participant B leaves the decision free to participant[s] A and does not force him [them] to transfer at least 10 points to B. In this case, participant[s] A may transfer any amount **between 0 and 120** to B.

The experiment therefore consists of two steps:

Step 1:

In the first step, participant B decides, either to force participant[s] A to a minimum transfer of 10 points or to leave free the decision on the amount to be transferred. [B has to make the same decision for all three (nine) participants A of his group. So he either forces all three (nine) participants A or he lets all three (nine) A's decide freely.]

Step 2:

In the second step, [every] A decides on the amount, which he wants to transfer to B. This may be an amount

- between 10 and 120, in case B has forced participant[s] A to transfer at least 10 points to B.

or

- between 0 and 120, in case B has not forced participant[s] A to transfer at least 10 points to B.

After [every] participant A has decided on how many points he wants to transfer to B [one participant A out of the group of four (ten) will be randomly picked. This participant A's decision on the amount transferred to B determines participant's B earnings] the experiment is over.

(Note: the following part is only contained in the instructions for participant A. Participant B received the instructions, "The decisions of A and B will be entered on the monitors at the computers.")

Please take notice: As participant A you have to decide on the amount to be transferred to B **before you know, whether B does force you to transfer at least 10**

points or whether he does not [and before you know, whether your decision will be chosen to determine B's earnings]. This means, you have to make two decisions. You will submit your decision through the following screen:

You are participant A.

You have 120 points. Participant B has 0 points.
You may transfer points to participant B.
Every single point you transfer, will be doubled by the experimenters.

Case 1: In case, Participant B forces you to a minimum transfer of 10 points:
How many points do you transfer in this case? x points

Case 2: In case, Participant B leaves the decision completely to you:
How many points do you transfer in this case? x points

So you will specify how many points you will transfer to B, in case B forces you to transfer a at least 10 points (case 1) and in case B leaves the decision to your free choice (case 2).

Which of the two decisions is relevant for the payout, will be determined by B's decision. In case B forces you to transfer him at least 10 points, your decision specified for case 1 will count. In case B leaves the decision to your free choice the amount of points specified for case 2 will count.

(Note: From here on, there are again identical instructions for both participants.)

A screen at the end of the experiment will inform you about the decisions made and the earnings resulting from these decisions.

Your earned points will be exchanged into Euros and paid out to you in cash, together with the show up fee.

Do you have any questions?

Please solve the following control questions. The answers have no consequences on your earnings. Their only purpose is to check that every participant has understood the rules of the experiment.

Question 1: Assumed participant B leaves the decision to participant A. A transfers 22 points to participant B. What are their earnings?

Earning A:

Earning B:

Question 2: Assumed, participant B forces participant A to transfer at least 10 points to B. A transfers 12 points to participant B. What are their earnings?

Earning A:

Earning B:

Question 3: Assumed, participant B leaves the decision to participant A. A transfers 6 points to participant B. What are their earnings?

Earning A:

Earning B:

[Question 1: Assumed participant B leaves the decision to participants A. The first A transfers 22 points, the second A 30 points and the third A 10 points to participant B. The first A's decision is randomly picked to determine participant B's earning. What are their earnings?

Earning First A:

Earning Second A:

Earning Third A:

Earning B:

Question 2: Assumed, participant B forces participants A to transfer at least 10 points to B. The first A transfers 20 points, the second A 12 points and the third A 30 points to participant B. The second A's decision is randomly picked to determine participant B's earning. What are their earnings?

Earning First A:

Earning Second A:

Earning Third A:

Earning B:

Question 3: Assumed, participant B leaves the decision to participants A. The first A transfers 15 points, the second A 25 points and the third A 6 points to participant B. The third A's decision is randomly picked to determine participant B's earning. What are their earnings?

Earning First A:

Earning Second A:

Earning Third A:

Earning B:]