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Article

Game Participation and Preservation of the Commons: An Experimental Approach

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Abstract: Framed field experiments are widely applied to study behavior in common pool resource dilemmas. Anecdotal evidence suggests that participation in such experiments improves cooperation in actual field settings. Yet, formal tests of such relationships are absent from the literature. We present results from a field experiment, investigating how participation in a two person prisoner's dilemma game affects contributions to a global public good, as measured by donations to an environmental foundation. We find that subjects who participate in the prisoner's dilemma game donate slightly more than subjects who do not participate in the game. Participants who are paired with a cooperative player in the prisoner's dilemma also donate more. We further find that donations substantially increase with income and decrease with concern for environmental issues.

Keywords: cooperation; environmental behavior; experimental economics; field experiment; land use conflicts and governance; prisoner's dilemma

1. Introduction

Over the last two and a half decades, our understanding of self-governed common pool resource management has improved substantially. Case study analysis has led the way to develop new theory [1],

showing that a "tragedy of the commons" [2] is not an inevitable outcome of common pool resource settings. Laboratory experiments have advanced our understanding of the role communication, punishment, or rewards play in shaping behavior in social dilemma games [3,4].

For the last 15 years, economic experiments on common pool resource management have been brought to the field [5–7], and in order to understand cross-cultural differences in fairness norms and to reduce bias from so-called WEIRD (Western Educated Industrialized Rich Democratic) subjects, non-student subject pools have been targeted [8,9]. Today, field experiments are widely applied and increasingly used to inform policy-making [10], and many experimentalists provide anecdotes of the positive effects game playing has on the collective management of common pool resources [7,11,12]. Although in environmental education board games are used for pedagogical purposes and stakeholder communication [13,14], for the field settings described above evidence on the effectiveness of simple economic games is absent: "By having subjects play simple games that mimic their day-to-day environment in essential ways and introducing slight variations thereto, one can use experiments to explain complex concepts. To the best of our knowledge, there have been no studies that have designed experiments with this as their main purpose" [10]. In this paper, we tackle this open question by asking whether economic games have a short term effect on behavior in environmental management. If such effects exist, one would like to know whether these are positive and large in the absence of other external interventions.

A key practical challenge to test the effect of game playing in the field is to find and to measure an adequate outcome variable. A recent large-scale research project, implemented in several Indian villages, studies the effect of playing "water management games" on geo-physical variables such as the water table [15,16]. At a smaller scale and in a different context, our paper follows a similar approach. In a simple explorative experiment, we investigate how being paired with a "cooperator" or "defector" in a two person prisoner's dilemma game affects cooperative behavior in the short term, as measured by a post-game anonymous donation to an environmental foundation, *i.e.*, contributing to a large environmental public good. According to our general hypothesis, the existence and direction of effects promoted by game playing depends on whether such an experience is positive or negative, *i.e.*, whether it is an experience of cooperation or defection, respectively. The two types of players in the prisoner's dilemma game, *i.e.*, cooperator *vs.* defector, serve us as treatments which we compare to a control group of participants who do not play the game. This allows us to (1) test whether social dilemma game playing can have a short term effect on environmentally cooperative behavior by itself and (2) the direction of such potential effects.

The paper sheds light on the merits and demerits of conducting social dilemma games in the field for inducing behavioral change. Also from personal experience, we know that conducting experiments in difficult contexts may evoke or aggravate conflicts in a particular community. Such effects could potentially violate ethical principles in experimental research (*cf.* [17]). With the aim to develop adequate field tools built on economic games, it is, thus, important to develop these carefully. This paper can be seen as a modest attempt to shed some light in that direction.

The remainder of the paper is structured as follows. In the next section, we introduce the experiment, develop the hypotheses, and describe the sample. Then, we present and discuss the results of the game. Finally, we summarize and conclude.

2. Experimental Design

Conflicts over natural resources are the norm rather than the exception. Rarely will one encounter empirical settings where, in one way or the other, distributional conflicts over common pool resources do not prevail. When extraction cannot be monitored and agreements cannot be enforced, resource users may find themselves trapped in a situation where individually rational behavior makes everybody worse off, *i.e.*, a social dilemma.

In the behavioral sciences, a large amount of literature is concerned with the question of how pro-environmental behavior can be advanced. One approach promotes the use of "green nudges"—small changes in the choice architecture that maintain the freedom of decision makers—with the aim to make the socially desirable choice easier [18–22]. There is also a large experimental literature on charitable donations (e.g., [23,24]) that seeks to identify social factors that determine the size of contributions. Although our study is related to this literature, as it seeks to identify factors that influence environmental behavior and uses a charitable donation as an outcome variable, the specific aim is to evaluate the scope of developing experimental games into educational tools for application in field settings.

Experimental Economics tries to reproduce these real-life dilemma settings in framed field experiments to study cause, effect, and solution mechanisms with greater external validity [25]. One of the most replicated findings in Experimental Economics is that people participating in repeated social dilemma games start with initially high levels of cooperation; however, in the absence of sanctioning, rewards, or communication, cooperation typically breaks down over time [4,26]. The simplest version of a social dilemma game is the two person prisoner's dilemma. In this game, independent of the other player's strategy, it is individually rational to choose the non-cooperative strategy. This behavior leads to a Pareto-inferior Nash equilibrium; both players would be better off if they could make binding agreements on cooperation.

In our experiment, we let a group of participants engage in such a prisoner's dilemma game. Rather than in the outcomes of the game itself, we are interested in understanding how different experience of participation affects subsequent behavior. If positive effects could be demonstrated, such games may, indeed, be helpful in the field. We formulate the following hypotheses:

H1: Positive experience—being paired with a cooperative player—in a prisoner's dilemma game results in positive behavioral change, as measured by a donation, after the game.

H2: Negative experience—being paired with a non-cooperative player—in a prisoner's dilemma game results in negative behavioral change, as measured by a donation, after the game.

To test these hypotheses we have developed the following experiment. In a first step, subjects play a prisoner's dilemma game which, for easier understanding, is framed as a decision to invest in a common project. Monetary payoffs of the prisoner's dilemma are depicted in Table 1.

Table 1. Payoff table prisoner's dilemma.

		Player 1	
		Invest	**Don't Invest**
Player 2	**Invest**	2 Euro, 2 Euro	3 Euro, 0 Euro
	Don't Invest	0 Euro, 3 Euro	1 Euro, 1 Euro

Source: own elaboration.

In each cell, the first number denotes Player 1's payoff, and the second number denotes Player 2's payoff. The social optimum is that both players invest, and in (Nash) equilibrium none of the players invests. In a second step, subjects play a framed dictator game which generates the main variable of interest. Participants in this game are compared to a group of people who have not played the prisoner's dilemma game, but are still asked to donate. For all groups, the outcome variable we study is the amount of an anonymous donation to an environmental foundation, which can also be understood as a dictator game [27]. The environmental foundation chosen is the "Deutsche Bundesstiftung Umwelt" (DBU), a foundation active in promoting research and project implementation concerned with environmental protection [28].

We played the game with 45 participants whom we recruited during an open door event at a German university. Every year, on a Saturday in late spring or early summer, the city of Berlin organizes the so-called "Lange Nacht der Wissenschaften" (long night of sciences), during which several universities and other research institutes open their doors and present their research and teaching program to the interested public. Typically, the event starts in the afternoon and lasts until midnight. Our experiment took place at a small stall presenting research on social-ecological systems, including posters and further information on the use of framed field experiments for their analysis. A recent overview and a typology of such experiments can be found in [29]. Note that in the classification of [25], our (donation) experiment can be regarded as a (natural) field experiment. In the donation part, subjects—although they play a game as part of our study—do not know that they are participating in an experiment on the effect of playing or not playing a game. Arguably, the context is rather artificial though. The prisoner's dilemma game played by subjects qualifies as an artefactual field experiment, however.

Visitors of the event were approached with a small standardized text presenting the idea of the game and asking for participation [30]. It was explained to them that, as a compensation for participation, everybody would receive five Euros. Everybody was also told that the reward, or parts of it, could be donated, and a "voting booth" was prepared and visible to visitors for this purpose. Donations were only matched to questionnaire data and assigned treatment using a code, making it impossible to link size of the donations to names. If visitors agreed to participate, they were presented with further instructions, printed out on paper. These instructions explained that with a 16 out of 45 probability, they would have to fill a small questionnaire; with a 29 out of 45 probability they would play a game—the prisoner's dilemma game explained above. To maintain anonymity and to reduce logistical demands, visitors playing the prisoner's dilemma game were paired with student players with whom we played the game in two lectures in the week before the event.

Students were told that we would play the game with visitors at the open door event and that they would receive payoffs from the game in the week after the event. They received written instructions depicting the payoffs, similar to those of the visitors [31]. Out of the 29 students who participated, 17 played cooperatively, *i.e.*, "Invest," and 12 played uncooperatively, *i.e.*, "Don't invest." Note that students were also paid, but their decisions are not part of the analysis of this study. The sole purpose of students' decisions was to assign visitors in the event to the "cooperation experience" *vs.* "defection experience" treatments in a meaningful and random way. Also note that beside the 29 visitors paired with student players, a control group of 16 visitors complemented the experimental design which is summarized in Table 2.

Table 2. Experimental design and sequence of events.

In total 45 visitors participate, everybody receives 5 Euros		
After a short general introduction, participants are randomly assigned to one of three treatments (Step 1)		
Baseline CONTROL 16 participants	Treatment 1 COOPGAME 17 participants	Treatment 2 DEFECTGAME 12 participants
	Rules of the game are read out and handed over in written form (Step 2)	
	Decision in prisoners' dilemma game (Step 3)	
	Receive information on game outcome; get paid; put payments to your pocket (Step 4)	
Receive envelope with five Euros; possibility to donate (Step 5)		
Sign receipt (Step 6)		
Short one-page questionnaire (Step 7)	Short two-page questionnaire (with three additional questions for those who played the game) (Step 7)	

Source: own elaboration.

It can be seen that step 1 and steps 5 to 7 were common to all 45 participants: everyone was approached with the same text, everyone received an envelope with five Euros [32]; everyone signed a receipt for the money; and everyone filled a small self-administered questionnaire. Participants in the CONTROL group went only through these stages. Participants in the other two treatments played the game in between those stages. The rules of the prisoner's dilemma game were explained to them, and they were informed that, to calculate their payoffs after their decisions, they would be paired with a student whose monetary payoff would also depend on the decision made in the game. Participants did not know anything about the distribution of cooperators or defectors among students. They were informed about what participants were paid according to the payoffs presented in Table 1 above, depending on the decision of the student with whom they were matched, as well as their own decision. After this, they were informed about the game outcome, they received payments in cash (if any), and they were asked to put away the money they received (if any). All protocols and documents we have used can be accessed in the Supplementary Material. Table 3 describes the sample and the variables used in the results part of the paper and presents some summary statistics on the participants.

It can be seen that from the 45 subjects participating, 22 were male and 23 female. On average, subjects were highly educated, with more than two thirds holding a university degree. The average year of birth was about 1977, which is approximately equal to an average age of 36 years. Participants' households are rather well off, with more than half of the sample having a monthly income of 2000 Euros of more. Most people agree with the statements "I am interested in environmental issues" and "In my daily decision-making, I consider the environmental impact." Most people do not regularly donate money. The environmental foundation, we have selected for the donation part, was known by about a quarter of participants.

Table 3. Variable description and summary statistics.

Variable Name	Description	N	Mean	SD	Min	Max
PLAYSGAME	= 1 if either COOPGAME or DEFECTGAME treatment (participant plays the game)	45	0.64	0.48	0	1
COOPPARTNER	= 1 if COOPGAME treatment (paired with cooperator in the game)	45	0.38	0.49	0	1
FEMALE	= 1 if participant is female	45	0.51	0.51	0	1
YEAROFBIRTH	= year of birth	44	1977.25	12.52	1947	1994
UNIVDEGREE	= 1 if participant holds university degree	45	0.69	0.47	0	1
INCOME	= 1 if monthly household income is 2000 Euros or more	43	0.56	0.50	0	1
ENVPROBLEMS	Agreement with statement "I am interested in environmental issues." on 5-point scale (1 = high agreement; 5 = low agreement)	45	1.36	0.61	1	3
ENVEVERYDAY	Agreement with statement "In my daily decision-making, I consider the environmental impact." on 5-point scale (1 = high agreement; 5 = low agreement)	45	1.60	0.58	1	3
DONBEHAV	Agreement with statement "I regularly donate money." on 5-point scale (1 = high agreement; 5 = low agreement)	44	2.68	1.34	1	5
KNOWDBU	= 1 if participant knows "Deutsche Bundesstiftung Umwelt" (DBU)	44	0.23	0.42	0	1
COOPERATESINPD	= 1 if participant cooperates in prisoner's dilemma game	29	0.76	0.44	0	1

Source: own calculation.

3. Results

3.1. Game Results and Treatment Effects

The vast majority of participants in the experiment—22 out of 29—cooperated in the prisoners' dilemma game. Matching them with the student sample resulted in the following outcomes (Table 4).

Table 4. Frequency table prisoner's dilemma game.

		Visitor At Open Door Event		
		Invest	**Don't Invest**	**Total**
Student	**Invest**	13	4	17
	Don't Invest	9	3	12
	Total	22	7	29

Source: own elaboration.

It can be seen that most of the students and visitor do not behave rationally and selfishly. Roughly half of the matched pairs (13) achieve the socially optimal outcome and only three matches result in the Nash equilibrium [33]. Table 5 describes the main treatment effects on the key outcome variable and

some useful binary transformations—the incidence of zero donations, of full donations, and of donations of more than five Euros [34].

Table 5. Donations by treatment.

Outcome Variable	CONTROL	DEFECTGAME Treatment (Player Was Paired with a Defector)	COOPGAME Treatment (Player Was Paired with a Cooperator)
Mean Donation in Euro (SD)	2.91 (2.28)	3.38 (2.04)	4.24 (2.02)
Zero donations (Absolute; relative frequency)	4 subjects; 25.00%	2 subjects; 16.67%	1 subject; 5.88%
Full donations (Absolute; relative frequency)	7 subjects; 43.75%	6 subjects; 50.00%	10 subjects; 58.83%
Donations of more than five Euro (Absolute; relative frequency)	0 subjects; 0.00	0 subjects; 0.00	3 subjects; 7.65% (all of them cooperators themselves)

Source: own calculations.

It can be seen from the table that compared to the CONTROL treatment, donations increase by 47 cents in the DEFECTGAME treatment. Compared to DEFECTGAME, another 86 cents more are donated in the COOPGAME treatment. Comparing the CONTROL to the COOPGAME treatment, we observe a difference of 1.14 Euros. Owed to the small sample size, differences in medians between the three treatments are statistically not significant at the five percent level (Kruskal-Wallis equality-of-populations test; degrees of freedom = 2; $\chi^2 = 2.654$; $p = 0.2653$).

Similarly, the proportion of zero donations steadily decreases from the CONTROL to the COOPGAME treatment. Formal testing of the differences of approximately 20 percent between CONTROL and COOPGAME reveals that the difference is statistically significant at the ten percent level (One-sided two-sample test of proportion; z = 1.5308; $p = 0.0629$) [35]. In line with these results, the proportion of full donations (of five Euros and more) increases in the experiment [36]. Three participants donated more than the five Euros they were endowed with. This difference is statistically significant at the five percent level (One-sided two-sample test of proportion; z = −1.7624; $p = 0.0390$) between the CONTROL and COOPGAME treatments and statistically significant on the ten percent level between the DEFECTGAME and COOPGAME treatments (z = −1.5369; $p = 0.0622$).

Summing up, independently from the particular measure, participating in the prisoner's dilemma game had a positive effect on altruistic behavior in the dictator's game. The positive effect was larger for participants who had a positive cooperative experience than for participants who were confronted with a negative cooperative experience. In the next section, we will challenge these findings by controlling for socio-demographic heterogeneity, which is of particular importance due to the fairly small sample and the absence of pre-game cooperation tests.

3.2. Game Decisions and Socio-Economic Heterogeneity

Table 6 presents four different specifications of OLS regression models where the amount donated is the dependent variable. The independent variables are presented in Table 3 above.

Table 6. OLS regression models on donations.

	(1)	(2)	(3)	(4)
PLAYSGAME	0.4625 (0.8089)	0.8533 (0.7541)	0.4377 (0.7319)	-
COOPPARTNER	0.8603 (0.7987)	0.6825 (0.7567)	0.6560 (0.7263)	0.8518 (0.7716)
FEMALE	-	−0.9634 * (0.5566)	-	-
YEAROFBIRTH	-	0.0628 * (0.0324)	0.0822 *** (0.0299)	-
UNIVDEGREE	-	−0.9970 (0.6508)	-	-
INCOME	-	2.6938 *** (0.7048)	2.9499 *** (0.6858)	-
ENVPROBLEMS	-	−1.6785 ** (0.6242)	−1.5792 *** (0.5313)	-
ENVEVERYDAY	-	0.8604 (0.6619)	-	-
DONBEHAV	-	−0.3343 (0.2598)	-	-
KNOWDBU	-	−0.1016 (0.7164)	-	-
COOPERATESINPD	-	-	-	0.5776 (0.8880)
Constant	2.9125 *** (0.5296)	−120.0077 * (64.0144)	−159.1082 ** (58.9099)	2.9418 *** (0.8902)
N	45	41	42	29
Adjusted R^2	0.029	0.371	0.343	−0.012
F	1.6541	3.3611 ***	5.2836 ***	0.8333

Source: own calculations; Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The first model includes only the randomized treatment variables as independent variables. Hence, the constant term is equal to the average donation in the CONTROL treatment (*cf.* Table 5). The coefficient of PLAYSGAME can be interpreted as the effect of playing the game, *i.e.*, the joint effect of COOPGAME and DEFECTGAME. The coefficient of COOPGAME is the additional amount donated as an effect of being paired with a student playing cooperatively. Columns two and three also control for socio-economic heterogeneity from the survey data. While model (2) includes the full set of independent variables, model (3) is a more parsimonious specification. Model (4) includes the 29 participants who have played in the game. As independent variables we include the treatment variable (COOPPARTNER) and the participant's behavior in the prisoner's dilemma game (COOPERATESINPD).

Model (1) performs rather poorly in terms of F-statistic and R^2 value. The models in the last two columns, however, show relatively high and statistically significant F-statistics, indicating a good overall explanatory power. The same applies to the relatively high R^2 values which show that more than one third of the variance in donations can be explained by assignment to treatment and observed socio-economic heterogeneity.

It can be seen that in all columns, treatment effects are positive and relatively large. Owing to the small sample, they are not statistically significant, however. In all models, the effects of PLAYSGAME and COOPGAME add up to more than 90 cents. In other words, in all three specifications, players who make a positive experience donate substantially more than those who do not play the game. More than 65 cents of this sum can be attributed to the difference between the positive and negative experience.

The second column shows that a relatively large gender gap exists in donations: women donate about 90 cents less. Models (2) and (3) show that the younger a participant, the more she donates. This effect is quite substantial. An increase in YEAROFBIRTH from 1960 to 1990 would, *ceteris paribus*, result in an increase in donation of about 2.75 Euros in model (3). Participants holding a university degree donate about one Euro less in the game. Very large, and statistically significant, effects can be observed for the income variable. Subjects with monthly incomes of more than 2000 Euros also donate substantially higher amounts—more than 2.50 Euros on average. Large and statistical significant effects can also be found for the coefficient of ENVPROBLEMS. A one point increase in disagreement reduces donations by more than 1.50 Euros. People concerned with the environment in their daily lives, donate smaller amounts. The effect of regular donations on donations in the game is rather small: as one would expect, participants who typically donate also donate somewhat more in our experiment. We have also controlled whether subjects are affected by their knowledge of DBU, the environmental foundation the money was donated to. The effect of knowing DBU is very small in model (2).

Model (4) tests for the predictive power of behavior in the abstract game for the donation decision (see for instance [37,38] for experiments on the predictive power of lab experiments for field behavior; also see Table 4 for outcomes of the prisoner's dilemma game). Because there is the possibility of endogeneity bias in the regression, we also calculated the correlation coefficient of cooperative behavior in the abstract game (COOPERATESINPD) and the amount donated ($r = 0.1272$; $p = 0.5108$). We also have to rule out the possibility that people who are more cooperative were selected for the COOPGAME treatment by chance, because the sample size is very small. We calculated the correlation coefficient of COOPGAME with COOPERATESINPD which is very close to zero ($r = 0.0169$; $p = 0.9306$).

4. Discussion

Earlier in this paper, we formulated two hypotheses. First, we were interested in testing whether making a "positive experience" from being paired with a cooperative player, raises donations in the second phase of our experiment (H1). Second, we expected that a "negative experience" would decrease donations when compared to a control group (H2). The results tend to support H1, but reject H2. Playing the game has a positive net effect, regardless of the absence of external intervention to steer learning. The effect is larger when subjects are paired with a cooperative partner. These results also hold when we control for observed socio-economic heterogeneity using regression analysis. The effect is rather small and statistically not significant, however. Socio-economic heterogeneity is more important in explaining donation behavior in our game. Especially the young, wealthy, and those interested less in environmental issues, donate substantially higher amounts, and large proportions of the observed variation can be explained by personal characteristics. Decisions in the abstract game do not predict donation behavior accurately, as indicated by the small coefficient of COOPERATESINPD, the negative

Adjusted R^2 statistic, and the low correlation coefficient of COOPERATESINPD with the amount donated. In line with [37], we do not find that pro-social behavior can be generalized across contexts.

It is interesting that people who care about environmental issues in their daily lives donate less in the game. One may interpret this as the possibility to substitute monetary donations for pro-environmental behavior in daily decision-making. Another interpretation would be that participants are aware of the crowding-out problem of intrinsic motivation [5,6,39,40]. Conceptual work differentiates at least four types of environmentally significant behavior [41], including activism, non-activist behavior in the public sphere, private-sphere environmentalism, and other environmentally significant behaviors. It will be important to distinguish these in future research. This would also mean paying greater attention to inter-relationships of the various dimensions. Ultimately, this points towards a drawback of our approach. In our experiment, we observe only a small fraction of the large spectrum of possible pro-environmental actions—a fairly simple donation decision or "non-activist behavior in the public sphere" as [41] would put it. In a future replication one may include a list of environmental organizations participants can choose from to donate to. Although one would still not cover all spheres of environmentally significant behaviors, at least the spectrum "non-activist behavior in the public sphere" would be extended.

It would, of course, be overly optimistic to expect a lasting effect of participating in a small experiment on decision-making beyond the immediate context (see [42,43] for recent studies focusing on the duration of effects following experimental manipulation). For investigating this question in greater detail, one would have to extend the experimental design substantially and observe participants' behavior over a longer period, as some scholars are already doing [12]. Our intention, however, was to test short-term effects in the absence of interventions other than game playing. The fairly large effect of income on donations could stem from a "warm glow effect" [44] that is relatively cheap to buy for wealthier participants. In a replication, endowments should also be manipulated in an experiment to control for such effects. This would also help to address the problem that someone who is randomly selected to play the game, because of the additional endowments from playing the PD game, on average, also ends up with more money.

A key difference of our game to the large-scale "water management games" currently conducted in the field [15,16], is the level of interaction among participants. In our game, paired players, students and visitors, do not know each other and our outcome variable is limited to the amount donated to an environmental foundation. In practice, people gaming with each other may also interact in resource management. Gaming effects on water use may have lasting consequences for livelihoods and eco-systems in the actual world. One should, thus, not easily conclude that games such as ours can contribute to an improved understanding of conflicts in all contexts and at all times. Moreover, our experiment was conducted with a very small sample, and it is advisable to run a replication with a larger group in order to validate its findings.

The "do no harm principle" of experimental ethics should be carefully evaluated in any field setting. If experimental research is directed at politically and economically vulnerable subjects, it is ethically advisable to start with a less vulnerable group in order to explore (potentially heterogeneous) treatment effects and unforeseen harm [17]. This is what we have tried to do in this paper. Although we find some support for a positive effect of game participation even if this experience is negative, we cannot rule out that repeated negative interaction undermines pro-environmental behavior in actual field settings. We can also not rule out the interaction of assigned treatment with observed or unobserved socio-demographic heterogeneity. If we would find, for instance, that in spite of an *average* positive effect, specific sub-groups are harmed by particular treatments, such groups could be excluded from participation or at least from

random assignment to treatment. Future research should pay more attention to identify such heterogeneity in treatment effects.

5. Summary and Conclusions

Framed field experiments have become a common method to study behavior in common pool resource dilemmas in specific field contexts. As experimentalists we often hear and experience that, beyond generating interesting scientific insights, the method has a lasting positive effect on participants' understanding of resource dilemmas encountered in the field. In this paper, we have developed a field experiment to investigate how participation in a simple two person prisoner's dilemma experiment affects subsequent donations to an environmental foundation. We find that donations increase when participants play the game. This effect is larger for those who have a positive cooperation experience. However, total effects are relatively small, and socio-demographic heterogeneity explains a much greater proportion of variation in donations.

In future research, our approach could be extended to other samples and contexts. Repeated gaming and questionnaire data on environmental behavior could yield further interesting insights. The topic could also be explored for environmental education more generally. Ultimately, in field contexts, one would also have to study how interaction in the game affects interaction in the field. In other words, the group interacting in the game sees each other again in actual life, and will have to "deal with" what happened in the game. Many of us can cite personal examples where—after playing a card or parlor game—friendships and relationships were put to the test or even ended. People can become quite emotional in gaming—for the good and for the bad.

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Author Contributions

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Conflicts of Interest

The authors declare no conflict of interest.

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28. We have selected this foundation to add environmental context to the game. At the same time we were interested in choosing an organization that does not evoke strong emotions in subjects. If we would have chosen a large and well-known organization such as Greenpeace, a participant's attitude towards this organization may have dominated the donation decision. Ultimately, this would have resulted in more variation in the data and less statistical power. Every participant has received a handout describing the work of DBU. It was made clear to participants that none of the involved researchers was affiliated with DBU or would in any way benefit from the donation. The handout is available from the authors upon request.
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30. An English translation of the text reads as follows: "We are a group of resource economists from this university and we frequently conduct experiments to study behavior in environmental decision-making. Today, we would like to give you the chance to participate in such an experiment to give you the opportunity to learn about our work. If you are interested, we will play—with some probability—a small game with you. It will not take more than 15 min. For your participation you will get compensated with five Euros. If you want or if you feel for some reason uncomfortable taking this money, you may anonymously donate this sum or parts of it to an environmental foundation." All additional materials and texts are available from the authors upon request.
31. Students received English instructions, whereas visitors received everything in German. We have spent great care, however, that, apart from language, instructions of the prisoner's dilemma game are the same for both parties.

32. In all cases the envelope contained one 10 Cent coin, two 20 Cent coins, one 50 Cent coin, two 1 Euro coins, and one 2 Euro coin (= 5 Euro in total). This allowed participants to choose any amount between 0 and 5.00 Euro in increments of 10 Cents. Like all other decisions, donations were made fully in private, and a voting booth was provided for this purpose. In this booth we placed a box into which subjects should put the envelopes, even when these are empty, *i.e.*, when all money was taken home.
33. There are various possibilities for explaining the larger proportion of cooperators in the visitor sample. For instance, visitors may care less about rewards because they are wealthier; they may also have lower opportunity costs of time in the context of the exhibition and self-select into a study which they may find interesting for other reasons. Note that we are not interested in this difference, however. The student sample serves us just as a source of exogenous cooperative and uncooperative decisions to be matched with visitors for practical reasons.
34. When we opened the box containing the envelopes with donations, we have found three envelopes containing more money than the five Euros everyone was equipped with. Subjects were asked to put away the money they earned in the prisoner's dilemma game. Because the donation was anonymous and took place in the voting booth we could not control how much people actually put into the envelopes. We could, thus, also not rule that somebody was adding more than the five Euros to the envelope. In fact, all those three envelopes contained seven Euros. In all three cases participants have played the game and in all three cases the outcome was C, C (Invest, Invest), *i.e.*, subjects have received two Euros from the game. We thus believe that these three participants have added the two Euros gained in the game to the donation.
35. The test statistics and p-values for the difference between CONTROL and DEFECTGAME are $z = 0.5318$ and $p = 0.2974$ and $z = 0.9392$ with $p = 0.1738$ for the difference between DEFECTGAME and COOPGAME.
36. The test results are $z = -0.3282$, $p = 0.3714$ when comparing CONROL and DEFECTGAME; $z = -0.4706$, $p = 0.3190$ when comparing DEFECTGAME and COOPGAME; and $z = -0.8659$, $p = 0.1933$ when comparing CONTROL and COOPGAME.
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