Vesely, S., Klöckner, C.A., & Brick, C. (2019, in press). Pro-environmental behavior as a signal of cooperativeness: Evidence from a social dilemma experiment. *Journal of Environmental Psychology*.

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Accepted 2019, *Journal of Environmental Psychology*

Post-print October 14, 2019

post-print DOI: 10.31234/osf.io/f3esj

Abstract

Pro-environmental behavior has social signaling value. Previous research suggests that enacting pro-environmental behaviors can signal certain personal characteristics, such as social status and trustworthiness, to others. Using an incentivized experiment, we show that people known to behave pro-environmentally are expected to be more cooperative, are preferred as cooperation partners, and elicit more cooperation from others. The presence of pro-environmental individuals may thus motivate others to exert more effort towards reaching cooperative goals, even in situations where individual and group goals are at odds (i.e., social dilemmas). However, people who behaved pro-environmentally were actually no more cooperative than those performing fewer pro-environmental behaviors.

1. Introduction

Climate change mitigation and many of the associated pro-environmental behaviors such as reducing air travel and meat consumption (Dietz, Gardner, Gilligan, Stern, & Vandenberg, 2009) have become contentious and polarizing subjects in the public discourse (McCright & Dunlap, 2011). As a consequence, people may be reluctant to display or advocate mitigation actions in order to avoid conflict, social sanctions and being perceived negatively by others (cf. Bashir, Lockwood, Chasteen, Nadolny, & Noyes, 2013; Brick, Sherman, & Kim, 2017). Also, people may sort into social relationships with those sharing similar views regarding climate protection, which would allow them to exhibit (or not) pro-environmental behaviors more freely, but this assortative matching could lead to even greater opinion polarization in the long term (Böhm, Pfister, Salway, & Fløttum, 2019).

One good strategy on how to start gaining more insight into the processes sketched in the previous paragraph is to examine how people behaving pro-environmentally (henceforth

referred to as “environmentalists” for short) are perceived by others, and whether such perceptions can have real consequences in terms of subsequent social interaction.

There is now a small but growing literature addressing the complex question of how environmentalists are perceived. What previous research shows is that pro-environmental behaviors and attitudes may be able to convey information about a person’s social status (Brooks & Wilson, 2015; Puska, Kurki, Lähdesmäki, Siltaoja, & Luomala, 2016; Sadalla & Krull, 1995; Skippon, Kinnear, Lloyd, & Stannard, 2016; but see Berger, 2017; Welte & Anastasio, 2010), trustworthiness (Fehrler & Kosfeld, 2013; but see Berger, 2017; Puska et al., 2016), and certain personality traits like conscientiousness, agreeableness, and altruism (Puska et al., 2016; Skippon & Garwood, 2011; Skippon et al., 2016). While existing research shows much promise, it has at least two limitations the present work attempts to address. First, we study not only whether behaving pro-environmentally shapes others’ perceptions of the actor, but also whether it can have an impact on subsequent social interaction. Second, we study whether people take others’ environmentalism into account when making decisions with real (financial) stakes on the line, as opposed to hypothetical decisions or survey responses (cf. Camerer & Hogarth, 1999; Kormos & Gifford, 2014; Klein, Hilbig, & Heck, 2017; Vesely & Klöckner, 2018a).

We extend the literature on the signaling function of environmentalism by testing whether pro-environmental behavior is perceived by others to signal cooperativeness, and by studying how people respond to such a signal. We also explore whether environmentalists behave more cooperatively themselves. Pro-environmental behavior can thus be linked to a key domain of social interaction (cooperation) through its function as a social signal. In this view, environmentally relevant decisions are not made in isolation from the broader social context, but drive and are driven by social influence processes.

People may sometimes refrain from behaving pro-environmentally if they think this could harm their social image (Brick et al., 2017). However, if pro-environmental behavior can serve as a reliable signal of cooperativeness, applied research could then build on this finding to facilitate pro-environmental behavior. Specifically, environmentalists’ greater perceived cooperativeness and others’ greater willingness to cooperate with them could be leveraged as a co-benefit of and further motivation for behaving pro-environmentally. This possibility echoes what has been suggested by Keohane and Victor (2016) in the context of climate change mitigation negotiations: that countries may contribute to climate change mitigation to build their reputation and to secure future cooperation from others (see also Bain et al., 2016; Brekke & Nyborg, 2008). Thus, if pro-environmental behavior is able to signal cooperative tendencies, this can have important practical implications.

Before proceeding to our hypotheses, we shall provide a brief outline of their key theoretical underpinnings. We study cooperation using a standard social dilemma setting (the public goods game) where the group’s material welfare is maximized by joint cooperation by everyone in the group, but at the same time an individual is materially better off not cooperating regardless of what the other group members do (Andreoni, 1988; Dawes, 1980). What motivates our prediction that people engaging in pro-environmental behavior are also more cooperative (see H4 below) is that both cooperative and pro-environmental behaviors are driven by pro-social preferences, such as inequity aversion and norm compliance in case of cooperation (Fehr & Schmidt, 1999; Kimbrough & Vostroknutov, 2016; Krupka & Weber, 2013) and attitudes, values, and norms in case of pro-environmental behavior (Bamberg & Möser, 2007; Klöckner, 2013). We specifically propose that pro-environmental and

cooperative behaviors may be linked by virtue of their underlying pro-social motives being correlated within individuals. This is consistent with previous research linking cooperation to pro-environmental behaviors and attitudes (Kaiser & Byrka, 2011; Sussman, Lavalée, & Gifford, 2016; Tarditi, Hahnel, Jeanmonod, Sander, & Brosch, 2018; but see Smith & Bell, 1992), as well as with research on associations between different pro-social motives more generally (Bamberg & Möser, 2007; Gächter, Nosenzo, & Sefton, 2013; Kimbrough & Vostroknutov, 2016; Klöckner, 2013). We next propose that if environmentally-friendly individuals are indeed more cooperative outside the lab, observers will have formed a mental association between environmentalism and cooperation through experience (see H1). Because in social dilemmas, interaction with cooperators rather than free-riders is by design more advantageous (see section 2.3.1 and Andreoni, 1988), we expect that environmentalists, if perceived to be cooperative, will be preferred as cooperation partners (see H2). Finally, provided that environmentalists are believed to be cooperative, others should cooperate with them (see H3) due to well-established reciprocity and inequity aversion motives (Fehr & Schmidt, 1999).

Hypotheses. H1: Individuals will expect those who perform more pro-environmental behaviors to be more cooperative in social dilemmas. H2: People who perform more pro-environmental behaviors will be preferred as cooperation partners in social dilemmas. H3: People who perform relatively more pro-environmental behaviors will elicit more cooperation from others. H4: People who perform relatively more pro-environmental behaviors will be more cooperative in social dilemmas.

To test our hypotheses, we invited participants to play four public goods games in the laboratory, select their preferred game partners, and respond to questionnaires, as detailed below.

2. Method

2.1 Participants and sessions

Two hundred and eight participants (111 females; mean age = 23.94 years, $SD = 5.45$) recruited from a subject pool maintained by the Vienna Center for Experimental Economics (VCEE) took part in the study. A priori power calculations indicated that a sample of at least 191 participants was required to detect a small effect (partial $R^2 = .04$) with alpha at .05 (two-tailed) and statistical power at .80 (Faul, Erdfelder, Lang, & Buchner, 2007). ORSEE (Greiner, 2015) was used for recruitment and z-Tree (Fischbacher, 2007) for programming. Participants were compensated for their time, mean earnings = 35.3 EUR (including payment for additional unrelated tasks, see section B5 in Appendix B). The design was independently reviewed and approved by VCEE staff, in accordance with University of Vienna regulations.

2.2 Questionnaire

Participants responded to 28 questions about their previous pro-environmental behaviors (most of the items were adapted from Kaiser, 1998; see Appendix D). We calculated the total score for each participant, with higher scores indicating enactment of more pro-environmental behaviors ($M = 18.03$, $SD = 3.77$, $\alpha = .70$). Participants also answered socio-demographic questions.

We then elicited participants' risk preferences, using a task adapted from Eckel and Grossman (2002). This served as a filler task obscuring the link between the environmental behavior questionnaire and the social dilemma games. Importantly, we later gave participants the

opportunity to condition their selection of partners in one of the social dilemma games on the potential partner's risk preferences (see section 2.5).

2.3 Public goods games

Participants played four standard one-shot linear public goods games (Andreoni, 1988) without feedback. In each game, participants formed anonymous groups of four. In each game, each participant was endowed with 20 tokens and had to decide how to distribute the tokens between a Group project and an Individual project. One token invested in the Individual project would yield one point to the investor and zero points to the other three group members. One token invested in the Group project would yield 0.5 points to all four group members. Thus, investing in the Group project (cooperation) maximized the group's material welfare, while investing in the Individual project yielded higher material utility to the individual. At the end of the experiment, one of the four games was randomly selected for payment with an exchange rate 10 points = 2 EUR.

2.3.1 Group matching (treatments)

In the "Most Environmental Game" condition, participants were informed they would be matched with the three most pro-environmental participants in the session (excluding themselves) based on the pre-experimental questionnaire. In "Least Environmental Game", participants were informed they would be matched with the three least pro-environmental participants in the session. In "Average Environmental Game", participants were informed they would be matched with the three participants in the session that were closest to that session's mean environmentalism score. In "Random Matching Game", participants were informed they would be matched into groups randomly. The order of the four games was randomized across participants.

2.4 Belief elicitation

After each game, participants guessed how many tokens others in their matching group contributed to the Group project in total in that game. Participants were given a 2 EUR bonus for guessing others' total contribution correctly within ± 3 tokens.

2.5 Partner selection

Participants next proceeded to play three repeated public goods games as a part of an unrelated study. Important for the present study, they were given an opportunity to select their preferred partners for one of these games from among other participants in the session. Specifically, each participant was shown a table listing all other participants in the session in random order, with the following information displayed in three columns: each participant's environmental score, risk seeking score and age. The order in which the three types of scores were displayed in the columns was randomized across participants. Thus, participants were able to condition their choice of partners on two additional plausible criteria besides environmental score (i.e., others' risk preferences and age, see Kocher, Martinsson, Matzat, & Wollbrant, 2015; Thöni, Tyran, & Wengström, 2012). Participants could then indicate on a 7-point scale whether they would like to be matched with each of the other participants present. Participants knew that their stated preferences would with some probability determine with whom they would be matched (see Appendix B).

3. Results

Figure 1 displays participants' contributions to the Group project in the four games and their beliefs of how much a co-player in their matching group contributed.

Fig. 1: Own actual and co-player's expected contributions (means and 95% CIs; maximum possible contribution per game was 20 tokens).

In Table 1, we report estimates of two regression models testing H1. In Model 1, we regressed participants' expectations of how much others in their matching group contributed to the Group project on matching group type dummies, with "Average Environmental Game" serving as the baseline category. Model 2 is the same as Model 1, but "Random Matching Game" serves as the baseline category. All reported tests are two-sided.

Table 1
Regression of expected contributions on group type

	Model 1 – Average Environmental Game used as baseline	Model 2 – Random Matching Game used as baseline
	<i>b</i> (95% CI)	<i>b</i> (95% CI)
Most Environmental Game	1.10 (0.62, 1.59)***	1.54 (1.01, 2.07)***
Least Environmental Game	-1.59 (-2.09, -1.08)***	-1.15 (-1.67, -0.63)***
Average Environmental Game		0.43 (-0.01, 0.88)
Random Matching Game	-0.43 (-0.88, 0.01)	
Constant	9.41 (8.71, 10.12)***	8.98 (8.29, 9.66)***
Observations	832	832
No. of clusters	208	208
<i>R</i> ²	.03	.03

Notes: *** $p < .001$. Estimation method is robust linear regression with standard errors clustered at the subject level.

We found clear support for H1: Environmentalists were believed to be more cooperative. Specifically, compared to either control group (Average Environmental Game or Random Matching Game), participants expected co-players who were known to perform the most pro-environmental behaviors in one's session to contribute more to the Group project, while the reverse was true for co-players who were known to perform the fewest pro-environmental behaviors.

The test of H2 is presented in Table 2. As described in section 2.5, for every individual in a session, each participant indicated whether they preferred to be matched with them on a 7-point scale. For every individual we averaged the preference ratings received from others. Everyone was thus assigned a “mean preference rating”. Higher values indicated that others wanted to be matched with this person, and lower values indicated that others preferred not to be matched with this person. In Table 2, we regressed participants’ mean preference rating on their environmental score, risk seeking score and age score (i.e., the indicators displayed during the rating exercise). We found strong support for H2: Participants preferred to be matched with others who performed many pro-environmental behaviors. Age and risk preferences had no effect on being preferred as cooperation partner.

Table 2

Regression of received preference ratings on players’ characteristics

	<i>b</i> (95% CI)
Environmental score	0.07 (0.06, 0.08)***
Risk score	0.00 (-0.01, 0.01)
Age score	0.00 (-0.01, 0.00)
Constant	3.12 (2.93, 3.31)***
Observations	208
R^2	.51

Notes: *** $p < .001$. Linear regression with robust standard errors.

Table 3 presents estimates of two regression models simultaneously testing H3 and H4. In Model 3, we regressed participants’ contributions to the Group project on their environmental score (to test H4) and on matching group type dummies (to test H3), with Average Environmental Game serving as the control group. Model 4 is the same as Model 3, but Random Matching Game serves as control.

Table 3

Regression of contributions on environmental score and group type

	Model 3 – Average Environmental Game used as baseline	Model 4 – Random Matching Game used as baseline
	<i>b</i> (95% CI)	<i>b</i> (95% CI)
Most Environmental Game	1.22 (0.58, 1.86)***	1.23 (0.64, 1.81)***
Least Environmental Game	-1.86 (-2.46, -1.25)***	-1.85 (-2.61, -1.09)***
Average Environmental Game		0.00 (-0.57, 0.58)
Random Matching Game	-0.00 (-0.58, 0.57)	
Environmental score	0.11 (-0.09, 0.30)	0.11 (-0.09, 0.30)
Constant	7.00 (3.33, 10.68)***	7.00 (3.32, 10.68)***
Observations	832	832
No. of clusters	208	208
R^2	.03	.03

Notes: *** $p < .001$. Robust linear regression with standard errors clustered at the subject level.

We found clear support for H3: Environmentalists elicited more cooperation from others. Specifically, compared to either control group, participants contributed more to the Group project when matched with co-players who were known to perform the most pro-environmental behaviors in one’s session, while they contributed less to the Group project when matched with co-players who were known to perform the fewest pro-environmental behaviors. Hypothesis H4 was not supported: Those who reported performing more pro-

environmental behaviors did not cooperate more than those performing fewer pro-environmental behaviors.

4. Discussion and conclusions

In this paper we focused on the signaling value of pro-environmental behavior and specifically on its ability to signal cooperative tendencies. We posited that pro-environmental behavior can serve as a signal of cooperation (H1), and that others would act on this signal (H2, H3), and we also proposed that environmentalists would themselves be more cooperative (H4). As predicted, environmentalists were perceived as more cooperative in the social dilemma setting (H1), they were sought after as cooperation partners (H2), and they elicited more cooperation from others (H3). Unexpectedly, environmentalists were not more cooperative compared to those performing fewer pro-environmental behaviors (H4). These findings contribute to the literature on the signaling value of environmentalism (e.g., Berger, 2017; Brick et al., 2017; Griskevicius, Tybur, & Van den Bergh, 2010) by showing that environmental behaviors signal a cooperative disposition and that others act on this signal in situations with real consequences.

An important implication of our results is that being seen as an environmentalist confers personal side-benefits to environmentalists, as others are more cooperative towards such individuals, and more willing to establish interactions with them (a form of social capital, see Cinyabuguma, Page, & Putterman, 2005). Such side-benefits could be leveraged by policy-makers to promote further pro-environmental action (Bain et al., 2016; Griskevicius et al., 2010; Keohane & Victor, 2016).

Environmentalists, however, do not appear to fulfill others' expectations of being more cooperative themselves (see H4). Subsequent research should therefore explore how to motivate environmentalists to meet others' initial positive expectations (see e.g. Bellemare, Sebald, & Suetens, 2018). Otherwise, cooperation is likely to break down in repeated encounters when initial positive expectations are not met (Fischbacher & Gächter, 2010). A possible explanation for failing to support H4 could be that cooperative decisions were made anonymously in our experiment, while past cooperative decisions involved in expectation formation had to be publicly observable. Decision observability promotes pro-social behavior (Bradley, Lawrence, & Ferguson, 2018), which may help explain why anonymous decisions deviate from others' expectations. An intriguing hypothesis consistent with our data is that environmentalists are particularly sensitive to being publicly observed. This suggests possible extensions of the present study, linking it to research on the role that decision observability plays in environmental behavior (Griskevicius et al., 2010; Brick et al., 2017; Vesely & Klöckner, 2018b).

A limitation of our study is that environmental behaviors were self-reported, rather than objectively measured (Kormos & Gifford, 2014; Lange & Dewitte, 2019). Another limitation is that we relied on a single decision paradigm, the "give some" public goods game, and replications using other types of social dilemmas could point to possible boundary conditions of the reported effects. There are for example subtle behavioral differences between "give some" and "take some" social dilemmas (Fosgaard, Hansen, & Wengström, 2014). One could speculate that different types of pro-environmental behavior (e.g., investment vs. curtailment) could be better able to signal cooperativeness in specific types of dilemmas (such as the give some vs. take some dilemmas). Another limitation is that only two "distractor" characteristics (age and risk preferences) were used along with environmentalism to inform participants about their potential cooperation partners. Finally, we cannot altogether rule out experimenter

demand, as information about others' pro-environmental behavior was somewhat prominent in the decision tasks and some participants may have felt compelled to react to it for this reason.

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Online Appendix A: Descriptive statistics

Table A1 presents key descriptive statistics, namely means and SDs (in brackets) summarizing participants' contributions to the Group project in the four games and their beliefs of how much each of the co-players in their matching group contributed on average. Raw data are available upon request.

Table A1

Summary of contributions and beliefs (means, SDs)

	Most Environmental Game	Least Environmental Game	Average Environmental Game	Random Matching Game
Own contribution to the Group project	10.16 (6.60)	7.08 (6.24)	8.94 (6.18)	8.93 (6.44)
Expected average contribution to the Group project by a co-player	10.52 (5.41)	7.83 (5.10)	9.41 (5.17)	8.98 (5.01)

Online Appendix B: Further details on methods

B1. Risk elicitation task (see section 2.2)

To elicit risk preferences, we used a task where one had to choose one of eight incentivized lotteries (played for real money) involving various degrees of risk (Eckel & Grossman, 2002). An example of a low risk lottery was a prospect of getting either 4.2 EUR or 6.0 EUR with equal probability, whereas an example of a high risk lottery was a prospect of getting either 1.4 EUR or 10.8 EUR with equal probability. Participants were assigned a risk seeking score which was equal to 1 if the safest lottery was selected and equal to 8 if the most risky lottery was selected, with values in between for lotteries involving intermediate levels of risk.

B2. Recoding responses when calculating scale reliability (see section 2.2)

When calculating scale reliability for the 28-item environmental behavior questionnaire, all values were recoded so that higher values indicated more pro-environmental behavior. We also did the following changes:

For item “Are you de-icing the refrigerator regularly?”, the response “I share the refrigerator with other people and someone else is responsible for this” was coded as missing, as it did not unambiguously reflect a pro- or anti-environmental behavior. We acknowledge that this coding decision (and similar coding decisions below) reflect a judgment call on our part.

For item “Are you getting your electricity from a provider that guarantees 100% regenerative energy production?”, the response “I can not influence at all from which provider to get electricity” was coded as missing.

For item “Do you use a tumble dryer to dry clothes?”, the response “I do not have a tumble dryer” was recoded as “No”.

For item “Do you bring your own coffee (tea) cup to school/work (instead of using cups from the coffee machine)?”, the response “I do not drink coffee (tea) at school/work” was coded as missing.

For item “Do you drive a car with low fuel consumption or an alternative fuel car (e.g., an electric vehicle)?”, the response “I do not drive” was assigned the same value as “Yes” (i.e., both being coded as the maximally pro-environmental response).

For item “Do you drive your car defensively to save fuel?”, the response “I do not drive” was assigned the same value as “Yes” (i.e., both being coded as the maximally pro-environmental response).

For item “Do you return dead batteries to collection points for dangerous waste?”, the response “I do not use batteries” was coded as missing.

For item “Do you buy organic meat products?”, the response “I do not eat dairy products” was coded as missing.

For item “Do you buy organic meat products?”, the response “I do not eat meat products” was assigned the same value as “Yes” (i.e., both being coded as the maximally pro-environmental response).

B3. Comprehension check (see section 2.3)

Before proceeding to actual game play, participants had to correctly answer control questions checking their comprehension of the game, and were given an opportunity to try out different investment strategies using an interface automatically calculating outcomes for each selected strategy. This was done in order to ensure that participants fully understood the social dilemma structure of the decision situation.

B4. Partner selection: Details of the matching protocol (see section 2.5)

Here we describe how we ensured that the preferences for cooperation partners elicited from participants in the task described in section 2.5 in the paper were, with some probability, able to determine with whom participants were subsequently matched. Technically, after participants submitted their preferences, the computer randomly assigned a “position” to every participant between 1 and n , where n was the number of participants in the session. The matching then proceeded in the following way: First, the participant with the highest position was matched with his or her three most preferred co-players (with ties broken at random). Second, the participant with the highest position among the un-matched participants was matched with his or her three most preferred co-players among those that have not yet been matched (again with ties broken at random), and so on until everyone was matched. Participants were made aware of this procedure beforehand.

B5. Unrelated tasks conducted in the session (not reported here)

Participants also played an additional one-shot public goods game and three iterated public goods games at the end of the session.

Online Appendix C: Additional analyses

C1. Non-parametric tests of H1 and H3

Results of Wilcoxon signed-rank tests lead to the same conclusion as the regression tests of H1 reported in Table 1 in the paper. Specifically, expected contributions by matching group members were higher in Most Environmental Game than in Average Environmental Game ($p < .001$) and in Random Matching Game ($p < .001$). Expected contributions by matching group members in Least Environmental Game were, as predicted, lower than in Average Environmental Game ($p < .001$) and in Random Matching Game ($p < .001$).

Results of Wilcoxon signed-rank tests similarly lead to the same conclusion as the regression tests of H3 reported in Table 3 in the main text. Contributions to the Group project were higher in Most Environmental Game than contributions in Average Environmental Game ($p < .001$) and in Random Matching Game ($p < .001$). Contributions in Least Environmental Game were, again as predicted, lower than in Average Environmental Game ($p < .001$) and in Random Matching Game ($p < .001$).

C2. Robustness (exploratory) analyses: Prediction of expected contributions

In Table C1 we repeat analyses reported in Table 1 in the paper, with additional controls (own environmental score, risk preferences, age and gender) added to the models. In Model C1, we regressed participants' expectations of how much others in their matching group contributed to the Group project on matching group type dummies and the additional control variables. "Average Environmental Game" matching group served as the baseline category. Model C2 is the same as Model C1, but the "Random Matching Game" group served as the baseline category.

As in the main analyses, hypothesis H1 received support also in the robustness analyses (in fact, matching group dummy coefficients remain virtually unchanged). Interestingly, individuals performing more pro-environmental behaviors expected others to contribute less. Older participants expected others to contribute more. The latter results should be interpreted with caution, as these analyses are exploratory in nature.

Table C1

Regression of expected contributions on matching group type and additional controls

	Model C1 – Average Environmental Game used as baseline	Model C2 – Random Matching Game used as baseline
	<i>b</i> (95% CI)	<i>b</i> (95% CI)
Most Environmental Game	1.10 (0.61, 1.59)***	1.54 (1.01, 2.07)***
Least Environmental Game	-1.59 (-2.10, -1.08)***	-1.15 (-1.67, -0.63)***
Average Environmental Game		0.43 (-0.01, 0.88)
Random Matching Game	-0.43 (-0.88, 0.01)	
Environmental score	-0.19 (-0.36, -0.03)*	-0.19 (-0.36, -0.03)*
Risk preferences	0.21 (-0.07, 0.49)	0.21 (-0.07, 0.49)
Age	0.22 (0.11, 0.32)***	0.22 (0.11, 0.32)***
Female	-0.27 (-1.50, 0.97)	-0.27 (-1.50, 0.97)
Constant	6.97 (3.06, 10.87)**	6.53 (2.60, 10.46)***
Observations	832	832
No. of clusters	208	208
R^2	.11	.11

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$, all tests are two-sided. Estimation method is robust linear regression with standard errors clustered at the subject level.

C3. Robustness (exploratory) analyses: Prediction of own contributions

In Table C2 we repeat analyses reported in Table 3 in the paper, including in addition three control variables (risk preferences, age and gender). In Model C3, we regressed participants' contributions to the Group project on their environmental score, on matching group type dummies (with the "Average Environmental Game" matching group serving as baseline) and the three control variables. Model C4 is the same as Model C3, but the "Random Matching Game" group serves as the baseline category.

Mirroring the results reported in the main text, hypothesis H3 received support also in the robustness analyses and H4 did not. Older participants contributed more on average, but this result should be regarded as exploratory.

Table C2

Regression of contributions on environmental score, matching group type and additional controls

	Model C3 – Average Environmental Game used as baseline	Model C4 – Random Matching Game used as baseline
	<i>b</i> (95% CI)	<i>b</i> (95% CI)
Most Environmental Game	1.22 (0.58, 1.87)***	1.23 (0.64, 1.81)***
Least Environmental Game	-1.86 (-2.46, -1.25)***	-1.85 (-2.61, -1.09)***
Average Environmental Game		0.00 (-0.57, 0.58)
Random Matching Game	-0.00 (-0.58, 0.57)	
Environmental score	0.10 (-0.10, 0.29)	0.10 (-0.10, 0.29)
Risk preferences	-0.10 (-0.49, 0.28)	-0.10 (-0.49, 0.28)
Age	0.18 (0.06, 0.29)**	0.18 (0.06, 0.29)**
Female	0.09 (-1.52, 1.70)	0.09 (-1.52, 1.70)
Constant	3.32 (-1.38, 8.02)	3.32 (-1.39, 8.02)
Observations	832	832
No. of clusters	208	208
R^2	.06	.06

Notes: ** $p < .01$, *** $p < .001$; all tests are two-sided. Estimation method is robust linear regression with standard errors clustered at the subject level.

C4. Exploratory analyses: Environmentalism as a predictor of cooperation

To explore whether own environmental score can predict cooperation, depending on the level of one's co-players' environmentalism, we regressed own contribution to the Group project on one's environmental score separately for each condition (see section 2.3.1). The results are reported in Table C3. Own environmentalism had no effect on contributions, irrespective of condition (and thus regardless of the environmentalism of one's co-players).

Table C3

Regression of contributions on environmental score

	Most Environmental Game	Least Environmental Game	Average Environmental Game	Random Matching Game
	<i>b</i> (95% CI)	<i>b</i> (95% CI)	<i>b</i> (95% CI)	<i>b</i> (95% CI)
Environmental score	0.19 (-0.05, 0.44)	-0.01 (-0.23, 0.22)	0.12 (-0.09, 0.34)	0.12 (-0.12, 0.36)
Constant	6.69 (2.13, 11.24)**	7.20 (2.91, 11.49)**	6.74 (2.65, 10.82)**	6.74 (2.29, 11.20)**

Observations	208	208	208	208
R^2	.01	.00	.01	.01

Notes: ** $p < .01$; all tests are two-sided. Estimation method is linear regression with robust standard errors.

Online Appendix D: Printscreens of instructions

Study summary

Welcome and thank you for participating in the study! Please read the instructions on this and the following screens carefully.

- For your participation, you will be paid a participation fee of 6 EUR. You will be able to earn more money based on your choices and the choices of others during the experiment.
- The study will have four parts.
- All decisions you make during the experiment and all answers in the questionnaire will be made privately and anonymously.

IMPORTANT RULES

- If you have any questions during the study, please raise your hand and wait for an experimenter to assist you.
- Please DO NOT talk or try to communicate with other participants during the experiment.
- Please DO NOT exit the experiment running on your computer under any circumstances (not even when you have finished). Please DO NOT try to access the internet, open other programs, etc. This could lead to the program crashing in the entire lab. If you have any problems with the computer, please raise your hand.

Thank you for following the rules:-)

Continue

Part 1

In this Part, we would like to ask you some questions. There will be 32 questions in total. Most of the questions ask about performance of certain behaviors. Please indicate if you most of the time personally perform a given behavior. Therefore, answer "no" if you never perform this behavior or if you perform it only rarely. Answer "yes" if you always or usually perform this behavior.

There are no right or wrong answers. We therefore ask you to answer all questions as accurately and truthfully as possible. Thank you. If you do not want to answer a question, you do not have to. All your responses in this Part are fully anonymous.

Continue

1) Do you reuse your shopping bags?

- ☐ Yes
- ☐ No

2) Do you switch off or disconnect electric devices completely when not using them (not using standby)?

- ☐ Yes
- ☐ No

3) Do you support higher taxes for environmentally damaging behavior?

- ☐ Yes
- ☐ No

Continue

4) Do you prefer to buy local food products?

- ☐ Yes
- ☐ No

5) Do you eat meat?

- ☐ Yes
- ☐ No

6) Do you return dead batteries to collection points for dangerous waste?

- ☐ Yes
- ☐ No
- ☐ I do not use batteries

Continue

7) Do you use phosphate-free laundry detergent?

- ☐ Yes
- ☐ No

8) Do you walk, ride a bicycle, or take public transportation to work or school?

- ☐ Yes
- ☐ No

9) Are you getting your electricity from a provider that guarantees 100% regenerative energy production?

- ☐ Yes
- ☐ No
- ☐ I can not influence at all from which provider to get electricity

Continue

10) Do you buy organic dairy products?

- ☐ Yes
- ☐ No
- ☐ I do not eat dairy products

11) Do you use a tumble dryer to dry clothes?

- ☐ Yes
- ☐ No
- ☐ I do not have a tumble dryer

12) Is the heater in your house shut off late at night?

- ☐ Yes
- ☐ No

Continue

13) Do you rather shower than take a bath?

- ☐ Yes
- ☐ No

14) Do you bring your own coffee (tea) cup to school/work (instead of using cups from the coffee machine)?

- ☐ Yes
- ☐ No
- ☐ I do not drink coffee (tea) at school/work

15) Do you vote for parties that have environmental topics high on their agenda?

- ☐ Yes
- ☐ No

Continue

16) Do you often talk with friends about problems related to the environment?

- ☐ Yes
- ☐ No

17) Do you drive a car with low fuel consumption or an alternative fuel car (e.g., an electric vehicle)?

- ☐ Yes
- ☐ No
- ☐ I do not drive

18) Are you de-icing the refrigerator regularly?

- ☐ Yes
- ☐ No
- ☐ I share the refrigerator with other people and someone else is responsible for this

Continue

19) Do you wait to have a full load before doing your laundry?

- ☐ Yes
- ☐ No

20) Do you drive your car defensively to save fuel?

- ☐ Yes
- ☐ No
- ☐ I do not drive

21) Do you usually buy beverages in reusable bottles?

- ☐ Yes
- ☐ No

Continue

22) Are you a member of an environmental organization?

- ☐ Yes
- ☐ No

23) Do you buy organic meat products?

- ☐ Yes
- ☐ No
- ☐ I do not eat meat products

24) Do you support financial incentives for environmentally beneficial technology?

- ☐ Yes
- ☐ No

Continue

25) Do you use a compost bin?

- ☐ Yes
- ☐ No

26) Do you collect and recycle used paper?

- ☐ Yes
- ☐ No

27) When buying new electronic devices, do you make sure to buy the ones with the lowest energy use?

- ☐ Yes
- ☐ No

Continue

28) Do you lower the room temperature when you are not home for longer periods?

- ☐ Yes
- ☐ No

29) Please indicate your major/area of study.

- ☐ Economics
- ☐ Engineering
- ☐ Humanities
- ☐ Science
- ☐ Social science
- ☐ Other

30) Please indicate your age in years.

Continue

31) What is your gender?

- ☐ Male
☐ Female

32) Please estimate your ANNUAL gross income (including your student grant and student loan) in EUR.

Continue

Part 2

In this Part, you will be asked to select from among eight different gambles one gamble (i.e., lottery) that you would like to play. The eight different gambles are listed below. All payoffs are stated in EUR. Please read the instructions further down on this screen and then select one of these gambles.

Gamble 1 4.8 EUR 4.8 EUR	Gamble 2 4.2 EUR 6.0 EUR	Gamble 3 3.8 EUR 6.8 EUR	Gamble 4 3.4 EUR 7.6 EUR
Gamble 5 3.0 EUR 8.4 EUR	Gamble 6 2.2 EUR 10.0 EUR	Gamble 7 1.4 EUR 10.8 EUR	Gamble 8 0.2 EUR 11.4 EUR

Each gamble has two possible outcomes that occur with equal probability (50%). To determine your payment once you have chosen a gamble, the computer simulates a coin flip and randomly determines whether the first or the second payoff will be implemented.

Your payment will be determined by which of the eight gambles you select, and which of the two possible outcomes occurs. For example, if you select gamble 4, you will be paid either 3.4 EUR or 7.6 EUR. If the computer randomly selects the first outcome, then you receive the low payoff of 3.4 EUR. If the computer randomly selects the second outcome, then you receive the high payoff of 7.6 EUR. You will learn the outcome of your gamble at the conclusion of the session.

I choose gamble number: ☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7
☐ 8

Continue

Part 3

In Part 3, you will interact with other participants in this session in five decision situations. The situations will be the same, but you will be matched with different participants in each situation.

You can earn more money based on your choices and the choices of others in this Part. Throughout this Part you will earn points. At the end of the experiment these points will be exchanged into EUR with the following exchange rate: 10 points = 2 EUR. Please note: You will be paid for precisely ONE of the five decision situations randomly selected at the conclusion of the experiment.

Continue

The decision situation

In each of the five decision situations in this Part, you will be assigned to a group with three other participants. Note that none of you will ever know the identity of the other people in the group (i.e., the matching and all decisions are anonymous).

Every group member, including you, will receive 20 "investment tokens". Every group member, including you, has to simultaneously decide how many of the 20 tokens to invest in his/her [Individual project](#) and how many to invest in the [Group project](#) (shared by all four group members).

The table below displays earnings (in points) from a 1-token investment by you to a given project.

Note that everyone in your group simultaneously makes their investment decisions, it is just not displayed in the table below (only your decision is displayed).

INVESTMENT by You		Your earnings	Member 2's earnings	Member 3's earnings	Member 4's earnings
1 token invested in Individual project	--->	1	0	0	0
1 token invested in Group project	--->	0,5	0,5	0,5	0,5

A summary of what the Earnings table displays is as follows:

Each token invested in the Individual project yields 1 point to you and 0 points to the other three group members. Total group earnings are 1 point.

Each token invested in the Group project yields 0.5 points to you and 0.5 points to each of the other three group members. Total group earnings are 2 points.

Do you understand how this works? If you have any questions, please raise your hand. You will need to answer a few brief control questions prior to making your actual decisions.

Note that the description of the decision situation is provided both on this screen and on the printed sheet you received.

Continue

Calculator

Before you make your decisions for real, you will now have an opportunity to try out different possible decisions using a "calculator". You can type in different possible (hypothetical) investments in the Individual projects by each group member. To make things easier, the computer will automatically fill in the respective investment in the Group project (it is always 20 investment tokens minus the amount of tokens invested in the Individual project).

When you press Calculate, the computer will calculate the group members' earnings according to the rules described on the previous screen and on the instructions sheet for Part 3 you received.

You can repeat the calculations with different possible investments by the individual group members. To do that you just type in different possible investments in their Individual projects by each group member and press Calculate (you can simply rewrite the old values). If you do not want to perform any more calculations press Continue. Then you will be asked to answer a few control questions.

	Member 1	Member 2	Member 3	Member 4
Investment in Individual project	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Investment in Group project				
	v v v	v v v	v v v	v v v
Earnings from Individual project				
Earnings from Group project				
Total earnings				

For easy orientation, the arrows in the table show the "flow of time". If you have any questions, please raise your hand and wait for an experimenter to come to you.

Calculate

Continue

Calculator

Before you make your decisions for real, you will now have an opportunity to try out different possible decisions using a "calculator". You can type in different possible (hypothetical) investments in the Individual projects by each group member. To make things easier, the computer will automatically fill in the respective investment in the Group project (it is always 20 investment tokens minus the amount of tokens invested in the Individual project).

When you press Calculate, the computer will calculate the group members' earnings according to the rules described on the previous screen and on the instructions sheet for Part 3 you received.

You can repeat the calculations with different possible investments by the individual group members. To do that you just type in different possible investments in their Individual projects by each group member and press Calculate (you can simply rewrite the old values). If you do not want to perform any more calculations press Continue. Then you will be asked to answer a few control questions.

	Member 1	Member 2	Member 3	Member 4
NEW investment in Individual project	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Investment in Individual project	5	4	15	10
Investment in Group project	15	16	5	10
	v v v	v v v	v v v	v v v
Earnings from Individual project	5	4	15	10
Earnings from Group project	23.0	23.0	23.0	23.0
Total earnings	28.0	27.0	38.0	33.0

For easy orientation, the arrows in the table show the "flow of time". If you have any questions, please raise your hand and wait for an experimenter to come to you.

Calculate

Continue

Part 3 - Control questions

To continue in the experiment please answer the following control questions correctly. There is always just one correct answer.

Imagine, hypothetically, that the investments by the group members are as follows:

	Member 1	Member 2	Member 3	Member 4
Investment in Individual project	15	15	10	0
Investment in Group project	5	5	10	20

1) What are Member 1's earnings from his/her Individual project (in points)?

2) What is the total group investment in the Group project (in tokens)?

3) How many decision situations in Part 3 will be randomly selected for payment at the end of the experiment?

4) What are Member 1's earnings from the Group project (in points)?

Continue

Note: You will learn the outcome of the decision situation randomly selected for payment, but only at the conclusion of the experiment. This means you will not receive feedback on others' decisions before the experiment is at its conclusion. This is common practice in this type of experiments.

Continue

Decision situation 1

Please read the following information carefully. You are now matched with three other participants in this session. These are the participants who, according to their responses to the questionnaire in Part 1 of this study, perform about as many pro-environmental behaviors as the average participant in this session. Please make your investment decision.

My investment in my Individual project:

My investment in the Group project:

Calculator

Continue

Guess

Before proceeding to the next decision situation, we would like to ask you how many tokens the three others you were now matched with invested in the Group project (i.e., 0-60 tokens).

If you guess the number of invested tokens correctly (± 3 tokens), you will earn an additional 2 EUR.

Please fill in your estimate:

Continue

Decision situation 2

Please read the following information carefully. You are now matched with three other participants in this session. These are the participants who, according to their responses to the questionnaire in Part 1 of this study, perform more pro-environmental behaviors than any other participant in this session (you are not counted). Please make your investment decision.

My investment in my Individual project:

My investment in the Group project:

Calculator

Continue

Guess

Before proceeding to the next decision situation, we would like to ask you how many tokens the three others you were now matched with invested in the Group project (i.e., 0-60 tokens).

If you guess the number of invested tokens correctly (± 3 tokens), you will earn an additional 2 EUR.

Please fill in your estimate:

Continue

Decision situation 3

Please read the following information carefully. You are now matched with three other participants in this session. These are the participants who, according to their responses to the questionnaire in Part 1 of this study, perform less pro-environmental behaviors than any other participant in this session (you are not counted). Please make your investment decision.

My investment in my Individual project:

My investment in the Group project:

Calculator

Continue

Guess

Before proceeding to the next decision situation, we would like to ask you how many tokens the three others you were now matched with invested in the Group project (i.e., 0-60 tokens).

If you guess the number of invested tokens correctly (± 3 tokens), you will earn an additional 2 EUR.

Please fill in your estimate:

Continue

Decision situation 4

Please read the following information carefully. You are now randomly matched with three other participants in this session. Please make your investment decision.

My investment in my Individual project:

My investment in the Group project:

Calculator

Continue

Guess

Before proceeding to the next decision situation, we would like to ask you how many tokens the three others you were now matched with invested in the Group project (i.e., 0-60 tokens).

If you guess the number of invested tokens correctly (± 3 tokens), you will earn an additional 2 EUR.

Please fill in your estimate:

Continue

Part 4

In Part 4, you will interact with other participants in this session in three decision situations.

The decision situations will be exactly the same as in Part 3 with one important difference: in a given decision situation, you will be matched with the same three participants for 10 rounds (repetitions).

You can earn more money based on your choices and the choices of others in this Part. Throughout this Part you will earn points (10 points = 2 EUR). Note, however, that in each of the three 10-round decision situations you will be paid for precisely ONE round. The rounds relevant for payment will be selected randomly by the computer at the end of the session.

Continue

The decision situation

As we mentioned, the decision situation in Part 4 is exactly the same as in Part 3, apart from the fact that in each decision situation there will be 10 rounds of interaction within the same group.

In a given decision situation in this Part, you will be assigned to a group with three other participants and you will interact with the same group members for 10 rounds. Note that none of you will ever know the identity of the other people in the group (i.e., the matching and all decisions are anonymous).

Every group member, including you, will receive 20 "investment tokens". Every group member, including you, has to simultaneously decide how many of the 20 tokens to invest in his/her [Individual project](#) and how many to invest in the [Group project](#) (shared by all four group members).

The table below displays earnings (in points) from a 1-token investment by you to a given project.

Note that everyone in your group simultaneously makes their investment decisions, it is just not displayed in the table below (only your decision is displayed).

INVESTMENT by You		Your earnings	Member 2's earnings	Member 3's earnings	Member 4's earnings
1 token invested in Individual project	--->	1	0	0	0
1 token invested in Group project	--->	0,5	0,5	0,5	0,5

A summary of what the Earnings table displays is as follows:

Each token invested in the Individual project yields 1 point to you and 0 points to the other three group members. Total group earnings are 1 point.

Each token invested in the Group project yields 0.5 points to you and 0.5 points to each of the other three group members. Total group earnings are 2 points.

Do you understand how this works? If you have any questions, please raise your hand.

Note that the description of the decision situation is provided both on this screen and on the printed sheet you received.

Continue

Note: After each round in each of the three Decision situations, you will learn the total investments within your group and your own earnings in points (conditional on the particular round being randomly selected for payment at the end of the session).

You will learn your actual earnings in this Part only at the end of the session, after the three Rounds (one per Decision situation) that will count towards your earnings are randomly selected.

Continue

Decision situation 1

For the next 10 Rounds of this Decision situation, you will be matched with a fixed group of three other participants in this session. You will be given an opportunity to choose your preferred partners with whom you will be matched in this Decision situation.

HOW TO SELECT YOUR PREFERRED GROUP MEMBERS

A table on one of the next screens lists all participants present here, excluding yourself. A portion of an identical table is visible below as an example. For illustration, the table below lists three hypothetical participants A, B, and C.

For each participant, we indicate his or her age relative to the other participants in this session - the OLDER a given participant, the HIGHER his or her score (see the second column). If a participant did not state his or her age, he or she will be assigned a score of "-1".

For each participant, we indicate his or her "risk preferences" - the MORE RISKY choice a given participant made in Part 2, the HIGHER his or her score (see the third column).

For each participant, we indicate his or her "environmental score" - the MORE PRO-ENVIRONMENTAL behaviors a given participant reported, the HIGHER his or her score (see the fourth column).

In the last column of the table, you will be later able to indicate which participants you would like to be matched with. You can use a scale ranging from 1 (= most preferred match) to x (= least preferred match). You can use the same preference rating for multiple participants, if you want.

The example table shows illustrative scores for each participant. Please use these scores to answer the control questions below. Notice that participants B and C have the same risk preferences. This means that they have chosen the same gamble in Part 2. Such ties are generally possible also with respect to the environmental score and relative age.

Example table:

Participant	Relative age	Risk preferences	Environmental score	Your preference rating	
A	2	2	1	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	7
B	3	1	2	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	7
C	1	1	3	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	7

Control questions:

- 1) Which participant is older, participant A or participant B? A ☐ ☐ B
- 2) Which participant has chosen a more risky gamble, participant A or participant B? A ☐ ☐ B
- 3) Which participant is more pro-environmental, participant A or participant B? A ☐ ☐ B
- 4) If you want to be matched with participant X rather than with participant Y, which one should you give a HIGHER preference rating number? X ☐ ☐ Y

If everything is clear, please press Continue to learn how the computer will use your and other participants' preference ratings to match you into groups in this Decision situation. You will be able to access the rules explained on this screen again if you need to.

Continue

Decision situation 1 - continued

HOW THE COMPUTER MATCHES PARTICIPANTS INTO GROUPS

Before you go on to state your preferences on the next screen, we will briefly explain in what way your (and everyone else's) preference ratings will be considered when the actual matching is done by the computer.

The computer first randomly assigns a "position" to every participant from 1 to n , where n is the number of participants in the session. The matching will then proceed in the following way.

First, the participant with the highest position (randomly assigned by the computer) is matched with his/her three most preferred co-players.

Second, the participant with the highest position (randomly assigned by the computer) among the un-matched participants is matched with his/her three most preferred co-players among those that have not yet been matched.

Next, the participant with the highest position (randomly assigned by the computer) among the un-matched participants is matched with his/her three most preferred co-players among those that have not yet been matched.

And so on until everyone is matched.

If everything is clear, please press Continue to state your preferences. You will be able to access the rules explained on this screen again if you need to.

Continue

Decision situation 1 - your preferred matches

Please state your preferences by assigning each participant in this session a rating from 1 (= least preferred) to 7 (= most preferred). Participants are not listed in any particular order. You are not listed in "your" table (hence the empty row C). If a given participant did not state his or her age, the table displays "-1". Recall that higher scores in columns 2-4 indicate older age, stronger preferences for risk, and more pro-environmental behavior.

Participant	Relative age	Risk preferences	Environmental score	Your preference rating
A	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
B	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
C				1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
D	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
E	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
F	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
G	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
H	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
I	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
J	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
K	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
L	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
M	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
N	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
O	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7
P	0	0	0	1 ☐ ☐ ☐ ☐ ☐ ☐ ☐ 7

Rules for selecting your preferred group members and rules explaining how the computer matches participants into groups in this Decision situation can be accessed by clicking on the first and second button, respectively. Submit your preferences by clicking on Submit.

Your preferences

Computer selection

Submit

Everyone in this session has now been matched into groups using their preference ratings and the described matching rules. You will be matched to the same three participants throughout Decision situation 1, which includes 10 Rounds. Please click on Continue to make your decision in the first of these Rounds.

Continue