UNIVERSITÉ DE NEUCHÂTEL

Institut de recherches économiques

IRENE Working Paper 18-06

Public good provision, in-group cooperation and out-group descriptive norms: A lab experiment

Serhiy Kandul and Bruno Lanz

Public good provision, in-group cooperation and out-group descriptive norms: A lab experiment*

Serhiy Kandul† Bruno Lanz ‡

This version: April 2021

Abstract

We use a public good experiment to study how in-group cooperation is affected by payoff-irrelevant information about cooperation in other groups (i.e., descriptive out-group feedback). We find that positive out-group feedback, indicating above-average cooperation, deters low in-group contributors from increasing their contribution toward the in-group average. By contrast, negative out-group feedback, which informs participants about below-average cooperation, deters high in-group contributors from decreasing their contribution toward the in-group average. These two effects work together to dampen contribution patterns associated with conditional cooperation. Further, we show that the effects are stronger for individual-level feedback (comparing individual contributions with the out-group average) than for group-level feedback (comparing total contributions by in-group members with that of other groups). Interestingly, when allowed to avoid out-group feedback information, the propensity to consult the feedback is similar for high and low in-group contributors, suggesting that information acquisition is not always self-serving.

Keywords: Conditional cooperation; Social norms; Public good game; Prosocial behavior; Deliberate ignorance.

JEL Codes: C91, D12, D62, D91, H41, Q41.

---

*We thank Cristina Cattaneo, Sylvain Chabé-Ferret, Yu Gao, Martin Kocher, Yohei Mitani, Michael Puntiroli, Tobias Regner, Evert Reins, Hiro Sakamoto, Matthias Uhl as well as seminar participants in Kyoto University and IRME workshop for useful comments and discussions. Excellent research assistance was provided by Fanol Kurteshi. Financial support from the Swiss National Science Foundation under grant PYAPP1_173650 is gratefully acknowledged. This research is part of the activities of SCCER-CREST (Swiss Competence Center for Energy Research), which is financially supported by Innosuisse. Any errors are ours.

†Digital Society Initiative, University of Zürich. Mail: Raemistrasse 69, 8001, Zürich, Switzerland. serhiy.kandul@uzh.ch.

‡University of Neuchâtel, Switzerland; ETH Zürich, Switzerland; Massachusetts Institute of Technology, USA. Mail: A.-L. Breguet 2, CH-2000 Neuchâtel, Switzerland. bruno.lanz@unine.ch.

1 Introduction

A large literature studies prosocial behavior and cooperation in the context of experimental public good games (see Chaudhuri, 2011, for a review). One robust finding is that public good contributions follow a pattern that is consistent with conditional cooperation, whereby participants contribute in proportion to contributions by other members of their group (see Fischbacher et al., 2001; Kocher et al., 2008; Fischbacher and Gächter, 2010; Fehr and Schurtenberger, 2018). This implies a tendency for individual contributions to adjust to information about average contributions of other in-group members. A separate strand of the literature on public good contributions shows that cooperation is also affected by information about cooperation outside of the group (Tan and Bolle, 2007; Boehm and Rockenbach, 2013; Janssen et al., 2016).[1] However, whereas conditional cooperation essentially derives from a payoff-relevant comparison of individual contribution against that of other in-group members, descriptive information about out-group contribution is payoff-irrelevant. In the context of a public good game, the impact of feedback information therefore depends on how participants resolve tensions between payoff-relevant in-group information and payoff-irrelevant out-group norms.

This paper provides evidence on how in-group cooperation associated with payoff-relevant information is affected by payoff-irrelevant information on out-group cooperation, which consists in a comparison of own behavior relative to the typical (e.g., average) behavior of a reference group. We employ a repeated linear public good experiment with groups of four participants (partner design) and set the parameters of the game such that it is individually optimal not to contribute to the public good and socially optimal to contribute one's full endowment. In each round, after participants have made their contribution, they receive standard information about their own payoff, which allows them to assess the contribution level of their in-group members. This is *payoff-relevant* information about in-group average contribution and an important driver of conditional cooperation.[2] This provides our baseline treatment. In the INDIVIDUAL

[1] As theories of social norms and normative feedback interventions suggest (Elster, 1989; Karlin et al., 2015), people with a preference to conform with norms who hold wrong beliefs about how others behave will adjust their behavior in response to information about the typical behavior of a reference group (Bicchieri and Xiao, 2009; Bicchieri and Dimant, 2019). Importantly, descriptive norms are distinct from injunctive norms, as the latter provide explicit information about what is considered to be socially desirable (see, e.g., Cialdini et al., 1990).

[2] Existing studies frame in-group contribution information in different ways. We choose to simply provide the feedback on individual payoffs, a standard feedback in public good games, not to artificially increase the salience of the in-group comparison. We come back to this below.

FEEDBACK treatment, participants also receive information on how their contribution compares to the average contribution of players from other groups in that round, a *payoff-irrelevant* out-group norm. Importantly, we do not disclose the exact average contribution by participants in other groups. Instead, information is presented as aggregate feedback indicating whether participants' contribution is "below","above" or "equal to" the out-group average. We therefore measure whether this minimal social comparison with the out-group suffices to affect contributions relative to the baseline.

In this setting, participants receive *positive* out-group feedback when their contribution is above the average contribution of players in other groups. Conversely, they receive *negative* out-group feedback when their contribution is below the average contribution of players in other groups.[3] Depending on in-group information feedback, positive and negative out-group feedback are predicted to impact cooperation differently. For example, if a participant contributes more than other members of his group, conditional cooperation induces a decrease in contribution. However, if that participant also learns that his individual contribution is below the out-group average (negative out-group feedback), then the desire to meet the out-group norm may actually make that participant increase his contribution. If instead the out-group feedback is positive, the breakdown of cooperation will be hastened.

We further consider whether the type of out-group feedback information influences cooperation. Whereas individual feedback compares individual contributions with the relevant out-group average, we also consider *group-level* feedback that informs participants about how their in-group aggregate contribution compares to that of ctother groups. More specifically, in the GROUP FEEDBACK treatment, the benchmark for comparisons is the average total contribution per group (n times the average individual contribution) computed for the other groups in a session. Importantly, this is in sharp contrast with other public good experiments with feedback (Tan and Bolle, 2007; Boehm and Rockenbach, 2013; Janssen et al., 2016) in which participants receive information on average contribution of others and can therefore make both individual and group-level comparisons at the same time (which essentially makes individual and group-level feedback indistinguishable). Instead, in our design participants may not be able to infer

[3] A minority of participants would receive a neutral feedback when their contribution is exactly equal to the average contribution of players in other groups. Since neutral feedback occurs only in a few instances, we do not focus on it in this paper.

individual comparison from the group-level comparison and vice versa.[4]

The distinction between individual and group-level comparisons is important because it gives different external benchmarks that are relevant for conditional cooperation: (i) individual-level feedback gives information about the degree to which a participant's own contribution complies with the norm, and (ii) group-level feedback allows a participant to assess whether other members of his group are cooperative.

Lastly, we consider two treatments in which participants can choose to ignore out-group feedback information, INDIVIDUAL CHOOSE and GROUP CHOOSE. In particular, whereas in treatments INDIVIDUAL FEEDBACK and GROUP FEEDBACK out-group information is presented to every participant right after the contribution stage, in treatments INDIVIDUAL CHOOSE and GROUP CHOOSE participants choose whether to receive the feedback or not. If they do, they receive the exact same individual or group-level feedback (depending on the treatment). If they choose not to receive the feedback, no additional information about the contributions in the out-group is provided. Regardless of their choice, participants always remain exposed to in-group norms via the information on their payoff. These treatments provide a mechanism to understand whether the propensity to ignore feedback depends on contributions, and in turn the extent to which information avoidance impacts cooperation patterns.

Our results can be summarized as follows. First, when participants receive positive (above average) individual-level feedback, average contributions decline, whereas negative (below average) individual-level feedback has no impact on average contributions. Group-level feedback (positive or negative) also does not affect contributions on average. Second, we provide evidence that out-group feedback information affects in-group cooperation patterns in two important ways. On the one hand, for low in-group contributors, a positive (above average) out-group feedback mitigates the upward adjustment to contributions resulting from conditional cooperation. This detrimental impact on cooperation is stronger in the case of individual-level feedback but is also present for the group-level feedback. On the other hand, for high in-group contributors, a negative (below average) out-group feedback slows down the downwards adjustment of contributions associated with conditional cooperation. This positive effect on cooperation, however, is only observed for individual-level feedback. Taken together, these countervailing

[4] We discuss the implications of this design feature in details in Section 2.

effects cancel each other out on aggregate, leading to similar aggregate contributions across the treatments. Treatments INDIVIDUAL CHOOSE and GROUP CHOOSE further show that participants chose to ignore individual-level feedback information in more than twenty five percent of the cases, whereas for group-level feedback information avoidance is below 10 percent. Interestingly, self-exposure to norms works for and against self-interest, as there is no difference in avoidance comparing (i) low in-group contributors for whom positive (above average) feedback would suggest not to increase contributions towards in-group average and (ii) high in-group contributors for whom negative (below average) out-group feedback would suggest not reducing contributions, as dictated by conditional cooperation.

This paper contributes to a literature that studies how information about contributions affects cooperation in a public good game setting. For example, Fischbacher et al. (2001) and Fischbacher and Gächter (2010) provide information about average in-group contributions; Tan and Bolle (2007) inform participants about total contribution in the group; Cox and Stoddard (2015) focus on information about individual contributions of all in-group members, whereas Nikiforakis (2010) provides earnings all other in-group members. As in studies on social norms, we consider the behavior of participants who do not affect each other's pay-off (Elster, 1989; Gächter et al., 2013; Erkut et al., 2015), and explicitly exclude own-group members from social comparison in both individual and group-level comparisons. By considering payoff-irrelevant feedback, we also contribute to a broader literature on purely informational interventions to enhance cooperation which do not entail any pecuniary or strategic incentives (see, e.g., Charness et al., 2014; Sheremeta and Savikhin Samek, 2014; Christens et al., 2019). Relative to these studies, our results suggest that providing information about out-group descriptive norms alone, without relying on injunctive norms (Schultz et al., 2007), is not sufficient to increase contributions in a public good game setting.

By providing information on the behavior in other groups, our study also relates to public good experiments with inter-group competition (Tan and Bolle, 2007; Boehm and Rockenbach, 2013; Janssen et al., 2016). The studies build on social identity theory (Tajfel and Turner, 1986; Brown, 2000), which suggests that people derive positive utility from favorable social comparisons without payoff-interdependence between the groups. In contrast to this approach, we exclude the possibility of individual inter-group comparisons and rely on a more aggregated feedback about the average contribution in all the other groups. Our experiment therefore sheds

light on whether identification of competing groups and the possibility to win or avoid the loss in a competition is a necessary pre-requisite for social norms to enhance in-group cooperation.

Finally, our work is also related to a literature that uses social norm feedback interventions to incentivize pro-social behavior in the field, including electricity and water conservation, tax compliance, and nutrition habits (Allcott, 2011; Ferraro et al., 2011; Ayers et al., 2013; Costa and Kahn, 2013; Allcott and Rogers, 2014; Allcott and Kessler, 2015; Robinson et al., 2014; Hallsworth et al., 2017). Many field interventions leveraging social norms aim to maximize exposure to feedback and hence rely on high frequency reports (Allcott and Rogers, 2014) or real-time social comparisons (De Dominicis et al., 2019).[5] We show that self-exposure to out-group feedback differs substantially between individual and group-level feedback and is not always self-serving (see also Dana et al., 2007; Mazar et al., 2008; Matthey and Regner, 2011; Grossman and van der Weele, 2017). Overall, the rate of self-exposure to individual-level out-group feedback that we find is much lower than the rate of self-exposure to in-group feedback reported in Bigoni and Suetens (2012). This suggests that payoff-interdependence is relevant for the willingness to receive normative feedback.

The remainder of the paper is organized as follows. Section 2 presents our experimental design and hypotheses. Section 3 summarizes our results. Section 4 provides some discussion and concluding comments.

2 Experimental design and hypotheses

This section describes the parameters of the public good game and our experimental treatments. We then discuss hypotheses tested from the data. The experimental script is provided in Appendix A, and the decision screens are reproduced in Appendix B.

2.1 Experimental procedure and treatment conditions

At the beginning of the experiment, participants are randomly matched in groups of $n = 4$ and play a repeated linear public good game over 10 periods (partner design). In each period,

[5] Anecdotal field evidence from Allcott and Kessler (2015) suggests that 34% of participants in a free social comparison program on energy use hold (weakly) negative willingness to pay for participation in one additional year of the program. This could indicate that the rate of self-exposure to out-group norms may be low in this setting.

Table 1: Overview of experimental treatments

Treatment	In-group norm	Out-group norm	
		Individual compliance	Own group compliance
Control	Yes	No	No
INDIVIDUAL FEEDBACK	Yes	Yes	No
INDIVIDUAL CHOOSE	Yes	Choice	No
GROUP FEEDBACK	Yes	No	Yes
GROUP CHOOSE	Yes	No	Choice

participants receive an endowment $e = 60$ tokens, where 1 token = CHF 0.25, and decide how much to contribute to a public good. One period out of 10 is then randomly chosen for payment.[6]

The payoffs are defined as follows:

$$\pi_i = 60 - a_i + \delta \cdot \frac{\sum_{i_g} a_{i_g}}{n}, \tag{1}$$

where a_i is the contribution of player i, and $\sum_{i_g} a_{i_g}$ is the total contribution to a public good in a group g, and $\delta = 1.6$ is a multiplier measuring the marginal social benefit of contributions. Because marginal per capita return $\delta/n = 0.4 < 1$, it is individually optimal to contribute $a_i = 0$. However, since the multiplier is $\delta > 1$, the socially optimal equilibrium is full contributions $a_i = 60$ for all $i \in i_g$. All participants go through a set of control questions before the game starts.[7]

We specify five experimental treatment that differ in terms of the information that is provided individually after each period of the game. Table 1 presents an overview of experimental treatments. Instructions are similar for all treatments, except for text referring to alternative feedback information for the out-group contribution norm (see Appendix A).

Starting with the control treatment, participants simply learn their payoff after every period,

[6] We choose random-period payment instead of pay-all scheme primarily to avoid wealth effects (i.e., let participants focus on per-period information feedback rather than on their accumulated earnings in the game). For a discussion of the advantages of this approach, see Charness et al. (2016). For other public good games with random period payment, see for example Holt and Laury (1997), Marks et al. (2006), Sheremeta and Savikhin Samek (2014), and Conte et al. (2019).

[7] Each experimental session also included a short second part unrelated to this study. Participants were informed about the two parts of the experiment, but they were not aware of the content of the second task when playing public good game. To avoid cross-task contamination, only one of the two tasks was randomly chosen for payment.

with no further information provided. Given their own contribution and the payoff information they can infer the in-group average contribution. In the other four treatments, in addition, participants have access to on-screen information about the average contribution of all participants outside their own group in that same period and session. This captures the out-group norm, and excluding own group members from the calculation of the average ensures that it provides payoff-irrelevant information to participants.[8]

Treatments then systematically vary with respect to (i) the level of feedback aggregation and (ii) the possibility to avoid information about out-group norms. In INDIVIDUAL FEEDBACK participants receive exogenous feedback about whether their individual contribution in round t, a_{it}, is *below*, *equal to*, or *above* the average individual contribution of participants in the other groups in that round, denoted $\overline{a}_{-gt}$.[9] In GROUP FEEDBACK participants exogenously receive information about whether total contributions in their group $\sum_{i_g} a_{i_g}$ is *below*, *equal to* or *above* the average total contributions in the other groups in that round, which can be written as $n \cdot \overline{a}_{-gt}$.[10] For both individual and group-level feedback the comparison is carried with respect to all out-group participants in the same session, so that the out-group norm is the same: The average of total group-level contributions is simply n times the individual-level average contribution among out-group participants.

In the INDIVIDUAL CHOOSE and GROUP CHOOSE treatments, we endogenize the provision of the information feedback. Participants are informed about the very same social comparison procedure applied in INDIVIDUAL FEEDBACK and GROUP FEEDBACK, respectively, but instead of seeing the outcome of the comparison on their screen at the end of each period, they are first given additional options: 'show comparison' and 'do not show comparison' (see Appendix B).[11] If a participant chooses to see the comparison, we show the exact same information as in the INDIVIDUAL / GROUP FEEDBACK. Alternatively, only the individual payoff is shown. To avoid

[8] Technically, participants first receive the out-group feedback followed by feedback on their payoff, if any.

[9] Specifically, individual-level feedback reads as follows: "The computer has computed the average contribution to a group account of all the other participants in the room (excluding your group). Your contribution is *above* (*below* or *equal to*) the average." In the instructions we refer to "group accounts" instead of "public goods." See Appendix A for details.

[10] The text for group-level feedback is: "The computer has computed the average total contribution to a group account of all the other groups in the room. The total contribution of your group is *above* (*below* or *equal to*) the average." See also Appendix A.

[11] This procedure sets no default option and thus targets lower level of ignorance in comparison to settings where uncertainty is normally set as a default (Dana et al., 2007; Matthey and Regner, 2011; Grossman, 2014).

informational asymmetries within each group, this choice is private. Moreover, participants are explicitly informed that their choice to reveal the comparison to the out-group contribution norm does not affect their payoff.

Importantly, in all treatments participants can infer the in-group average, but we do not provide information about in-group average contribution explicitly. First, this is a relatively standard procedure in public good experiments (e.g., Chaudhuri, 2011), and it allows us not to increase the salience of in-group contribution norms relative to the out-group norms. Second, it mitigates possibilities for cross-inferences between individual and group-level comparisons as we also do not provide the exact out-group average. This allows us to differentiate between individual and group-level comparisons with the out-group. This design feature is different from other studies with out-group comparisons, where participants are able to make both individual and group-level comparisons at the same time (Tan and Bolle, 2007; Boehm and Rockenbach, 2013; Janssen et al., 2016).

Table 2 summarizes all possible combinations for in-group and out-group comparisons, the associated possibilities for cross-inferences across feedback types (INDIVIDUAL vs. GROUP), and the predicted impacts on contributions. Specifically, in column (1) we list the outcome of a comparison between individual contribution a_{it} and the in-group average of individual contributions, denoted $\overline{a}_{gt}$.[12] This is known in all treatments via payoff information. In column (2) we list possible outcomes of a comparison with the out-group norm provided in the treatments. For individual-level feedback (INDIVIDUAL), we compare individual contribution a_{it} with the out-group individual-level average (denoted $\overline{a}_{-gt}$). For group-level feedback (GROUP), we compare total in-group contribution $n \cdot \overline{a}_{gt}$ with the average of total contributions in other groups $n \cdot \overline{a}_{-gt}$, where the n cancels out on each side. Column 3 indicates the possibilities of cross-inferences between individual and group comparisons. Lastly, Column 4 presents the predicted effect of in-group and out-group comparisons on contributions.

The table shows that, in the case of individual-level feedback, conflicting information from in-group and out-group comparisons enables inference about group-level comparison. For example, if a participant learns that $a_{it} < \overline{a}_{gt}$ and $a_{it} > \overline{a}_{-gt}$, then it must be that total in-group contributions are higher than average total contribution in the other groups ($\overline{a}_{gt} > \overline{a}_{-gt}$). By

[12] This is equivalent to a comparison between individual contributions and the average contribution of other in-group players $\overline{a}_{-igt}$.

Table 2: Cross-inferences between individual and group-level comparisons

Feedback type	In-group comparison	Out-group comparison	Cross-inference between individual and group comparisons	Predicted effect on contributions (in-group / out-group)
	(1)	(2)	(3)	(4)
INDIVIDUAL	$a_{it} < \overline{a}_{gt}$, below	$a_{it} < \overline{a}_{-gt}$, below	Group-level comparison impossible	+ / +
	$a_{it} < \overline{a}_{gt}$, below	$a_{it} > \overline{a}_{-gt}$, above	$\overline{a}_{gt} > \overline{a}_{-gt}$	+ / -
	$a_{it} > \overline{a}_{gt}$, above	$a_{it} < \overline{a}_{-gt}$, below	$\overline{a}_{gt} < \overline{a}_{-gt}$	- / +
	$a_{it} > \overline{a}_{gt}$, above	$a_{it} > \overline{a}_{-gt}$, above	Group-level comparison impossible	- / -
GROUP	$a_{it} < \overline{a}_{gt}$, below	$\overline{a}_{gt} < \overline{a}_{-gt}$, below	$a_{it} < \overline{a}_{-gt}$	+ / +
	$a_{it} < \overline{a}_{gt}$, below	$\overline{a}_{gt} > \overline{a}_{-gt}$, above	Individual-level comparison impossible	+ / -
	$a_{it} > \overline{a}_{gt}$, above	$\overline{a}_{gt} < \overline{a}_{-gt}$, below	Individual-level comparison impossible	- / +
	$a_{it} > \overline{a}_{gt}$, above	$\overline{a}_{gt} > \overline{a}_{-gt}$, above	$a_{it} > \overline{a}_{-gt}$	- / -

Notes: For participants whose individual or group contributions are *exactly equal* to the in-group or out-group average, it is always possible to cross-infer their group and individual comparisons to the out-group, respectively. Predicted effect on contributions from in- and out-group feedback, respectively. "+" - increase and "-" - decrease in contributions.

contrast, conflicting information prevents the use of group-level information to determine how individual contributions compare with the out-group average. Thus a participant who learns that $a_{it} < \overline{a}_{gt}$ and $\overline{a}_{gt} > \overline{a}_{-gt}$ (or $a_{it} > \overline{a}_{gt}$ and $\overline{a}_{gt} < \overline{a}_{-gt}$) cannot infer whether his own contribution a_{it} is above or below out-group average $\overline{a}_{-gt}$.

A confirming feedback produces opposite implications. For example, learning that one's own contribution is below both the in-group average $a_{it} < \overline{a}_{gt}$ and the out-group average $a_{it} < \overline{a}_{-gt}$ does not allow inference about group-level comparison ($n \cdot \overline{a}_{gt}$ vs. $n \cdot \overline{a}_{-gt}$). By contrast, for group-level feedback, when $a_{it} < \overline{a}_{gt}$ and $\overline{a}_{gt} < \overline{a}_{-gt}$ (or when $a_{it} > \overline{a}_{gt}$ and $\overline{a}_{gt} > \overline{a}_{-gt}$), it is possible to infer individual-level comparison.

Importantly, in cases where cross-inferences between individual-level and group-level feedback is possible, the salience of this possibility is low. This sets the individual vs. group-level comparisons further apart and allows us to investigate whether feedback aggregation matters for the effectiveness of out-group feedback. In the next sections we discuss predictions about the impact of information feedback.

2.2 Hypotheses

We now state a number of hypotheses derived from the experimental design. First, we expect that information about in-group contributions will produce the common pattern of conditional cooperation (Fischbacher et al., 2001; Kocher et al., 2008; Fischbacher and Gächter, 2010):

Hypothesis 1. *Participants who contribute below (above) the in-group average increase (decrease) their contribution towards the in-group average.*

These predicted positive and negative effects associated with in-group comparisons are denoted by "+" and "-" as the first term in column 4 of Table 2. We note, however, that these effects are present both in the baseline and in the treatments, as participants receive feedback on their payoff in all treatments.

Next, if participants hold preferences to conform with norms (e.g., Gächter et al., 2017; Krupka and Weber, 2013), we hypothesize that they will adjust their contributions upon receiving information about the contributions by others (Bicchieri and Xiao, 2009; Bicchieri and Dimant, 2019):

Hypothesis 2. *Participants who contribute below (above) the out-group average increase (decrease) their contribution towards the out-group average.*

These predicted positive and negative effects from out-group comparisons are denoted by "+" and "-" as the second term in column 4 of Table 2 for both individual and group-level comparisons.

In cases where in-group and out-group feedback work in the same direction (+,+ or -,- in Table 2), treatments are likely to produce little or no difference with the baseline. By contrast, when in-group and out-group feedback work in opposite directions (+,- or -,+ in Table 2), treatments are likely to produce a difference relative to the baseline. For example, if participants above their in-group average reduce contributions because of conditional cooperation, information that they are above the out-group norm would mitigate this decline.

Hypothesis 3. *For high in-group contributors, negative (below average) out-group feedback (INDIVIDUAL and GROUP) has a positive effect on contributions.*

By contrast, for participants contributing below their in-group average and who would tend to increase contributions through conditional cooperation, learning that they are above the out-group norm would have a negative impact on contributions.

Hypothesis 4. *For low in-group contributors, positive (above average) out-group feedback (INDIVIDUAL and GROUP) has a negative effect on contributions.*

The aggregate effect of the feedback on contributions depends on the relative strength of these two effects.

The relative effect of individual and group-level feedback depends on participants' preferences. Participants who care about their individual compliance with norms should be more affected by the individual-level feedback, whereas those who identify more strongly with their group would be more affected by group-level feedback (Tajfel and Turner, 1986; Hogg and Reid, 2006). We therefore formulate no directional hypothesis regarding the relative strength of individual and group-level comparisons. However, we note that the differences in the effects between individual and group-level feedback are likely to be more pronounced in cases where cross-inferences are not possible (see Table 2 rows 1, 4, and 6, 7).

In treatments with endogenous feedback, however, we predict some difference in the propensity to ignore information in INDIVIDUAL CHOOSE and GROUP CHOOSE. First, group-level feedback allows participants to assess the relative cooperativeness of the other in-group members, so that it can be seen as more valuable and therefore more likely to be consulted relative to individual-level feedback. Second, negative individual-level feedback may hurt self-image of participants and therefore prompt participants to ignore it more often than group-level feedback (Dana et al., 2007; Grossman and van der Weele, 2017). Based on this, we predict individual feedback to be ignored more often then group-level feedback.

Hypothesis 5. *Participants avoid individual feedback more often than a group-level feedback.*

One implication is that the effects described in Hypotheses 3 and 4 are predicted to be mitigated in treatments with endogenous feedback, and any differences between exogenous and endogenous feedback treatments are predicted to be more pronounced for individual-level comparisons.

3 Results

We ran 16 experimental sessions in the laboratory of the University of Neuchâtel in March 2018. Table 3 presents the descriptive summary of our sample. In total, 272 participants recruited via a university mailing list took part in the experiment. The experiment was programmed in zTree (Fischbacher, 2007). Each session lasted about one hour, and the average payment was CHF 17.16.

Table 3: Summary statistics of treatments and experimental sessions

Treatment	Sessions	Participants	% females	Average age	Contributions	
					Mean	St-dev.
Control	3	56	58.9	23.4	29.04	22.80
INDIVIDUAL FEEDBACK	4	52	61.5	23.8	22.68	18.36
INDIVIDUAL CHOOSE	3	56	60.7	22.4	26.38	19.82
GROUP FEEDBACK	3	52	59.6	21.8	25.58	20.71
GROUP CHOOSE	3	56	64.3	21.9	23.65	19.16

Notes: The treatments were run in separate sessions in a randomized order. Contributions averaged over individual participants. Standard deviations for individual contribution reported.

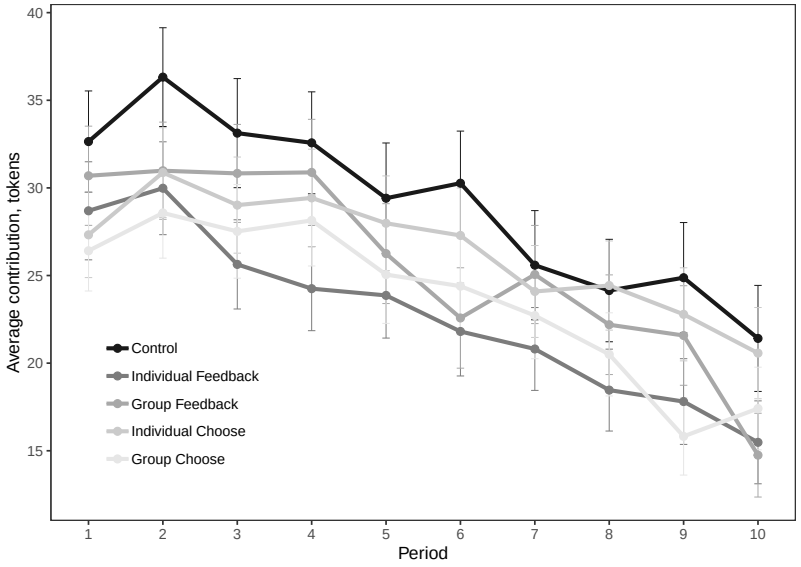
We start this section by reporting the aggregated treatment effects on the contributions. We then provide separate evidence for positive feedback (above average out-group contributions) and negative feedback (below average out-group contributions) and analyze the effects of out-group contribution norms on high and low in-group contributors. We finish with a discussion of self-exposure to out-group norms.

3.1 Aggregate effect of out-group feedback

Figure 1 depicts average contributions across periods and experimental treatments. In all treatments, average contributions start at around half of the endowment (30 tokens) and gradually fall to around one third of the endowment (20 tokens) towards the end of the game. The decreasing pattern of contributions reflects a typical cooperation break-down found in public goods literature (Ledyard, 1995; Chaudhuri, 2011). Contributions are highest in the CONTROL, whereas INDIVIDUAL FEEDBACK contributes the least, although differences are small and statistically non-significant (p-values for all pairwise two-sided Wilcoxon rank sum tests using matching groups as a unit of observation are greater than 0.1).

Figure 2 reports average individual contributions conditional on being below the out-group average in the previous period (negative feedback, with predicted positive impact on contributions) or above out-group average (positive feedback, with predicted negative impact on contributions). Panel (a) shows individual-level feedback treatments, and Panel (b) focuses on

Figure 1: Average contributions by treatment (standard errors in bars)



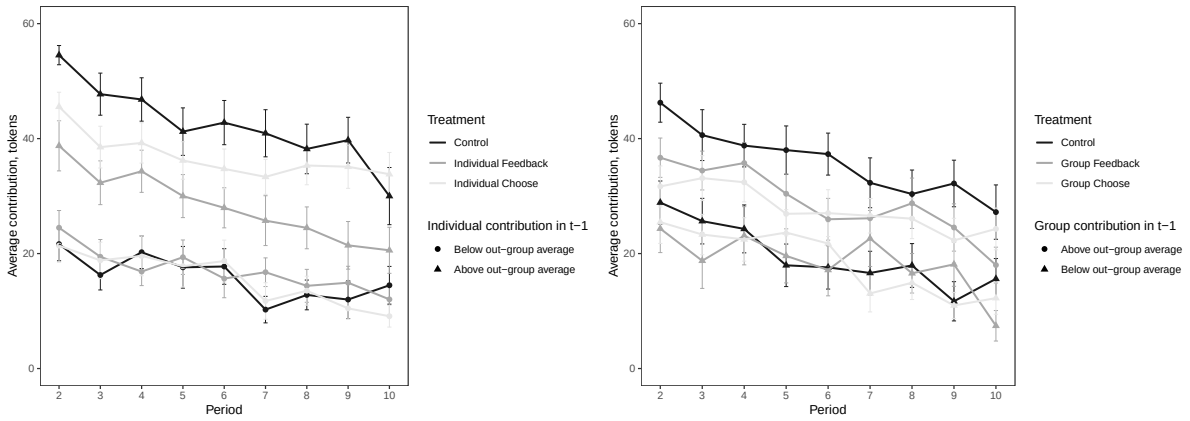
group-level feedback treatments.[13] We also report trajectories for the control treatment as a reference, where participants are grouped either in reference to individual (Panel a) or group-level norm compliance (Panel b).[14]

We find that the contributions of participants with positive (above out-group average) exogenous feedback (upper part of Figure 2, Panel a) are lower relative to the control ($p = 0.011$, Wilcoxon rank sum test; average contribution per matching group as unit of observation). This finding is consistent with a boomerang effect documented in Schultz et al. (2007), and can at least partially account for lower contributions in INDIVIDUAL FEEDBACK, and is partly consistent with Hypothesis 2. This effect is less prominent for the group-level feedback where information only includes individual contributions indirectly through an in-group average, so that incentives to reduce one's own contribution is lower. Negative (below out-group average) feedback does not promote contributions. Indeed, trajectories for both individual and group-level feedback reported in the bottom part of Figure 2, Panels (a) and (b), are very similar to the control treatment.

[13] One observation in INDIVIDUAL FEEDBACK treatment and four observations in GROUP FEEDBACK treatment are exactly equal to the out-group average. For simplicity, these observations (not the participants) are excluded from the analysis.

[14] Contribution trajectories for the control treatment differ in Panel a and b. The reason is that the basis for average contribution comparisons (individual or group-level) are different in each panel.

Figure 2: Average contribution by treatment and compliance with the out-group contribution norm (standard errors in bars)



(a) Individual feedback treatments

(b) Group-level feedback treatments

We now use a set of OLS random effects panel regressions to carry out further statistical inference on the impact of treatments on cooperation.

In Table 4, we start by regressing individual contributions (a_{it}) on pooled treatment dummies: INDIVIDUAL is an indicator variable equal to one if participant i is in one of the two treatments with individual feedback (0 otherwise), and GROUP is equal to one if i is in one of the two treatments with group-level feedback (0 otherwise). Results are reported in column 1. In column 2, we control for participants' individual lagged contribution and lagged in-group average contributions. Thereafter we separately consider observations with contribution below out-group average in the previous round (negative feedback, columns 3 and 4) and above out-group average in the previous round (positive feedback, columns 5 and 6).[15]

Regression results in columns 1 and 2 confirm that both individual and group-level feedback do not affect average contributions. Columns 3 and 4 further show that receiving a negative feedback (below out-group average) in both treatments does not significantly affect contributions. By contrast, we find some evidence that positive out-group feedback (above out-group average) has a negative impact on contributions, although the impact is statistically significant only for individual-level comparison (column 5).[16]

[15] The same regressions using Tobit specifications are reported in Appendix C.

[16] Tobit specifications reported in C1 suggest that the negative impact on contributions is also significant for group-level comparisons.

Table 4: Public good contributions across treatments and feedback types

Contributions (a_{it})	Full sample		Out-group feedback in t-1			
			Below average		Above average	
	(1)	(2)	(3)	(4)	(5)	(6)
INDIVIDUAL	-4.44	-0.84	-0.92	-0.63	-7.99*	-2.22
	(3.60)	(0.98)	(3.22)	(2.85)	(3.71)	(2.24)
GROUP	-4.46	-1.07	-2.85	-2.32	-4.82	0.44
	(3.32)	(0.90)	(2.94)	(2.67)	(3.50)	(2.08)
Own contribution in t-1	-	0.66***	-	0.44***	-	0.56***
		(0.03)		(0.08)		(0.05)
Average in-group in t-1	-	0.13***	-	0.06	-	0.27***
		(0.03)		(0.06)		(0.06)
Intercept	32.67***	9.32***	23.73***	15.08***	48.67***	9.59*
	(2.97)	(1.74)	(2.65)	(3.00)	(3.20)	(4.21)
Observations	2720	2448	827	827	867	867
R^2	0.05	0.48	0.04	0.21	0.09	0.37

Notes: OLS random effects panel regressions reported. Column 1 includes choices by all 272 participants over ten periods (the first period with no feedback is an omitted category). In columns 2-6, choices over nine periods are included. Columns 3 and 4 focus on observations for which own or group contributions in the previous period is below out-group average. Columns 5 and 6 focus on observations for which own or group contributions in the previous period is above out-group average. In columns 2, 4 and 6 we control for lagged own contribution and lagged average contribution by other in-group members. All specifications include period fixed effects. Standard errors are clustered at the group level and reported in parentheses. *, ** and *** denote p<0.05, p<0.01, and p<0.001 respectively.

In Table 5 we document possible differences between treatments with endogenous and exogenous feedback. We follow the same approach as in Table 4 although we include separate treatment dummies for each treatment condition. Results largely confirm the discussion above. In addition, we find that the effect of positive out-group feedback (above out-group average) on contributions is mainly driven by exogenous feedback (INDIVIDUAL FEEDBACK, -11.28, column 6). In INDIVIDUAL CHOOSE, where participants have the possibility to avoid out-group feedback, the negative effect is smaller and not statistically significant (-5.14, column 5).[17]

3.2 The effect of out-group feedback on in-group cooperation

We now provide evidence about how out-group feedback information affects in-group cooperation. To do so, we split participants according to whether their contribution in the previous

[17] Results from Tobit regressions reported in Table C2 confirm that participants who were above out-group average contribute significantly less in INDIVIDUAL FEEDBACK but not in INDIVIDUAL CHOOSE.

Table 5: Public good contributions in treatments with exogenous and endogenous feedback

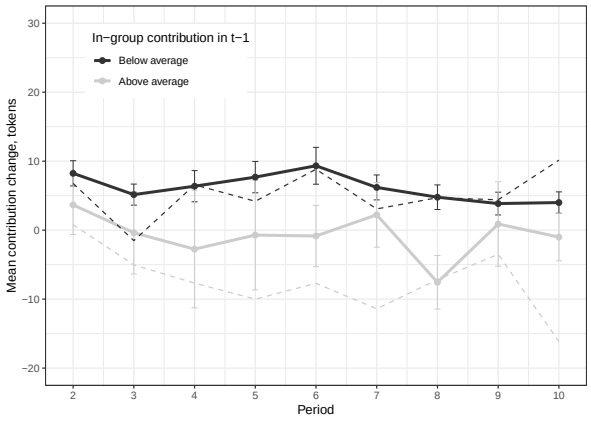
Contributions (a_{it})	Full sample		Out-group feedback in t-1			
			Below average		Above average	
	(1)	(2)	(3)	(4)	(5)	(6)
INDIVIDUAL FEEDBACK	-6.36	-1.63	-0.92	-0.80	-11.28**	-4.07
	(3.60)	(0.98)	(3.22)	(2.85)	(3.71)	(2.24)
INDIVIDUAL CHOOSE	-2.66	-0.13	-0.93	-0.44	-5.14	-0.90
	(4.25)	(1.11)	(3.77)	(3.28)	(4.23)	(2.36)
GROUP FEEDBACK	-3.46	-1.21	-3.31	-2.84	-3.03	0.41
	(3.47)	(0.95)	(3.35)	(3.06)	(3.59)	(2.28)
GROUP CHOOSE	-5.38	-0.97	-2.49	-1.91	-6.56	0.24
	(3.75)	(1.05)	(3.15)	(2.76)	(4.17)	(2.33)
Own contribution in t-1	-	0.66***	-	0.44***	-	0.55***
		(0.03)		(0.08)		(0.05)
Average in-group in t-1	-	0.12***	-	0.06	-	0.27***
		(0.03)		(0.06)		(0.06)
Intercept	32.67***	9.44***	23.75***	15.12***	48.77***	10.35**
	(2.97)	(1.74)	(2.65)	(2.99)	(3.20)	(4.24)
Observations	2720	2448	827	827	867	867
R^2	0.05	0.48	0.04	0.21	0.11	0.37

Notes: OLS random effects panel regressions reported. Column 1 includes choices by all 272 participants over ten periods (the first period with no feedback is an omitted category). In columns 2-6, choices over nine periods are included. Columns 3 and 4 focus on observations for which own or group contributions in the previous period is below out-group average. Columns 5 and 6 focus on observations for which own or group contributions in the previous period is above out-group average. In columns 2, 4 and 6 we control for lagged own contribution and lagged average contribution by other in-group members. All specifications include period fixed effects. Standard errors are clustered at the group level and reported in parentheses. *, ** and *** denote p<0.05, p<0.01, and p<0.001 respectively.

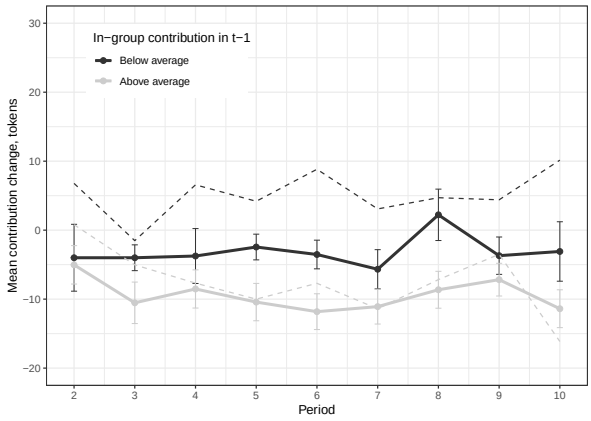
period is below or above the average contributions by other *in-group* members and estimate how contributions of these two groups change from one period to the next depending on the type of out-group feedback received. This is documented in Figure 3, which reports an average change in contributions from the previous to the current period ($a_{it} - a_{it-1}$). In all panels, dashed lines represent the control group, showing that participants who contribute above (below) their in-group average tend to decrease (increase) their contributions over time. These results are consistent with conditional cooperation envisaged by Hypothesis 1.

Starting with panels (a) and (b) in Figure 3, we report changes in contributions for pooled individual feedback treatments, respectively focusing on negative feedback information (below out-group average) in Panel (a) and positive feedback information (above out-group average) in Panel (b). We observe two main departures from the control treatment. First, for partic-

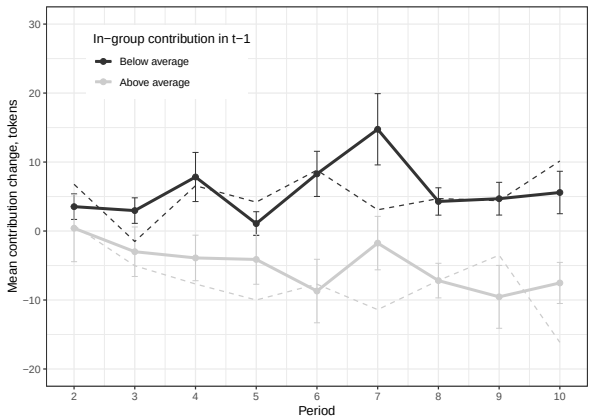
Figure 3: Average change in contributions (control group in dashed lines, standard errors in bars)



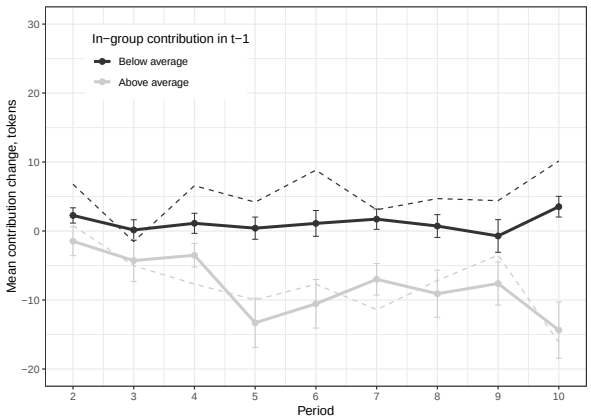
(a) Individual feedback: Below out-group average in t-1



(b) Individual feedback: Above out-group average in t-1



(c) Group-level feedback: Below out-group average in t-1



(d) Group-level feedback: Above out-group average in t-1

ipants who contribute above their in-group average and learn that they contribute below the out-group average (Panel a), the decline of contributions (towards in-group average) is much less pronounced relative to the control. This is consistent with Hypothesis 3. Second, Panel (b) shows that participants who contribute below their in-group average and receive positive individual feedback reduce their contributions compared to the previous period, whereas the in-group norm in the control suggests an increase. This is in line with Hypothesis 4.

Results for group-level feedback treatments, reported in Panel (c) for below out-group average feedback and in Panel (d) for above out-group average feedback, show slightly different patterns. In particular, only the negative effect of the positive feedback (group is above average) on below-average in-group contributors is visible.

Corresponding regression results for changes in contributions ($a_{it}-a_{it-1}$), using OLS random effects panel models, are reported in Table 6 (see Huck et al., 1999; Bigoni and Suetens, 2012, for similar approaches). In columns 1-3, we provide results for contributions below the in-group average in the previous period, and report those for contributions above the in-group average in the previous period in columns 4-6. In columns 1 and 4, we pool all treatments together into single treatment dummies (individual and group-level, exogenous and endogenous feedback), and estimate the effect of positive (above out-group) and negative (below out-group) feedback in t-1 on the change in contributions. Then, in columns 2 and 5, we estimate separate effects for individual-level and group-level feedback by introducing two interaction terms. Finally we include interaction terms for endogenous feedback in columns 3 and 6. Standard-errors are clustered at the group-level and reported in parentheses.[18]

For observations with contributions below the in-group average (column 1), positive (above out-group) feedback reduces the change in contributions by 7.28 tokens on average, suggesting that such information has a negative impact on cooperation patterns. By contrast, negative (below out-group) feedback has no effect. Moreover, results in column 2 suggest that the effect of positive (above out-group) feedback is stronger for individual-level feedback than for group-level feedback. Column 3 suggests no significant difference in how exogenous and endogenous feedback affect the change in contributions.

For participants above the in-group average (column 4), the effects of the out-group feedback

[18] The corresponding Tobit specification is presented in Table C3. Results are consistent.

Table 6: Conditional cooperation with out-group and in-group feedback

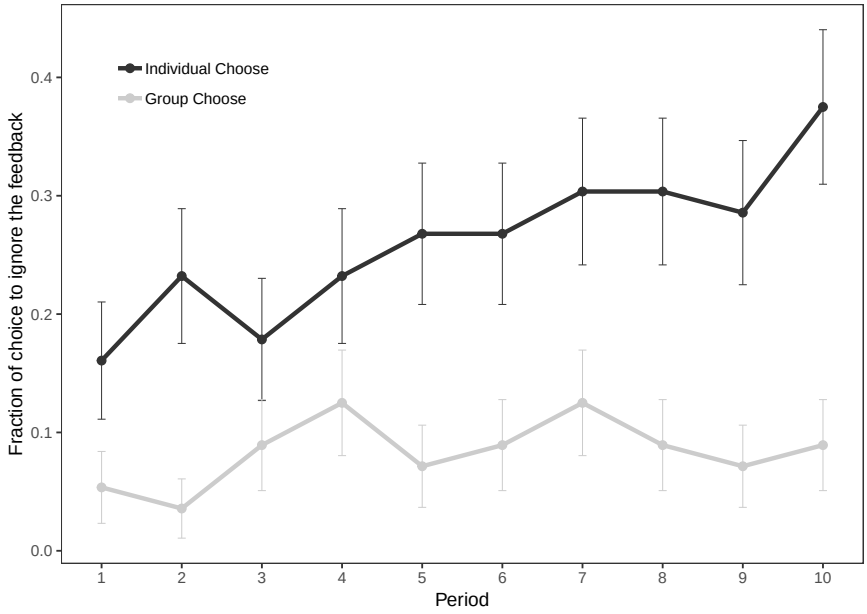
Δcontributions $(a_{it} - a_{it-1})$	Below in-group average in t-1			Above in-group average in t-1		
	(1)	(2)	(3)	(4)	(5)	(6)
Above out-group average in t-1	-7.28***	-5.45**	-5.45**	-1.77	-0.69	-0.67
	(1.94)	(1.94)	(1.95)	(1.45)	(1.59)	(1.59)
Below out-group average in t-1	-0.05	-0.91	-0.91	5.40**	3.40	3.36
	(1.94)	(2.13)	(2.14)	(1.62)	(1.80)	(1.80)
Above out-group average in t-1	-	-6.67**	-5.98***		-1.95	-4.00
x_INDIVIDUAL		(1.69)	(1.39)		(1.88)	(2.39)
Below out-group average in t-1	-	1.26	0.11		6.48**	9.66***
x_INDIVIDUAL		(1.52)	(1.90)		(2.44)	(2.29)
Above out-group average in t-1	-	-	-1.01			4.01
x_INDIVIDUAL CHOOSE			(2.66)			(2.76)
Below out-group average in t-1	-	-	2.37			-7.45*
x_INDIVIDUAL CHOOSE			(1.96)			(3.11)
Intercept	8.63***	8.50***	8.50***	-1.97	-2.11	-1.96
	(2.00)	(2.01)	(2.01)	(1.57)	(1.55)	(1.55)
Observations	1271	1271	1271	1126	1126	1126
R^2	0.05	0.05	0.05	0.04	0.04	0.05

Notes: OLS random effects panel regressions reported. Choices over nine periods are included. Columns 1-3 focus on observations with contributions below the in-group average in the previous period. Columns 4-6 focus on observations with contributions above the in-group average in the previous period. All specifications include period fixed effects. Standard errors are clustered at the group level and reported in parentheses. *, ** and *** denote $p<0.05$, $p<0.01$, and $p<0.001$ respectively.

are mirrored. In particular, positive (above out-group) feedback has no effect, whereas negative (below out-group) feedback mitigates the drop in contributions (+5.45 per period on average). Furthermore, column 5 indicates that the impact is larger for individual-level feedback. Lastly, column 6 suggests that the possibility to choose not to receive the feedback significantly reduces the change in contributions for the individual level comparisons (-7.45, Below out-group average x_INDIVIDUAL CHOOSE). We revisit this below.

Taken together, the difference between individual and group-level feedback emerges for conflicting in-group vs. out-group feedback: "below, above" and "above, below". These results support the Hypotheses 3 and 4 and predictions laid out in Table 2.

Figure 4: Avoidance of feedback on out-group norms by treatment (standard errors in bars)



3.3 Avoidance of out-group contribution norms

Figure 4 depicts the percentage of participants choosing not to receive the feedback on out-group contribution norms in experimental treatments INDIVIDUAL CHOOSE and GROUP CHOOSE. On average, across all 10 periods, participants in INDIVIDUAL CHOOSE treatment are around three times more likely to actively ignore feedback as compared to those in the GROUP CHOOSE treatment. Specifically, participants in INDIVIDUAL CHOOSE deliberately ignore out-group norms in 26.1% of choice occasions, the corresponding number being 8.4% in GROUP CHOOSE.

Figure 4 further shows that the difference between the two treatments is large starting from the first period of the game. After the first period, around 95% of participants in the GROUP CHOOSE treatment consult the comparison with the other groups in the session, whereas only 84% of participants in the INDIVIDUAL CHOOSE treatment consult their individual comparison with the out-group contribution norm ($p<0.10$, one-sided chi-square test with individual participants as unit of observation). In subsequent periods, information avoidance in the GROUP CHOOSE treatment remains low, whereas in the INDIVIDUAL CHOOSE treatment information avoidance increases sharply. At the end of the 10th period, only 63% of participants in the INDIVIDUAL CHOOSE treatment elect to consult the feedback, whereas the corresponding share is 91% in GROUP CHOOSE ($p<0.001$, one-sided chi-square test with individual participants as

Table 7: Feedback avoidance in INDIVIDUAL CHOOSE and GROUP CHOOSE treatments

Ignore feedback (=1)	(1)	(2)	(3)
INDIVIDUAL CHOOSE	0.18***	0.18***	0.18***
	(0.047)	(0.049)	(0.047)
Above in-group average in t-1	-	-0.01	-0.01
		(0.02)	(0.016)
Above in-group average in t-1 x_INDIVIDUAL	-	-	-0.027
			(0.028)
Intercept	0.02	0.05	0.05
	(0.040)	(0.030)	(0.031)
Observations	1120	1001	1001
R^2	0.06	0.07	0.07

Notes: OLS random effects panel regressions reported. Observations from all 10 periods (column 1) and last nine periods (after the feedback, columns 2 and 3) are included. All specifications include period fixed effects. Robust standard errors clustered at group level in parentheses. *, ** and *** denote p<0.05, p<0.01, and p<0.001 respectively.

unit of observation). This is in line with Hypothesis 5.

Table 7 presents corresponding results from OLS random effects regressions where the outcome variable is a binary variable for the decisions to ignore the feedback (equal to one if the participant ignores the feedback, zero otherwise). In column 1 we compare the rate of avoidance between group-level feedback (intercept) and individual feedback ("INDIVIDUAL CHOOSE" dummy). In column 2 we add a dummy variable equal to one if the lagged contribution is above the average of other in-group members (i.e., relatively high in-group contributor), and in column 3 we also include an interaction with the individual-level feedback dummy.[19]

Table 7 confirms that participants are more likely to ignore individual-level feedback than group-level feedback. This difference might explain the observation that treatments with endogenous and exogenous feedback differ only for individual-level feedback. More interestingly, columns 2 and 3 report that above-average in-group contributors consult the feedback as often as do below-average in-group contributors (small and non-significant coefficients for the variable "Above in-group average in t-1"). This suggests that high in-group contributors are ready to expose themselves to negative ("below average") feedback on the out-group norm, which

[19] Corresponding probit regressions are presented in Table C4 of Appendix C. The results are consistent.

goes against their self-interest to decrease contributions towards the in-group norm. This result contrasts with other studies showing that the possibility to ignore information leads to more self-interested behavior (Dana et al., 2007; Matthey and Regner, 2011).

4 Discussion and conclusion

In this paper, we have used a standard public good game to study the effect of individual and group-level out-group feedback on in-group cooperation. One important aspect of out-group feedback considered in this study is that it is payoff-irrelevant: By design, out-group average contribution should have no influence on participants' earnings. Our results suggest that out-group feedback has a differentiated effect on low and high in-group contributors that is in line with patterns of conditional cooperation. For example, low in-group contributors, who tend to increase contributions towards the in-group average, are pulled back by positive (above out-group average) feedback. Similarly, the decline in contribution by high in-group contributors is mitigated by negative (below out-group average) feedback. Moreover, the effect on low in-group contributors is present for individual and group-level feedback, whereas the effect on high in-group contributors is driven by individual-level comparisons only.

In contrast to many field interventions, we did not show the exact average behavior of others. Therefore, participants could not estimate how far they stood from the reference level, and this could have both positive and negative effects. Specifically, it may improve the motivation of participants who are far away from the reference level and who may otherwise feel discouraged by the effort required to comply with the norm. By contrast, participants closer to the reference level may benefit from more precise information. Understanding whether the distance to the reference level matters for the effectiveness of social norm feedback information is a relevant research question.

Similarly, our experiment offers interesting insights into the possibility for participants to ignore social norm feedback. First, our data suggest that a vast majority of participants choose to receive the feedback. A significant minority of participants, however, choose to ignore information about the out-group contribution norm, and we found that the likelihood of information avoidance is higher for individual-level feedback than for group-level feedback. Second, high and low in-group contributors expose themselves to feedback on out-group norms to the same

degree, suggesting that both groups appear to be interested in drawing inferences about their contribution behavior from more global comparisons with payoff-irrelevant others. Further evidence on the motivation for self-exposure to social norms is warranted.

Appendix A Experimental script

These instructions were printed and handed out to participants. The text is the same for all treatments, except for the part that discusses information feedback after all participants have made their contribution decision.

Instructions

Welcome and thank you for participating in this experiment. Please switch off your mobile phones and do not talk to other participants. If you have a question, raise your hand, and the experimenter will answer you privately.

In this experiment you can earn money. Your earnings depend on your own decisions, the decisions of other participants as well as on chance.

During the experiment your earnings will be expressed in Tokens which will be converted at the end of the experiment in CHF at the following conversion rate:

1 Token = 0.25 CHF.

During the whole experiment your anonymity is guaranteed.

Experimental procedure

The experiment consists of two parts. The following instructions explain the first part of the experiment. The instructions for the second part of the experiment will be presented to you after you have finished the first part.

After the second part of the experiment is over, the computer will randomly select either first or the second part of the experiment to define your final payment.

Therefore, you will either receive the payment from part 1 or from part 2 of the experiment. Since both parts can be selected with equal probability, please take all the decisions carefully in both parts of the experiment.

Part 1

At the beginning of this part of the experiment, the participants will be matched in the groups of four. The participants remain in the same groups throughout all 10 rounds in this part of the experiment.

At the beginning of every round, each participant receives an endowment of **60 Tokens**. Next, the participants will be asked to make a decision regarding this endowment.

In each group every participant has its own **account A**, and the group has a common **account B**. It means, in every group there are four private accounts A, one for each participant, and a single common account B.

The participants decide how they would like to allocate their endowment of 60 tokens between accounts A and B.

For each token the participants put on their private account A, they receive exactly one token. The tokens the participants in a group put on the group account B are summed up and **multiplied by 1.6**. The resulting total amount of tokens on the account B is then divided equally among the four members of the group.

The payment of each participant is thus defined as follows:

tokens on account A + **0.4***sum of contributions to group account B

Thus your earnings from account A are independent from the decisions of other participants. You simply keep the money that you put on account A.

Your payment from the account B, however, depends on the decisions of all group members.

It holds that you always receive 0.4 of the sum of the contributions to the group account B, regardless of how many tokens you contribute to this account; the more tokens are contributed to the group account B, the higher are the total earnings of the group (since the value of each contribution is increased by 60%).

Consider the following example:

Group member	1	2	3	4
Endowment	60	60	60	60
Contribution to group account B	0	20	40	60
Sum of contributions	120			
Profit from group account	120*1.6/4=48			
Tokens kept on private account A	60	40	20	0
Profit for round	108	88	68	48

After all the group members have made their decisions, you will be informed about your payment in that round.

Individual feedback:

Every round once all the participants have made their decisions, the computer will compare your

contribution to the group account B with the average contribution of all the other participants (your group members are not included in this comparison). Your relative position is then defined as below, above or equal to the average. After the comparison is made, your relative standing will be shown to you on the screen. The information about your relative position does not affect your payment.

Individual choose:

Every round once all the participants have made their decisions, you will have the opportunity to compare your contribution to the group account B with the average contribution of all the other participants (your group members are not included in this comparison). Your relative position is then defined as below, above or equal to the average. If you choose to make a comparison, your relative position will be shown to you on the screen. It means that you decide individually whether to know your relative position. Your decision to display or not to display your relative position will not be disclosed to other participants. The information about your relative position does not affect your payment.

Group feedback:

Every round once all the participants have made their decisions, the computer will make a comparison of the total contribution of your group to the group account B with the average total contributions to the account B of the other groups. The relative position of your group is then defined as below, above or equal to the average. After the comparison is made, the relative position of your group will be shown to you on the screen. The information about the relative position of your group does not affect your payment.

Group choose:

Every round once all the participants have made their decisions, you will have the opportunity to compare the total contribution to a group account B of your group to the average total contribution to account B of the other groups. The relative position of your group is then defined as below, above or equal to the average. If you choose to make a comparison, the relative position of your group will be shown to you on the screen. It means that you decide individually whether to know the relative position of your group. Your decision to display or not to display it will not be disclosed to other participants. The information about the relative position of your group does not affect your payment.

You will then be informed about your payment in that round.

Once the 10 rounds are over, the computer will randomly select one round to define your

payment for this part of the experiment. Therefore, your payment in this part of the experiment will be determined according to the decisions made in that particular round based on the aforementioned procedure. Since every round can be selected with equal probability, please take all the decisions carefully.

The experiment will then proceed to the second part. The experiment will end with the questionnaire which does not affect your payment. Should you read the instructions carefully, please click on “continue”. Before the experiment begins, you will be asked a few control questions to test your understanding of the experimental procedure.

Good Luck !

Appendix B Decision screens

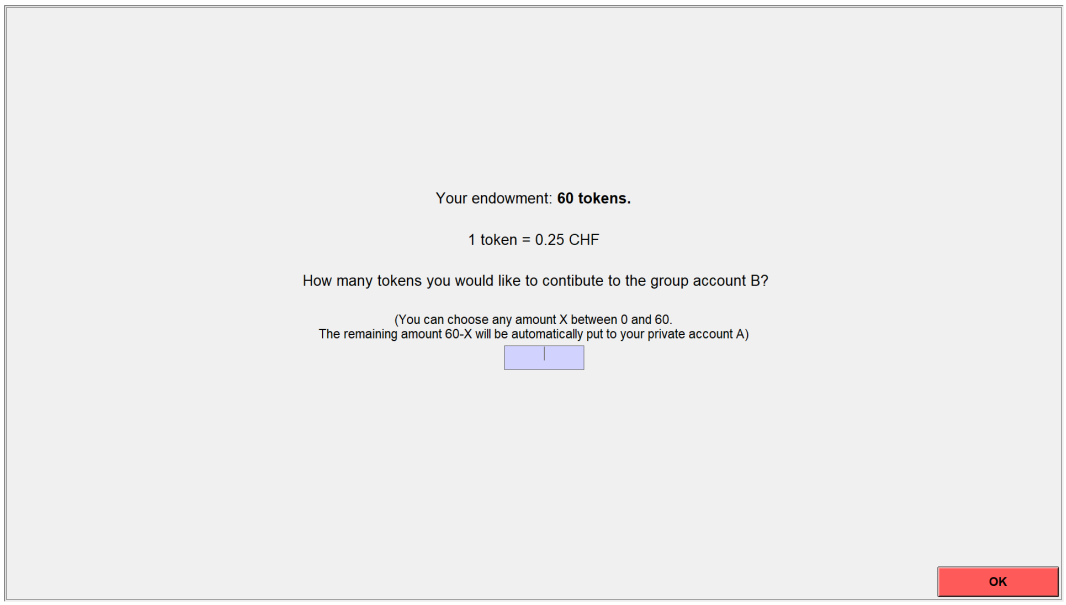


Figure B1: Contribution stage

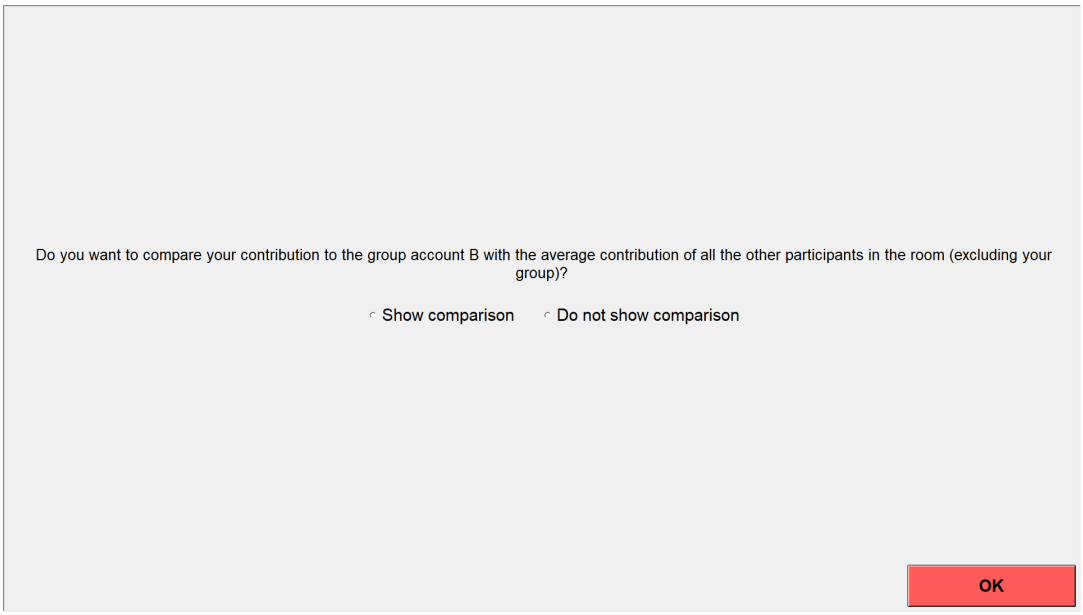


Figure B2: Individual choose: choice to ignore the feedback

Figure B3: Individual feedback: both individual feedback treatments

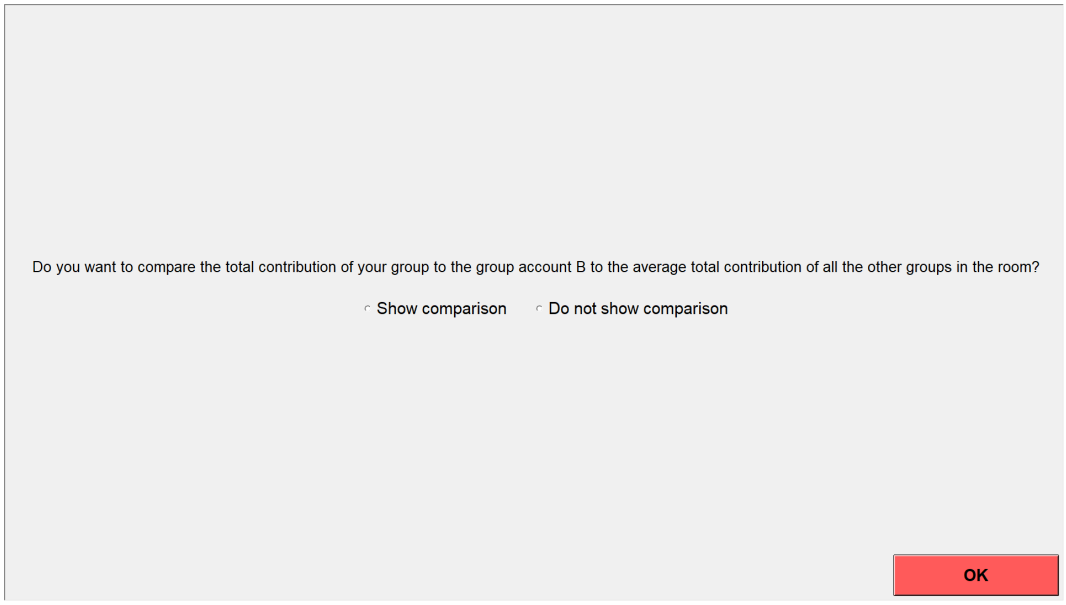


Figure B4: Group choose: choice to ignore group-level feedback

Figure B5: Group feedback: both group feedback treatments

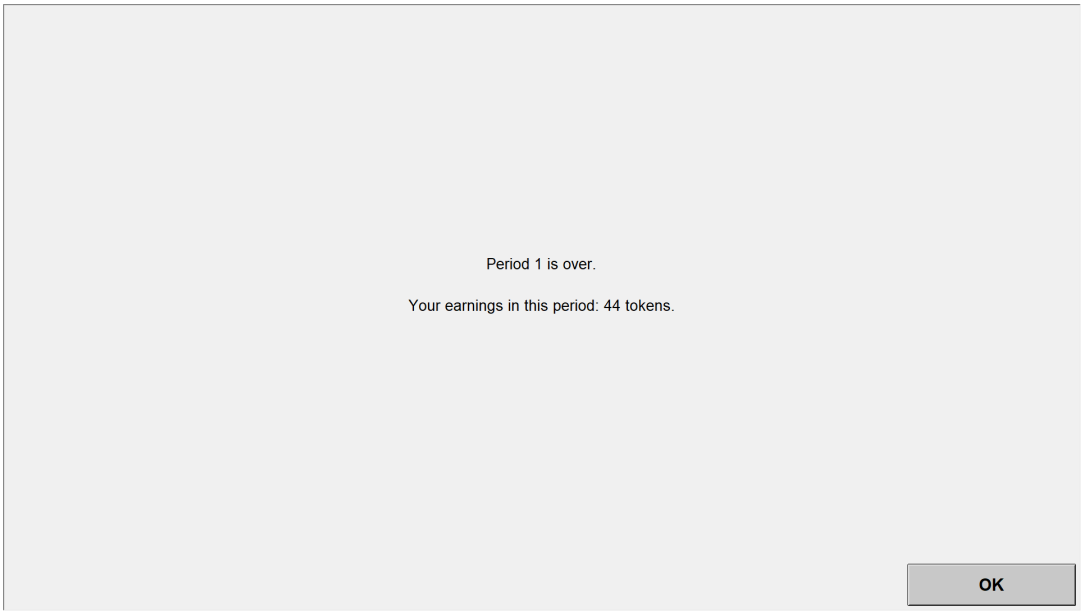


Figure B6: Payoff feedback: all treatments

Appendix C Additional regression results

Table C1: Public good contributions across treatments and feedback types, Tobit specifications

Contributions (a_{it})	Full sample		Out-group feedback in t-1			
			Below average		Above average	
	(1)	(2)	(3)	(4)	(5)	(6)
INDIVIDUAL	-6.50	-4.24	-0.96	-0.69	-13.63**	-5.52
	(3.92)	(2.82)	(3.53)	(2.94)	(4.65)	(3.53)
GROUP	-6.81	-4.64	-3.11	-2.48	-9.74*	-2.20
	(3.92)	(2.82)	(3.55)	(2.95)	(4.67)	(3.55)
Own contribution in t-1	-	0.39***	-	0.55***	-	0.71***
		(0.03)		(0.09)		(0.08)
Average in-group in t-1	-	0.16***	-	0.04	-	0.42***
		(0.05)		(0.08)		(0.09)
Intercept	35.86***	20.30***	22.00***	12.02***	60.96***	7.29
	(3.36)	(3.17)	(3.30)	(3.97)	(4.52)	(6.64)
Observations	2720	2448	827	827	867	867

Notes: Tobit random effects panel regressions reported. 0 and 60 as lower and upper bounds. Column 1 includes choices by all 272 participants over ten periods (the first period with no feedback is an omitted category). In columns 2-6, choices over nine periods are included. Columns 3 and 4 focus on observations for which own or group contributions in the previous period is below the out-group average. Columns 5 and 6 focus on observations for which own or group contributions in the previous period is above the out-group average. In columns 2, 4 and 6, we control for lagged own contribution and lagged average contribution by other in-group members. All specifications include period fixed effects. Standard errors are clustered at the group level and reported in parentheses. *, ** and *** denote $p<0.05$, $p<0.01$, and $p<0.001$ respectively.

Table C2: Public good contributions in treatments with exogenous and endogenous feedback, Tobit specifications

Contributions (a_{it})	Full sample		Out-group feedback in t-1			
			Below average		Above average	
	(1)	(2)	(3)	(4)	(5)	(6)
INDIVIDUAL FEEDBACK	-9.65*	-6.60*	-0.69	-0.58	-19.09***	-8.88*
	(4.56)	(3.28)	(3.97)	(3.31)	(5.35)	(4.14)
INDIVIDUAL CHOOSE	-3.54	-2.05	-1.28	-0.79	-8.65	-2.83
	(4.48)	(3.21)	(4.13)	(3.44)	(5.21)	(3.91)
GROUP FEEDBACK	-5.38	-4.21	-4.09	-3.49	-6.78	-1.77
	(4.56)	(3.27)	(4.18)	(3.49)	(5.35)	(4.03)
GROUP CHOOSE	-8.12	-5.05	-2.31	-1.65	-12.53*	-2.89
	(4.47)	(3.22)	(3.99)	(3.31)	(5.27)	(4.07)
Own contribution in t-1	-	0.39***	-	0.55***	-	0.71***
		(0.03)		(0.09)		(0.08)
Average in-group in t-1	-	0.15**	-	0.05	-	0.40***
		(0.05)		(0.08)		(0.09)
Intercept	35.86***	20.41***	22.03***	11.98***	61.10***	8.28
	(3.35)	(3.16)	(3.30)	(3.96)	(4.47)	(6.66)
Observations	2720	2448	827	827	867	867

Notes: Tobit random effects panel regressions reported. 0 and 60 as lower and upper bounds. Column 1 includes choices by all 272 participants over ten periods (the first period with no feedback is an omitted category). In columns 2-6, choices over nine periods are included. Columns 3 and 4 focus on observations for which own or group contributions in the previous period is below the out-group average. Columns 5 and 6 focus on observations for which own or group contributions in the previous period is above the out-group average. In columns 2, 4 and 6, we control for lagged own contribution and lagged average contribution by other in-group members. All specifications include period fixed effects. Standard errors are clustered at the group level and reported in parentheses. *, ** and *** denote $p<0.05$, $p<0.01$, and $p<0.001$ respectively.

Table C3: Out-group feedback and in-group contribution norms, Tobit specifications

Δcontributions ($a_{it} - a_{it-1}$)	Below in-group average t-1			Above in-group average t-1		
	(1)	(2)	(3)	(4)	(5)	(6)
Above out-group average in t-1	-6.81***	-5.20**	-5.20**	-1.58	-0.55	-0.50
	(1.47)	(1.58)	(1.57)	(1.65)	(1.95)	(1.89)
Below out-group average in t-1	0.16	-0.57	-0.57	5.45**	3.45	3.33
	(1.36)	(1.60)	(1.60)	(1.87)	(2.06)	(2.01)
Above out-group average in t-1	-	-6.10**	-5.75*		-1.87	-4.05
x_INDIVIDUAL		(1.88)	(2.62)		(1.76)	(2.09)
Below out-group average in t-1	-	1.08	0.03		6.52*	9.79**
x_INDIVIDUAL		(1.37)	(1.60)		(2.54)	(3.11)
Above out-group_IND_CHOOSE t-1	-	-	0.50			4.23
x_INDIVIDUAL CHOOSE			(3.18)			(2.25)
Below out-group_IND_CHOOSE t-1	-	-	2.16			-7.79
x_INDIVIDUAL CHOOSE			(1.73)			(4.08)
Intercept	7.88***	7.81***	7.80***	-2.15	-2.30	-2.12
	(1.56)	(1.57)	(1.56)	(1.99)	(1.99)	(1.96)
Observations	1271	1271	1271	1126	1126	1126

Notes: Tobit random effects panel regressions reported, with -60 and 60 as lower and upper bounds respectively. Choices over nine periods are included. Columns 1-3 focus on observations with contributions below the in-group average in the previous period. Columns 4-6 focus on observations with contributions above the in-group average in the previous period. All specifications include period fixed effects. Standard errors are clustered at the group level and reported in parentheses. *, ** and *** denote p<0.05, p<0.01, and p<0.001 respectively.

Table C4: Feedback avoidance in INDIVIDUAL CHOOSE and GROUP CHOOSE treatments, Probit

Ignore feedback (=1)	(1)	(2)	(3)
INDIVIDUAL CHOOSE	1.83***	1.96***	1.97***
	(0.400)	(0.381)	(0.394)
Above in-group average in t-1		-0.17	-0.16
		(0.212)	(0.200)
Above in-group average in t-1			-0.036
x_INDIVIDUAL			(0.153)
Intercept	-4.10***	-3.86***	-3.86***
	(0.567)	(0.543)	(0.551)
Observations	1120	1001	1001

Notes: Probit random effects panel regressions reported. Observations from all 10 periods (column 1) and last nine periods (after the feedback, columns 2 and 3) are included. All specifications include period fixed effects. Robust standard errors clustered at group level in parentheses. *, ** and *** denote p<0.05, p<0.01, and p<0.001 respectively.

References

Allcott, H. (2011) "Social norms and energy conservation," *Journal of Public Economics*, 95, 9, pp. 1082 – 1095.

Allcott, H. and J. Kessler (2015) "The welfare effect of nudges: A case study of energy use social comparisons." NBER Working Paper Series.

Allcott, H. and T. Rogers (2014) "The short-run and long-run effects of behavioral interventions: Experimental evidence from energy conservation," *American Economic Review*, 104, 10, pp. 3003–37, October.

Ayers, U., S. Raseman, and A. Shih (2013) "Evidence from two large field experiments that peer comparison feedback can reduce residential energy usage," *Journal of Law, Economics and Organization*, 29, pp. 992–1022.

Bicchieri, C. and E. Dimant (2019) "Nudging with Care: The Risks and Benefits of Social Information," *Public choice*, s11127-019-00684-6.

Bicchieri, C. and E. Xiao (2009) "Do the right thing: but only if others do so," *Journal of Behavioral Decision Making*, 22, 2, pp. 191–208.

Bigoni, M. and S. Suetens (2012) "Feedback and dynamics in public good experiments," *Journal of Economic Behavior & Organization*, 82, 1, pp. 86 – 95.

Boehm, R. and B. Rockenbach (2013) "The inter-group comparison - intra-group cooperation hypothesis: Comparisons between groups increase efficiency in public goods provision," *PLOS ONE*, 8, pp. 1–7, 02.

Brown, R. (2000) "Social identity theory: Past achievements, current problems and future challenges," *European Journal of Social Psychology*, 30, pp. 745–778, 11.

Charness, G., R. Cobo-Reyes, and N. Jimenez (2014) "Identities, selection, and contributions in a public-goods game," *Games and Economic Behavior*, 87, pp. 322 – 338.

Charness, G., U. Gneezy, and B. Halladay (2016) "Experimental methods: Pay one or pay all," *Journal of Economic Behavior & Organization*, 131, pp. 141–150, 08.

Chaudhuri, A. (2011) "Sustaining cooperation in laboratory public goods experiments: A selective survey of the literature," *Experimental Economics*, 14, 1, pp. 47–83, Mar.

Christens, S., A. Dannenberg, and F. Sachs (2019) "Identification of individuals and groups in a public goods experiment," *Journal of Behavioral and Experimental Economics*, 82, p. 101445.

Cialdini, R., R. Reno, and C. Kallgren (1990) "A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places," *Journal of Personality and Social Psychology*, 58, pp. 1015–1026.

Conte, A., M. Levati, and N. Montinari (2019) "Experience in public goods experiments," *Theory and Decision*, 86, pp. 65–93.

Costa, D. L. and M. E. Kahn (2013) "Energy conservation "nudges" and environemtalist ideology: Evidence from a randomized residential electricity field experiment," *Journal of the European Economic Association*, 11, 3, pp. 680–702.

Cox, C. and B. Stoddard (2015) "Framing and feedback in social dilemmas with partners and strangers," *Games*, 6, pp. 394–412, 09.

Dana, J., R. Weber, and J. Kuang (2007) "Exploiting moral wiggle room: Experiments demonstrating an illusory preference for fairness," *Economic Theory*, 33, 1, pp. 67–80, October.

De Dominicis, S., R. Sokoloski, C. M. Jaeger, and P. W. Schultz (2019) "Making the smart meter social promotes long-term energy conservation," *Palgrave Communications*, 5, pp. 1–8.

Elster, J. (1989) "Social norms and economic theory," *Journal of Economic Perspectives*, 3, 4, pp. 99–117, December.

Erkut, H., D. Nosenzo, and M. Sefton (2015) "Identifying social norms using coordination games: Spectators vs. stakeholders," *Economics Letters*, 130, Supplement C, pp. 28 – 31.

Fehr, E. and I. Schurtenberger (2018) "Normative foundations of human cooperation," *Nature Human Behaviour*, 2, pp. 458–468.

Ferraro, P. J., J. J. Miranda, and M. K. Price (2011) "The persistence of treatment effects with norm-based policy instruments: Evidence from a randomized environmental policy experiment," *American Economic Review*, 101, 3, pp. 318–22, May.

Fischbacher, U. (2007) "z-tree: Zurich toolbox for ready-made economic experiments," *Experimental Economics*, 10, 2, pp. 171–178, Jun.

Fischbacher, U., S. Gächter, and E. Fehr (2001) "Are people conditionally cooperative? Evidence from a public goods experiment," *Economics Letters*, 71, 3, pp. 397 – 404.

Fischbacher, U. and S. Gächter (2010) "Social preferences, beliefs, and the dynamics of free riding in public goods experiments," *American Economic Review*, 100, 1, pp. 541–56, March.

Gächter, S., D. Nosenzo, and M. Sefton (2013) "Peer effects in pro-social behavior: Social norms or social preferences?" *Journal of the European Economic Association*, 11, 3, pp. 548–573.

Gächter, S., L. Gerhards, and D. Nosenzo (2017) "The importance of peers for compliance with norms of fair sharing," *European Economic Review*, 97, pp. 72 – 86.

Grossman, Z. (2014) "Strategic ignorance and the robustness of social preferences," *Management Science*, 60, 11, pp. 2659–2665.

Grossman, Z. and J. J. van der Weele (2017) "Self-image and willful ignorance in social decisions," *Journal of the European Economic Assosiation*, 15, pp. 173–217, April.

Hallsworth, M., J. A. List, R. D. Metcalfe, and I. Vlaev (2017) "The behavioralist as tax collector: Using natural field experiments to enhance tax compliance," *Journal of Public Economics*, 148, pp. 14 – 31.

Hogg, M. and S. Reid (2006) "Social identity, self-categorization, and the communication of group norms," *Communication Theory*, 16, pp. 111–136, 02.

Holt, C. A. and S. K. Laury (1997) "Classroom games: Voluntary provision of a public good," *Journal of Economic Perspectives*, 11, 4, pp. 209–215, December.

Huck, S., H. Normann, and J. Oechssler (1999) "Learning in cournot oligopoly: An experiment," *The Economic Journal*, 109 (454), pp. C80–C95.

Janssen, M., A. Lee, and H. Sundaram (2016) "Stimulating contributions to public goods through information feedback: Some experimental results," *PLoS ONE*, 11.

Karlin, B., J. F. Zinger, and R. Ford (2015) "The effects of feedback on energy conservation: A meta-analysis," *Psychological Bulletin*, 144, pp. 1205–1227.

Kocher, M., T. Cherry, S. Kroll, R. J. Netzer, and M. Sutter (2008) "Conditional cooperation on three continents," *Economics Letters*, 101, 3, pp. 175–178.

Krupka, E. L. and R. A. Weber (2013) "Identifying social norms using coordination games: Why does dictator game sharing vary?" *Journal of the European Economic Association*, 11, 3, pp. 495–524.

Ledyard, J. O. (1995) "Public Goods: A Survey of Experimental Research," in J. Kagel and A. Roth eds. *Handbook of experimental economics*: Princeton University Press, Chap. 2.

Marks, M., D. Lehr, and R. Brastow (2006) "Cooperation versus free riding in a threshold public goods classroom experiment," *The Journal of Economic Education*, 37, 2, pp. 156–170.

Matthey, A. and T. Regner (2011) "Do I Really Want to Know? A Cognitive Dissonance-Based Explanation of Other-Regarding Behavior," *Games*, 2, 1, pp. 114–135, February.

Mazar, N., O. Amir, and D. Ariely (2008) "The dishonesty of honest people: A theory of self-concept maintance," *Journal of Marketing Research*, 45, 6, pp. 633–644.

Nikiforakis, N. (2010) "Feedback, punishment and cooperation in public good experiments," *Games and Economic Behavior*, 68, 2, pp. 689 – 702.

Robinson, E., J. Thomas, P. Aveyard, and S. Higgs (2014) "What everyone else is eating: A systematic review and meta-analysis of the effect of informational eating norms on eating behavior," *Journal of the Academy of Nutrition and Dietetics*, 114, 3, pp. 414 – 429.

Schultz, P. W., J. M. Nolan, R. B. Cialdini, N. J. Goldstein, and V. Griskevicius (2007) "The constructive, destructive, and reconstructive power of social norms," *Psychological Science*, 18, 5, pp. 429–434.

Sheremeta, R. M. and A. Savikhin Samek (2014) "Recognizing contributors: an experiment on public goods," *Experimental Economics*, 17, pp. 673–690.

Tajfel, H. and J. C. Turner (1986) "The social identity theory of intergroup behaviour," in S. Worchel and W. G. Austin eds. *Psychology of Intergroup Relations*, Chicago: Hall Publishers, 2nd edition, pp. 7–24.

Tan, J. and F. Bolle (2007) "Team competition and the public goods game," *Economics Letters*, 96, 1, pp. 133–139.