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Identification of individuals and groups in a public goods experiment☆

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ABSTRACT

Revealing the identities of contributors has been shown to increase cooperation in public goods games. In this paper we experimentally investigate whether this finding holds true when decisions are made by groups rather than individuals. We distinguish between groups in which members can discuss face-to-face to reach a decision and groups in which members communicate via computer chat. The results confirm the positive effect of identification on cooperation among individuals. For groups, however, we only find a small and temporary effect of identification, irrespective of the type of communication.

1. Introduction

People often behave more socially oriented when their actions are observable by others. For example, visitors to a national park contribute more to the maintenance of the park when the solicitor can see the contribution (Alpizar, Carlsson & Johansson-Stenman, 2008). Energy consumers are more likely to take part in a blackout prevention program when their decision can be observed by their neighbors (Yoeli, Hoffman, Rand & Nowak, 2013). Church goers donate more when the offering can be observed by the persons sitting next to them (Soetevent, 2005). Citizens are more likely to vote when there is a high chance that this decision is observed by others (Funk, 2010). Experiments have shown that cooperation in public goods games increases when the players' identities and their actions are revealed to the other players (Andreoni & Petrie, 2004; Rege & Telle, 2004).

Given people's sensitivity to identification and observance by others, increasing transparency can be an effective way to improve cooperation. For instance, Finland publishes information about its citizens' taxable income in order to reduce tax avoidance.[1] But does this result also hold for group behavior? Are groups, like individuals, sensitive to the observance and potential approval or disapproval by others? To the best of our knowledge, these questions have not been answered yet, although many important economic, financial, and political decisions are in fact made by groups rather than individuals. Examples include decisions by households, firms, governments, delegation teams, nongovernmental organizations, or unions. It has long been known in social psychology that groups behave differently than individuals. The concept of "deindividuation" describes how anonymity and diffusion of responsibility within groups lead to less restrained and more impulsive and aggressive behavior (Festinger, Pepitone & Newcomb, 1952; Zimbardo, 1969). Groups show more competitive behavior in social dilemma situations than individuals which has been labeled the "interindividual-intergroup discontinuity effect" (Insko & Schopler, 1998; Wildschut, Pinter, Vevea, Insko & Schopler, 2003). A growing behavioral economics literature shows that groups learn more quickly, make more sophisticated and payoff-oriented decisions, and are less influenced by cognitive limitations, behavioral biases, and social considerations (for reviews see Charness & Sutter, 2012; Kugler, Kausel & Kocher, 2012).

Despite the growing interest in group behavior, little is known about the effects of identification on groups. Previous research has shown that, while identification of individuals intensifies emotions and moral

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reactions towards them (Kogut & Ritov, 2005a; Small & Loewenstein, 2003, 2005), identification of groups does not have the same effects (Kogut & Ritov, 2005b). However, this research only shows how observers respond but not how groups themselves respond to their identification. Shepherd, Spears and Manstead (2013) show that members of a group feel less shame for a questionable group decision the more they identify with the group. This study, however, neither provides a comparison between individuals and groups nor a comparison between identified and unidentified actions.

In this paper, we investigate the effects of identification on cooperation among individuals and groups in a controlled experimental setting. This approach allows us to create clear counterfactual situations without identification and to compare the behavioral responses of individuals and groups. We first compare the willingness to cooperate of individuals and groups in a finitely repeated public goods game in which no identifiable information about players is displayed. The public goods game is played either by four individuals or by four groups consisting of four individuals each and acting as a unitary player. In half of the groups, members communicate face-to-face to reach a decision while in the other half of the groups, members communicate anonymously via computer chat. All groups are required to discuss the problem and make consensus decisions. We then increase the transparency in the game by revealing the players' identities and actions. Following the approach of Andreoni and Petrie (2004) and Samek and Sheremeta (2014, 2016), we use digital photos to identify individuals and teams. At the end of every round, photos of the individuals or teams are displayed along with their contributions to the public good. Subjects know about this procedure in advance and can adjust their contributions if they wish. The two types of communication among group members, face-to-face and computer chat, represent two different group decision processes. Face-to-face communication represents a process where members openly discuss the available strategies and jointly make a decision. The members of the group know each other and what each of them contributes to the final decision. Computer chat communication represents a process where the members of a group decide jointly but the individual members' input remains anonymous. Therefore, they do not have much more information than outsiders.

We predict that groups react less sensitively to the disclosure of identities than individuals do. As members of a group share the responsibility and accountability for a decision, they do not feel singled out for doing something inappropriate. They can support and convince each other that they have made an appropriate decision for which there is no need to be concerned about others' disapproval. This opportunity does not exist for an individual decision maker. Furthermore, groups may expect less (unspoken) disapproval from other groups than individuals expect from other individuals. It is well known that individuals dislike being the "sucker" and that they get angry and frustrated when they have been exploited by others (Ahn, Ostrom, Schmidt, Shupp & Walker, 2001; Kurzban, McCabe, Smith & Wilson, 2001). Individuals can thus be expected to strongly disapprove of free-riders. The feelings of frustration and anger may be less intense for groups because the members share the fate.

Our experimental results largely confirm the prediction. Revealing identities significantly improves cooperation among individuals while the effect for groups is relatively small and does not last, irrespective of the type of communication. Without identification, groups contribute more to the public good than individuals. In particular at the beginning of the game when it is unclear what the other players will do, groups are more willing to risk a high contribution. However, groups increase their contributions only slightly and temporarily when their identities are revealed to the other groups. Individuals, by contrast, make significantly higher contributions when their identities are revealed and the increase persists. This confirms that revealing identities and the mere suspicion that others may disapprove of one's behavior constitute strong incentives for individuals to behave more socially oriented. The novel insight is that this effect is smaller for groups.

The remainder of the paper proceeds as follows: Section 2 provides the background for our study, summarizing previous findings from social psychology and behavioral economics. Section 3 explains the experimental design. Section 4 presents the results, Section 5 discusses the results and concludes.

2. Background

As background for our study, this section will summarize previous findings on the influence of identification and disapproval on social behavior and the differences between individuals and groups.

One of the most robust results of research on human cooperation is that cooperation improves when actions are observable. Making actions observable has significant positive effects in settings as diverse as blood donation, blackout prevention, support for national parks, church offerings, or voting in small communities (for reviews, see Kraft-Todd, Yoeli, Bhanot & Rand, 2015; Rand, Yoeli & Hoffman, 2014).

Also laboratory experiments have shown that cooperation in public goods games improves significantly when the players have to convey their contributions to the other players after the game (Rege & Telle, 2004) or when a photo of them is shown along with their contributions (Andreoni & Petrie, 2004). The photos have a much smaller effect when they are published without the contribution decisions (a similar result was obtained by Brosig, Weimann & Ockenfels, 2003). Building on these findings, Samek and Sheremeta (2014) show that the positive effect remains when only the two lowest contributors are shown, but disappears when only the two highest contributors are shown, indicating that shame associated with having given less than others is a stronger motivation than prestige which can be gained by contributing more than others. Similarly, allowing subjects to communicate their disapproval increases pro-social behavior. Subjects behave more cooperatively when they can send disapproval points (Masclet, Noussair, Tucker & Villeval, 2003) or judgmental messages to each other after the game (López-Pérez & Vorsatz, 2010; Peeters & Vorsatz, 2013), even when the feedback has no direct effect on payoffs. The opportunity to give feedback also increases transfers in dictator games (Andreoni & Rao, 2011; Ellingsen & Johannesson, 2008). Taken together, this research suggests that, given individuals' sensitivity to observance and potential disapproval by others, increasing transparency can be an effective way of improving cooperation. It is not yet clear, however, if this is also the case for groups.

Recent reviews of the experimental literature have concluded that group behavior tends to be closer to standard game theoretical predictions than individual behavior (Charness & Sutter, 2012; Kugler et al., 2012). For instance, groups have been shown to send less money in the trust game (Kugler, Bornstein, Kocher & Sutter, 2007), to make and accept smaller offers in the ultimatum game (Bornstein & Yaniv, 1998), to behave more rationally in a bargaining game (Vollstädt & Böhm, 2019), and to give less in the dictator game (Luhan, Kocher & Sutter, 2009). Groups have also been shown to be less cooperative in prisoners' dilemma games (Insko & Schopler, 1998; Wildschut et al., 2003) or common-pool resource games (Gillet, Schram & Sonnemans, 2009). The lower cooperativeness has been explained by the ability of groups to justify selfish decisions (social support of shared self-interest hypothesis), to create a shield of anonymity and diffuse responsibility (identifiability hypothesis), and to anticipate the selfishness of other groups (schema-based distrust hypothesis). But there are also some reasons to expect groups to be more cooperative than individuals. It is well known that the fear to be exploited by others is an important barrier for individuals to cooperate (Ahn et al., 2001; Kurzban et al., 2001). Many people are conditional cooperators, meaning that they are willing to cooperate only if others do so, too. Thus, when it is unclear how the other players will act, cooperation is a risky decision. Groups have been shown to be better at handling risk than individuals (Rockenbach, Sadrieh & Mathauschek, 2007) and they may be more prepared to cooperate under strategic uncertainty. Also, as mentioned

before, the feeling of being the "sucker" may be less disturbing for groups as it is shared among the members. Another possible reason why groups may be more cooperative than individuals is provided by the social comparison theory. According to this theory, people are motivated to present themselves in a more favorable way than they expect others to be (Cason & Mui, 1997). An individual who chooses to free ride when deciding alone may be reluctant to recommend this action when discussing within a group. Finally, groups might be better able to reason through a repeated game, anticipate other players' behavior, and choose a strategy that gives a higher overall payoff. Müller and Tan (2013), for example, find that groups are more cooperative and earn higher payoffs in a repeated Stackelberg market game than individuals. So far, only two studies compared individuals and groups in a repeated public goods game. Auerswald, Schmidt, Thum and Torsvik (2018) find that groups contribute more to the public good than individuals, whereas Huber, Model and Städter (2019) do not find a significant difference between individuals and groups. The difference between the two studies may be explained by the different group size (3 versus 2). Both studies find that groups punish less and earn higher payoffs when the game includes a punishment mechanism. In short, although most studies point to more self-interest in groups, many aspects of group behavior are still not fully understood. This is clearly the case for group behavior in finitely repeated public goods games where only little research has been done so far.

Another relevant difference between individuals and groups pertains to how people perceive and react to their identification. Identified individuals generally evoke stronger emotions and moral reactions than non-identified individuals. This can lead to more generous behavior towards identified victims or more punitive behavior towards identified wrongdoers (Kogut & Ritov, 2005a; Small & Loewenstein, 2003, 2005). These effects of identification have not been found for groups (Kogut & Ritov, 2005b). These findings support the conjecture mentioned above that there may be weaker and less emotional disapproval among identified groups than among identified individuals.

To the best of our knowledge, there is no study that has looked into the effects of revealing the identities of unitary groups. A few studies have explored related questions. Using a prisoners' dilemma, Insko et al. (1987) show that groups behave more cooperatively when, prior to the game, all members from both groups meet and discuss than when only two representatives meet. Identification might play a role for this positive effect of social contact but it is impossible to distinguish it from the other aspects of social contact such as communication or familiarity. In a related study, Schopler et al. (1995) find that groups cooperate more when they can hear not only the names and decisions from the members of their own group but also from the members of the opposing group. The difference to our study is that, instead of revealing the identity of the whole group as a unitary decision maker, the identities and decisions of the individual members are revealed. Another difference is that identification is done through voice and not a picture. Hauge and Rogeberg (2015) show that representatives who act on behalf of groups contribute more to a public good when there is a chance that they will have to make their decision public. This effect is stronger for men than for women. The difference to our study is that individuals do not make a decision within a group but on behalf of a group. This is an important difference because these decisions are still individual decisions and not group decisions.

3. Experimental design

We consider an n-player linear public goods game. In each round of the game (there is a finite number of repetitions), n symmetric players who are endowed with y tokens each may contribute to the production of a public good. Each player's contribution costs are assumed to depend only on the own contribution level while the benefits depend on the total provision of the public good. The payoff function for player i is given by

$$\pi_i = y - g_i + a \sum_{j=1}^{n} g_j \tag{1}$$

where g_i is i's contribution to the public good with $0 \leq g_i \leq y$ and a denotes the constant marginal per capita return from contributing to the public good with $0 < a < 1 < na$. The full cooperative public goods contribution level that maximizes social welfare is given by $g_i^{FC} = y \ \forall \ i$. However, under the standard economics assumption of rational payoff-maximizing agents, the only subgame perfect Nash equilibrium in the finitely repeated game is given by $g_i^{NC} = 0 \ \forall \ i$. The Nash equilibrium involves dominant strategies such that each player's choice does not depend on the contribution levels chosen by the remaining players.

In all of our experimental treatments, $n = 4$ players played the public goods game for ten rounds with $y = 100$ and $a = 0.4$. Depending on the treatment, a player was represented either by an individual or a unitary group of four persons. We chose relatively large groups in order to give the members a real chance to hide within the group, even when identities are revealed. The experimental sessions were held in a computer lab (MaXLab) at the University of Magdeburg, Germany, using undergraduate students recruited from the general student population. The experiment was organized and recruited with the software hroot (Bock, Baetge & Nicklisch, 2014).

Overall, 720 students participated in the experiment, whereby each student took part in one treatment only. We conducted six treatments which are summarized in Table 1: (1) a treatment in which players decided individually and no information about players was revealed (*Indi-NoPic*), (2) a treatment in which players decided individually and information about each individual's identity was revealed to all players (*Indi-Pic*), (3) a treatment in which players decided as a four-person team with face-to-face communication and no information about the teams was revealed (*F-Team-NoPic*), (4) a treatment in which players decided as a four-person team with face-to-face communication and information about each team was revealed to all players (*F-Team-Pic*), (5) a treatment in which players decided as a four-person team with computer chat communication and no information about the teams was revealed (*C-Team-NoPic*), (6) a treatment in which players decided as a four-person team with computer chat communication and information about each team was revealed to all players (*C-Team-Pic*).

Following the design of Andreoni and Petrie (2004) and Samek and Sheremeta (2014), we used digital photos to identify individuals and teams to one another. Digital photos show the appearance but do not allow for communication between players, which may confound the effects of identification alone. In addition to the photo, first names were included as part of the identification of players. Upon arriving at the lab, each subject got a printed name card with his or her first name and hold up the name card while the photo was taken. In the individual treatments and the team treatments with computer chat, we took a photo of each individual separately because players in the same group and members of the same team were not supposed to meet each other. Team members in the treatments with face-to-face communication, on the other hand, were supposed to meet each other, so in these cases we took a photo of the whole team. Care was taken that the faces displayed on all photos had about the same size, so it was not the case that the

Table 1
Treatments.

Treatment	Picture	Decision making	Communication within teams	Number of subjects	Number of observations
Indi-NoPic	No	Individual	–	40	10
Indi-Pic	Yes	Individual	–	40	10
F-Team-NoPic	No	Team	Face-to-face	160	10
F-Team-Pic	Yes	Team	Face-to-face	160	10
C-Team-NoPic	No	Team	Computer chat	160	10
C-Team-Pic	Yes	Team	Computer chat	160	10

individual photos showed subjects more prominently than the team photos (see Appendix for samples).

Participants in the individual treatments were randomly assigned into groups of four players to play the game and they stayed together for the ten rounds of play. Similarly, in the team treatments, teams of four persons were formed randomly and then four teams were randomly assigned into a meta-group to play the public goods game. The four persons within a team and the four teams within the meta-group stayed together throughout the game. In all treatments, contribution decisions in each round were made simultaneously. After all players made their contribution decisions, the total amount of the public good was displayed as well as the contribution made by each player or team, sorted from the largest to the smallest amount. In the treatments *Indi-NoPic, F-Team-NoPic*, and *C-Team-NoPic*, no additional information about the players was revealed (not even an ID number). In the treatments *Indi-Pic, F-Team-Pic*, and *C-Team-Pic* the names and photos of every individual or team were displayed next to their contribution. This way, each individual or team was recognized and also ranked according to their contribution to the public good from the largest to the smallest amount. In *C-Team-Pic*, the four individual photos were shown next to each other, jointly forming a team photo.

During the game, earnings were presented in tokens. In the individual treatments, 100 tokens converted to €1. In the team treatments, 100 tokens converted to €4 and earnings were distributed equally among team members. In each session, subjects were seated at linked computers to play the game (software z-Tree; Fischbacher, 2007). In the team treatments with face-to-face communication, each team had its own room where the members could openly talk face-to-face. Each team member had his or her own computer. In the team treatments with computer chat, team members also had their own computer but they had no visible or other contact with each other, except of the anonymous computer chat which was open throughout the game.[2] In all team treatments, members of a team were asked to discuss the contribution decision in a civilized way (without using threats or insults) and make a decision within five minutes. In the team treatments with computer chat communication, members were also told that they must not identify themselves, and they adhered to this rule. To ensure consensus decisions during the game, each team member had to enter the same contribution for the computer to accept the team decision. If any one member deviated, the computer did not accept the decision and all team members had to start anew.[3] Note that this feature makes our design particularly conservative. It ensures that teams made consensus decisions where each member had to agree. Allowing for majority voting where members can be overruled should increase the difference between teams and individuals because it further obscures responsibility among team members.

The experiment included two short questionnaires, one before subjects knew about the game and another one after they had played the game. In the ex-ante questionnaire, subjects were asked about their personal background and some attitudinal characteristics, including gender, trust, and beliefs about others' selfishness. An important question was how much they care about what other people think about them which they could answer on a scale from 1 being "not at all" to 10 being "very much." This question was included to elicit subjects' concerns about their image. After this questionnaire, a set of written instructions was handed out which explained the game and included several numerical examples and control questions (see Appendix for instructions). The control questions tested subjects' understanding of the payoff function given in (1) to ensure that they were aware of the payoff-maximizing strategy and the dilemma situation. The game only began after all subjects read the instructions and answered the control questions correctly. After the game, subjects were asked to complete a second questionnaire which asked about their motivations and emotions during the game. While the teams with face-to-face communication were allowed to talk during the game, they were requested to read the instructions and complete the control questions as well as the two questionnaires individually and in silence, which they did. After the final questionnaire was completed, the subjects were paid their earnings in cash. Care was taken that individuals and teams left the lab one by one so that they did not meet or see each other.

4. Results

4.1. Contributions to the public good

The left panel in Fig. 1 shows the average contributions across rounds by treatment. The *Indi-NoPic* treatment shows by far the lowest contributions with 25.7 tokens on average (out of 100 tokens). Individuals in the *Indi-Pic* treatment contributed more than twice as much, namely 53 tokens on average. A Mann-Whitney-Wilcoxon (MWW) test shows that the difference between the two treatments is statistically significant ($N = 20$, $P = 0.0257$).[4] This result confirms the findings from the previous literature that revealing contributors' identities significantly increases cooperation among individuals (Andreoni & Petrie, 2004; Samek & Sheremeta, 2014).

Teams in the *F-Team-NoPic* treatment allocated on average 45.9 tokens to the public good and teams in *C-Team-NoPic* contributed 46.2 tokens on average. Compared to *Indi-NoPic* this is an increase of approximately 80%, and the differences are at least weakly significant ($N = 20$, $P < 0.10$ each). Thus, irrespective of the type of communication, teams contribute more than individuals when identification is not possible which has also been observed by Auerswald et al. (2018).

When identities were revealed, teams in *F-Team-Pic* contributed 56.3 tokens on average which is an increase of 23% compared to *F-Team-NoPic*. Teams in *C-Team-Pic* contributed 64.4 tokens on average, 39% more than the teams in *C-Team-NoPic*. The differences in average contributions due to the revelation of identities are much smaller for teams than for individuals (the increase for individuals is 106%) and they lack statistical significance ($N = 20$, $P > 0.10$ each). We find no significant differences between the teams with face-to-face communication and the teams with computer chat communication, neither when identities are kept private nor when identities are revealed ($N = 20$, $P > 0.10$ each). Thus, whether the discussion takes place face-to-face or via computer chat appears to matter little for cooperation. This result is in contrast to Kocher and Sutter (2007) who found more generous behavior with face-to-face communication than with communication through the computer, but in their experiment the computer communication was not only anonymous but also restricted to proposals and votes. As there are no significant differences between the teams with different types of communication, we can pool *F-Team-NoPic* and *C-Team-NoPic* into *Team-NoPic* and pool *F-Team-Pic* and *C-Team-Pic* into *Team-Pic*, and test again if identification has an effect. With the larger data set, we find a weakly significant difference between *Team-NoPic* and *Team-Pic* ($N = 40$, $P = 0.0834$). This shows that identification has an effect on teams, too, but the size of the effect is much smaller and the statistical significance is weaker than for individuals.

[2] In the computer chat, subjects were denoted by numbers which could not be linked with the photos. The chat was open in every stage of the game and closed between the stages. When a member of the team left the stage in order to proceed to the next stage, all remaining team members were informed that one member has left the stage.

[3] All teams were able to reach a common decision within the time limit.

[4] Unless stated otherwise, we use the meta-group as unit of observation in the statistical tests. That means, four individuals constitute an observation in *Indi-NoPic* and *Indi-Pic* and four teams (16 individuals) constitute an observation in *F-Team-NoPic, F-Team-Pic, C-Team-NoPic*, and *C-Team-Pic*. We use two-sided tests throughout the paper.

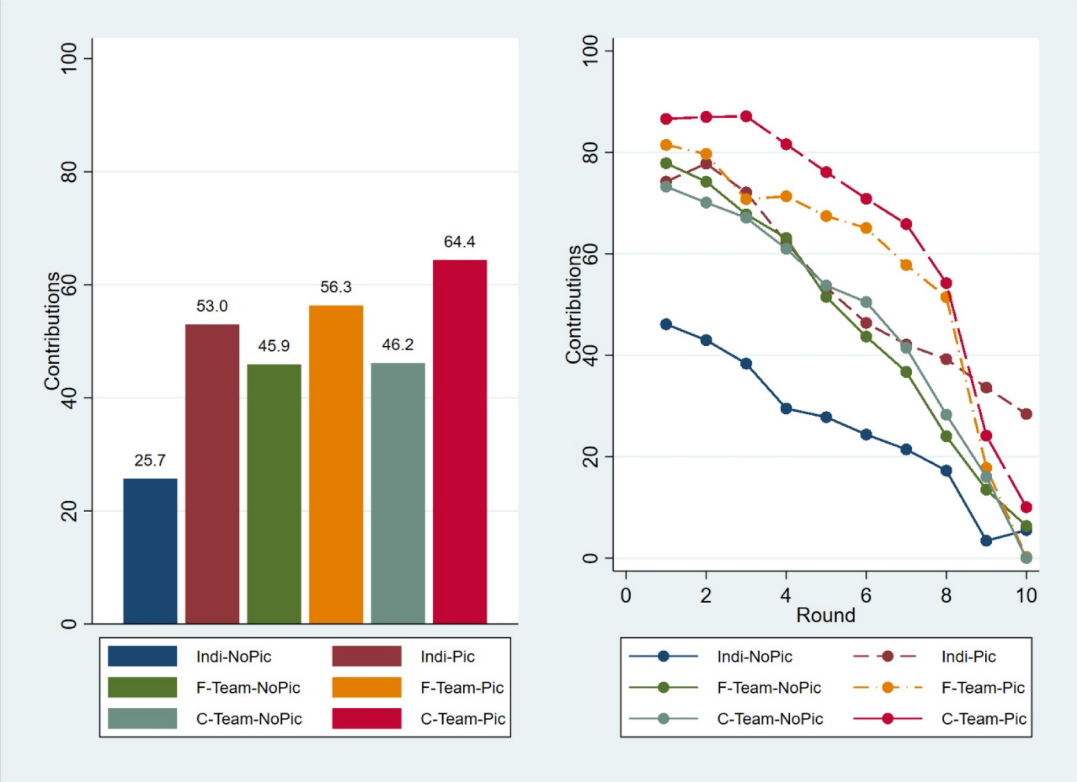

Fig. 1. Average contributions across rounds and over time by treatment.

As teams contribute more than individuals in the anonymous game, the smaller effect of identification on teams may be due to a mere ceiling effect. In the following, we will show that this may be true at the beginning of the game but not towards the end. The right panel in Fig. 1 shows how average contributions in the different treatments develop over time. As has been observed in many other public goods experiments, average contributions decrease over time in all six treatments. However, the initial contribution level and the slope of the downward trend differ. The first round is particularly interesting because players had to choose their contributions without any information about what the other players might do. Therefore, we can consider each player and each team as an independent observation in the statistical tests for the first round. Subjects in *Indi-NoPic* started the game carefully with relatively low contributions in the first round (46.1 tokens on average), arguably to avoid the risk of being exploited by others. Subjects in *Indi-Pic*, by contrast, started the game at a much higher contribution level (74.3 tokens), which represents an increase of 61%. A Mann-Whitney-Wilcoxon test at the player level reveals that the difference in the first round is highly significant ($N = 80$, $P = 0.0005$). The difference between the two treatments remains relatively stable until the end of the game. Interestingly, *Indi-Pic* is the only treatment in which subjects managed to stay well above zero contributions in the last round (28.4 tokens). Thus, the disclosure of identities has an immediate and lasting effect on individual contribution decisions.

Without identification, teams contributed more than individuals, especially at the beginning of the game. In the first round, teams in *F-Team-NoPic* contributed 77.9 tokens and teams in *C-Team-NoPic* contributed 73.3 tokens on average. Teams appeared more willing to risk a high contribution at the start of the game when the contributions by the other players were not yet known. However, the difference between teams and individuals decreased over time and vanished by the end. In the last round, teams in *F-Team-NoPic* contributed only 6.3 tokens on average and the teams in *C-Team-NoPic* contributed almost zero.

Teams in *F-Team-Pic* and *C-Team-Pic* also started at a high level (81.5 tokens and 86.6 tokens, respectively). The increase in first round contributions due to identification amounts to 5% for the F-Teams ($N = 80$, $P = 0.4726$) and 18% for the C-Teams ($N = 80$, $P = 0.0341$). Also in the middle part of the game, contributions in *F-Team-Pic* and *C-Team-Pic* exceed the contributions in their counterparts without picture, but then drop sharply in the last three rounds. In the last round, the differences are very small and contributions in *F-Team-Pic* are even lower than in *F-Team-NoPic*. Hence, for teams, the disclosure of identities only has a temporary effect.

It is also interesting to look at the extreme decisions, that is, contributing either all or nothing to the public good. Table 2 shows the proportions of zero contributions and full contributions for the first round, the last round, and all rounds together. It shows that, in the first round of *Indi-NoPic*, 22.5% of individuals contributed the full amount to the public good. The share of full contributions is substantially higher in the other five treatments (45 – 70%). This confirms that individuals in *Indi-NoPic* started the game rather carefully and tried to avoid the risk of being exploited by others. This concern appears to be less important in the other treatments. This is especially remarkable for *F-Team-NoPic* and *C-Team-NoPic* in which identities were kept private. For *F-Team-NoPic*, one could argue that concerns about others' opinions when showing selfish behavior are triggered within the team and so lead to higher contributions. But this argument cannot explain the high contributions in *C-Team-NoPic* where the members of a team remained

Table 2
Percentage of zero and full contributions by treatment.

	First round		Last round		All rounds	
	Zero	Full	Zero	Full	Zero	Full
Indi-NoPic	22.5	22.5	90.0	5.0	49.3	10.3
Indi-Pic	2.5	45.0	55.0	22.5	25.8	36.5
F-Team-NoPic	5.0	47.5	85.0	5.0	39.5	24.5
F-Team-Pic	2.5	60.0	85.0	0.0	26.5	45.3
C-Team-NoPic	5.0	47.5	97.5	0.0	29.3	19.0
C-Team-Pic	0.0	70.0	82.5	7.5	20.8	48.8

anonymous. Thus, being in a team alone appears to reduce the fear of being exploited by others and increase the willingness to risk a high contribution in the first round. However, teams were unable to keep cooperation up and experienced a sharp reduction in contributions towards the end of the game.

Turning to the other extreme, *Indi-NoPic* has a much higher percentage of zero contributions in the first round (22.5%) than the other treatments. The share of zero contributions is very low in *Indi-Pic* (2.5%), arguably because individuals did not want to be identified as a free-rider. Zero contributions in the first round are also rare in the team treatments (0 – 5%). A plausible explanation for this is that groups are better at anticipating the negative effects that such a strategy may have on the other players and overall payoffs. Indeed, the analysis of the chat protocols (see Appendix) suggests that maximizing payoffs and keeping the others' contribution level up were the most important motivations for the groups, whereas fairness or concerns to be exploited were mentioned only rarely. One point becomes clear when we compare the individual and the team treatments: Teams did not just average over what the members would have done individually. If they did, we would observe a similar average contribution level and fewer extreme decisions at both ends, that is fewer zero contributions and fewer full contributions. But this is not the case.

Let's now look at the extreme decisions in the last round. Here, the *Indi-Pic* treatment turns out to be the outlier. In *Indi-Pic* there are more full contributions (22.5%) than in the other treatments (0 – 7.5%). Likewise, there are fewer zero contributions (55%) than in the other treatments (82.5 – 97.5%). This confirms that the effect of the identification on individual behavior is still at play in the last round, whereas the differences for the teams are much smaller.

4.2. Differences between individuals and teams

To compare the effects of the pictures between individuals and teams in greater detail we employ a series of regression models. To this end, we pool the data of all treatments. The dependent variable is a player's or a team's contribution per round. The first two specifications (1) and (2) in Table 3 show results from linear regressions on contributions in the first round that are still independent of the behavior of the other players. In addition to the variables shown in the table, column (2) includes control variables controlling for subjects' gender, image concerns, and beliefs about others' trustworthiness and helpfulness. These variables were elicited prior to the game. The dummy variable *Picture* quantifies the effect of revealing the identities. The dummy variables *F-Team* and *C-Team* indicate whether decisions were made by individuals, teams with face-to-face communication, or teams with computer chat communication. The regressions include two interaction terms to show if the teams reacted significantly different to the pictures than the individuals. *Picture*F-Team* takes the value one for the subjects in *F-Team-Pic* and the value zero otherwise. Likewise, *Picture*C-Team* takes the value one for the subjects in *C-Team-Pic* and the value zero otherwise. The regression results confirm that the pictures lead to a significant increase in first round contributions for individuals. The increase amounts to almost 30 tokens and thus almost one-third of the endowment. Teams contribute significantly more in the first round than individuals when identities are not revealed. The interaction terms show that the teams react significantly less sensitively to the pictures than the individuals. The difference is smaller for the C-Teams than the F-Teams and it is only weakly significant when the control variables are included.

Columns (3) and (4) in Table 3 show random effect regressions for the contributions decisions made in rounds 1 to 10. In these regressions, the number of the current round is additionally included as an explanatory variable. The variable *Round* accounts for the downward trend of contributions over time. It is negative and significant in both specifications. The significant dummies *F-Team* and *C-Team* indicate that contributions in *F-Team-NoPic* and *C-Team-NoPic* are significantly higher than in *Indi-NoPic*. The interaction terms are no longer significant, though both coefficients point in the same direction as before. The effect of the pictures on individuals is still significant. Finally, columns (5) and (6) show regressions results on the contributions decisions made in the last round. We observe that the interaction term *Picture*F-Team* is significantly negative while *Picture*C-Team* is negative but not significant.

In summary, the regression analyses confirm that the pictures have an immediate positive effect on contributions of individuals. Teams react significantly less sensitively to the pictures. The difference is particularly pronounced for the teams that use face-to-face communication and less pronounced for the teams than use computer chat

Table 3
Results from linear regressions on contribution decisions.

	OLS first round		Random effects round 1–10		OLS last round	
	(1)	(2)	(3)	(4)	(5)	(6)
Picture (d)	28.12***	29.49***	27.28**	27.60**	22.90**	22.75**
	(7.264)	(7.231)	(11.36)	(10.93)	(11.22)	(11.11)
F-Team (d)	31.75***	29.17***	20.20*	17.66*	0.800	−0.256
	(7.394)	(7.771)	(10.38)	(10.17)	(6.819)	(5.918)
Picture (d) * F-Team (d)	−24.50**	−24.97**	−16.84	−16.25	−28.98**	−28.20**
	(10.25)	(10.27)	(16.58)	(16.07)	(12.75)	(12.20)
C-Team (d)	27.13***	27.62***	20.47**	20.20**	−5.500*	−5.448*
	(7.506)	(7.612)	(8.903)	(8.632)	(3.174)	(3.081)
Picture (d) * C-Team (d)	−14.75	−17.41*	−9.063	−10.68	−12.88	−13.99
	(9.418)	(8.964)	(14.67)	(14.10)	(14.02)	(14.10)
Round			−7.119***	−7.119***		
			(0.414)	(0.414)		
Constant	46.12***	41.46***	64.84***	59.58***	5.525*	−0.859
	(6.221)	(7.676)	(7.440)	(7.903)	(3.174)	(4.080)
Control variables	No	Yes	No	Yes	No	Yes
Observations	240	240	2400	2400	240	240

Ordinary least squares (OLS) regression and random effects panel regression with clustering of standard errors at the meta-group level. Numbers are marginal effects or discrete effects in case of dummy variables; standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Depended variable is an individual's (or team's) contribution per round. (d) indicates dummy variable. Definition of variables: *Picture* = 1 if identities are revealed, 0 otherwise; *F-Team* = 1 if face-to-face treatment, 0 otherwise; *C-Team* = 1 if chat treatment, 0 otherwise; *Picture*F-Team* = Interaction dummy of *Picture* and *F-Team; Picture*C-Team* = Interaction dummy of *Picture* and *C-Team; Round* = number of round. Control variables: *Female* = 1 if individual is female (or team consists of at least three female members), 0 otherwise; *Image concerns* = 1 if individual (or team on average) cares about image, 0 otherwise; *Trust* = 1 if individual (or team on average) considers others as trustworthy, 0 otherwise; *Others helpfulness* = 1 if individual (or team on average) considers others as helpful, 0 otherwise.

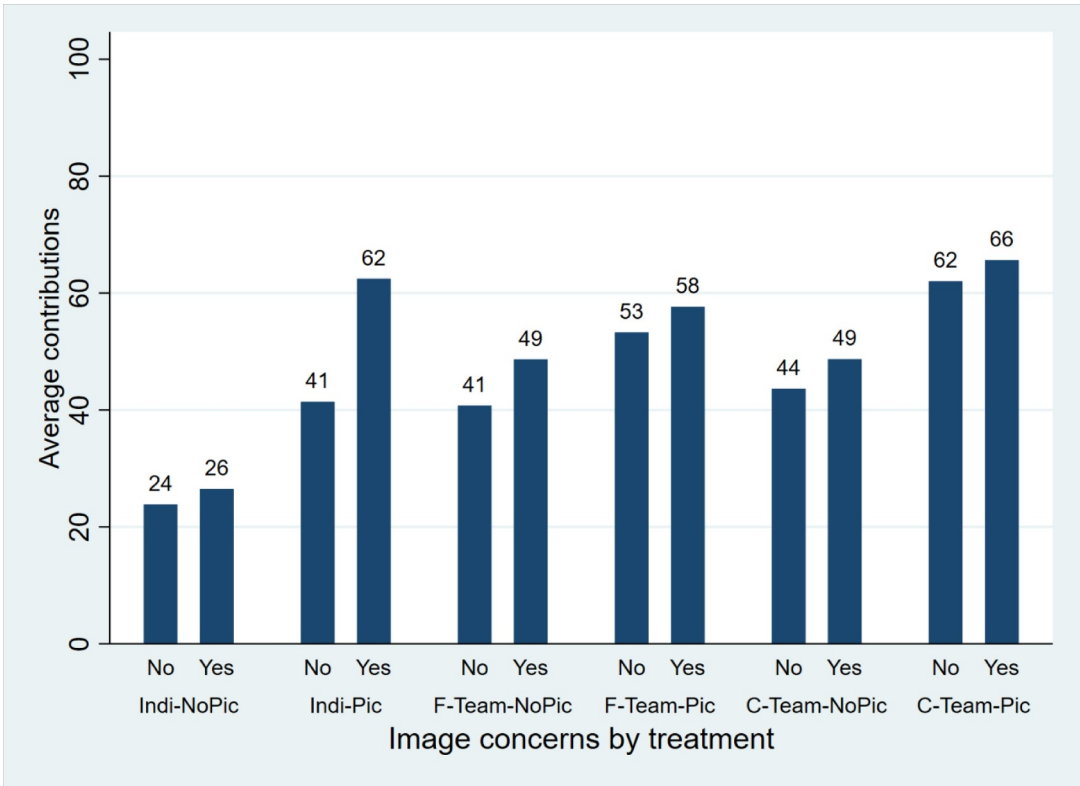

Fig. 2. Average contributions conditional on image concerns.

communication.

4.3. Image concerns

In our ex-ante questionnaire, we asked participants to state how much they care about what other people think about them on a scale from 1 being "not at all" to 10 being "very much." Fig. 2 compares the average contributions of subjects who care strongly about their image ("Yes," answer categories 6–10) and subjects who do not care much about their image ("No," answer categories 1–5). For the team treatments, we consider the average answer to this question to distinguish between teams that care strongly ("Yes," average answer is 6 or higher) and teams that care less ("No," average answer is below 6). In all treatments, individuals and teams who care about their image contribute more to the public good than those who do not care (difference between "Yes" and "No" within treatments). Remarkably, the by far largest difference can be found in the *Indi-Pic* treatment; individuals who care about their image contribute about 50% more than those who do not care. In the other treatments, this difference is less than 20%.

Furthermore, we see that the disclosure of identities increases contributions by both players who care strongly about their image (difference between "Yes" with and without picture) and players who care less (difference between "No" with and without picture). However, the disclosure of identities has by far the largest impact on individuals who care strongly; their contributions are substantially higher in *Indi-Pic* than in *Indi-NoPic* (138%). This difference is much larger than for the individuals who do not care much (71%) and any type of team (18–41%).

We run additional regressions to study the effects of image concerns in greater detail. The results are provided in the Appendix. They confirm that the pictures have a significantly stronger effect on individuals who are concerned about their image than on individuals who care only little about this. We do not find significant differences between teams consisting of members who are concerned about their image and teams whose members care only little. While teams tend to contribute more to the public good when their members are concerned about their image (in some cases significantly), the effect of the pictures is not enhanced by image concerns. These findings suggest that being in a team helps sensitive individuals to overcome their image concerns when identities are revealed. While intuitive, our data do not allow us to examine this hypothesis further. Future research may test the suitability of alternative psychological scales to elicit image concerns and whether the lower sensitivity within teams is due to the diffusion of responsibility or merely because sensitive subjects are matched with insensitive subjects.

4.4. Acquaintances in the treatments with pictures

In the ex-post questionnaire, we asked subjects in all treatments in which identities were revealed if they knew another player or a person in another team. Two persons (5%) in *Indi-Pic*, 36 persons (22.5%) in *F-Team-Pic*, and 40 persons (25%t) in *C-Team-Pic* answered this question positively. The difference between individuals and teams is simply caused by the fact that the subjects in the team treatments got to see 12 persons in the other three teams while the individuals only saw three other persons.[5] Regression analysis (see Table A3 in the Appendix) shows that knowing another player or someone in the other teams had no significant effect in *Indi-Pic* and *F-Team-Pic*. A higher number of team members who knew a person in another team increased contributions in *C-Team-Pic*. If anything, however, this makes our main result only stronger since removal of those teams would lower contributions in *C-Team-Pic* and move it even closer to the contribution level in the *C-Team-NoPic* treatment.

We also asked a number of other questions in the ex-post

[5] This question referred only to acquaintances in the other teams and not to acquaintances in the own team. In *C-Team-Pic*, we also asked about acquaintances in the own team and nine persons (5.6%) answered this question positively. Regression analysis shows that knowing someone in the own team had no significant effect on contributions.

questionnaire in order to elicit subjects' perceptions after having played the game. The results are shown in the Appendix. They show, for example, that the participants in the team treatments were generally satisfied with their team, they felt involved in the decision making process and agreed with the final decision. The most interesting finding is the difference between individuals and teams with respect to their appreciation of the pictures. The individuals in *Indi-Pic* appear to perceive the pictures as more useful and influential than the teams in *F-Team-Pic* and *C-Team-Pic* which is consistent with actual behavior. However, when the participants in the anonymous treatments were asked whether they would have preferred to play the game with pictures, high contributing teams in *F-Team-NoPic* and *C-Team-NoPic* supported the idea of removing anonymity much more than low contributing teams, while the support among high contributors and low contributors in *Indi-NoPic* was equally low. This raises interesting questions about the willingness of individuals and teams to employ a "naming and shaming" mechanism which go beyond the scope of this study.

5. Discussion and conclusion

Increasing transparency, and thereby exploiting the human tendency to behave more socially oriented under supervision, has been suggested as an effective way to improve cooperation (Kraft-Todd et al., 2015; Rand et al., 2014). This can even have positive side effects beyond the interpersonal relations, for example, when a change of personal eating or commuting habits due to social pressure has positive effects on the global climate (Nyborg et al., 2016). Our results confirm previous findings that identification and the mere suspicion of others' approval or disapproval is an incentive for individuals to behave more cooperatively (Andreoni & Petrie, 2004; Rege & Telle, 2004; Samek & Sheremeta, 2014). The effect of revealing individuals' identities on cooperation is immediate, sizable, and permanent. A more detailed analysis shows that in particular individuals who care about their image make higher contributions to the public good when identities are revealed.

The novel result of our experiment is that the disclosure of identities only has a relatively small and temporary effect on cooperation among groups. Groups react significantly less sensitively to the pictures than the individuals. While teams consisting of members who care about their image tend to contribute more to the public good than teams whose members care only little, the effect of the pictures is not enhanced by image concerns. Thus, being in a team appears to help subjects to overcome their image concerns when identities are revealed.

We furthermore find that the differences between individuals and teams are particularly pronounced when the teams communicate face-to-face. The differences are smaller and less significant when the teams use a computer chat to communicate. A plausible reason why the difference is more pronounced for the F-Teams is that they become acquainted more easily. This facilitates social support within the team and enables a sense of group identity. Previous research has shown that members of groups feel less shame for a questionable decision the more they identify with the group (Shepherd et al., 2013).

In conclusion, decision makers who want to use transparency to improve social outcomes, as for example policy makers or fundraisers, should try to target individuals rather than groups as increasing transparency among groups may only have small effects on their behavior. Group interactions seem to require stronger regulations at least when responsibility for decisions is diffused and members can hide within the group. We believe that this is the case for most group decisions.

Our study also adds to the relatively small literature on the differences between individuals and groups in the anonymous public goods game. We find that, irrespective of the type of communication, groups contribute more than individuals which is in line with Auerswald et al. (2018). Especially at the beginning of the game when it is not yet clear what the other players will do, groups appear to be more willing to risk a high contribution. They are also less likely than individuals to start the game with contributing nothing, perhaps because groups are better able to anticipate the negative effect this strategy may have on the other players' willingness to cooperate. The analysis of the chat protocols shows that payoff maximization and keeping others' contributions high were the main motivations for the teams (see Appendix). These motivations can also help to explain why groups' contributions decrease quickly over time and come close to zero by the end of the game. It is important to note that, while the potential for the pictures to make a difference is limited at the beginning of the game when groups contribute a lot anyway, there is great potential at the end of the game when contributions are very low. But, unlike in the case of the individuals, the potential is not used.

Finally, our study shows that contributions in the anonymous individual public goods game, the "workhorse" to study human cooperation, is the outlier among our treatments and produces the by far lowest contributions to the public good. All other treatments which include more real-life elements like identification, communication, and interaction produce higher contributions, at least in the first half of the game. The low contributions in the standard public goods game should perhaps not be interpreted as lack of cooperativeness but instead as a lack of real-life elements. Allowing subjects to communicate and decide together with others or to see more information about each other increases cooperation significantly without any changes in the incentives or the rules of the game.

It would be interesting to test if our results hold under different group decision making rules, for instance, when a majority rule is used or when one member decides as a group representative. As a majority rule further obscures responsibility and accountability within groups we would not expect a greater effect of identification under this rule. The decision by a group representative would be more interesting as it combines elements of both individual and group decision making (Hauge & Rogeberg, 2015). Likewise, revealing the input of each single member, rather than the final decision only, may lead to different results as this would make responsibility more transparent (Schopler et al., 1995). By forming groups according to certain preferences instead of random formation, for example by subjects' image concerns, one could further investigate if subjects become less sensitive in groups or if the matching of heterogeneous subjects is the more important factor.

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Supplementary materials

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