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Abstract

Clean up your own mess: An experimental study of moral responsibility and efficiency

by Michael Jakob, Dorothea Kübler, Jan Christoph Steckel and Roel van Veldhuizen*

Although market-based environmental policy instruments feature prominently in economic theory and are widely employed, they often meet with public resistance. We argue that such resistance may be driven by a feeling of moral responsibility where citizens prefer to tackle environmental problems themselves, rather than delegating the task to others by means of a market mechanism. Using a laboratory experiment that isolates moral responsibility from alternative explanations, we show that moral responsibility induces participants to incur a sizable cost on themselves as well as on other participants. We discuss the implications of this finding for the design and implementation of environmental policies.

Keywords: Laboratory Experiment, Moral Responsibility, Environmental Policy, Market Mechanism, Climate Change

JEL classification: C90, H23, Q53, Q54, Q58

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1. Introduction

There is a long-standing tradition in economics emphasizing the merits of market-based policies, such as pollution taxes and tradable permit schemes, as a means to curb environmental externalities and limit the over-use of exhaustible resources (Baumol and Oates 1988). By providing incentives to reduce pollution or resource use, these policies are in general more efficient in economic terms than traditional command-and-control measures, such as product or performance standards. They hence offer the possibility to yield better economic outcomes for everyone, i.e., to result in Pareto improvements.

In the last decades, these theoretical insights have made their way into policy making. Tradable quotas are frequently employed to ensure sustainable management of fisheries (Arnason 2012). Pollution taxes, e.g., on transport fuels, are applied throughout the OECD as well as numerous developing countries (OECD 2015). To date, 40 countries and over 20 cities, states, and regions have introduced a price on carbon emissions, either in the form of taxes or in the form of tradable permit schemes (Kossoy et al. 2015). In addition, voluntary offset mechanisms to compensate for individual emissions have become popular, particular in OECD countries (Kossoy et al., 2015).

Nevertheless, market-based environmental policies have repeatedly been met with resistance from various sources. The trading of emission permits is compared to the medieval practice of paying money to be cleared from one's sins, as put succinctly in the Earth Island Journal (Smith 2009):

> *'Congress's new cap-and-trade scam would put the Church's indulgence scheme to shame.'*

Also, buying offsets to compensate for one's greenhouse gas emissions has been seen as a way to ease one's conscience without changing one's behavior. As George Monbiot (2006) writes in "The Guardian":

> '*Our guilty consciences appeased, we continue to fill up our SUVs and fly round the world without the least concern about our impact on the planet … it's like pushing the food around on your plate to create the impression that you have eaten it*'

Not only journalists and environmental activists, but also the church has taken a critical stance on emissions trading, most notably in Pope Francis's (2015) widely discussed encyclical 'Laudato Si':

> *'The strategy of buying and selling "carbon credits" can lead to a new form of speculation which would not help reduce the emission of polluting gases worldwide. This system seems to provide a quick and easy solution under the guise of a certain commitment to the environment, but in no way does it allow for the radical change which present circumstances require. Rather, it may simply become a ploy which permits maintaining the excessive consumption of some countries and sectors' (Para. 171)*

The above statements reflect the distinction established by Page (2011) who differentiates between two types of criticisms of emissions trading. First, it may fail to bring about long-term behavioral change required for successful climate change mitigation and undermine intrinsic incentives for environmentally friendly behavior. Second, emissions trading may violate non-consequential objectives, such as justice and fairness (see also Caney 2010).

That is, there appears to be a strong presumption that using a market mechanism to compensate for an environmental externality is not morally equivalent to altering one's environmental behavior, even if both courses of action result in identical outcomes.

This raises the question of *why* people object to such market mechanisms. In this study, we hypothesize that people may experience a feeling of 'moral responsibility' to eliminate waste they are responsible for, i.e. "to clean up their own mess", even if delegating the task to someone else would result in a Pareto improvement. For example, they may feel responsible for their or their country's role in climate change, and would like it to directly fight climate change, e.g., by reducing their own emissions. As a result, people may consider it immoral to buy their way out of this responsibility, even if doing so would constitute a Pareto improvement. We emphasize that in this study we refer to a motive to adopt behavior that is morally recommended or socially desirable that we call "moral responsibility". We use the term in a broad sense that does not distinguish between *conventions*, *social norms* or *moral obligations* (see Southwood 2011 for a detailed discussion).

While the aforementioned quotes of environmental activists and the church are suggestive of moral responsibility, they are not conclusive. For example, they may also reflect a lack of understanding of the benefits of market mechanisms (as argued by Nordhaus 2015), or the view that the assumptions of economic models demonstrating the superiority of trading schemes do not hold. To separate these alternatives from moral responsibility and to investigate whether moral concerns are held by the general population (in our case students), we use a laboratory experiment. It eliminates potential confounds and allows us to directly identify whether moral objections exist and, if so, what they depend on.

In the experiment, we let some of our participants engage in a real-effort task that involves throwing chickpeas into a bowl. Very few chickpeas hit their target, leaving a large number of chickpeas on the floor, for which these participants are then responsible. We then ask participants to either clean up the chickpeas themselves or delegate the cleaning task to another participant. While we construct the experiment such that delegation is Pareto optimal, feelings of moral responsibility may push participants to clean up themselves. This creates a trade-off between efficiency and moral responsibility.

We then isolate moral responsibility from other explanations using a control treatment in which a third party was responsible for the chickpeas on the floor. In our main treatment, 60 percent of participants decided to clean up their own chickpeas, even though this was economically inefficient. Importantly, this is significantly higher than the 30 percent of people cleaning up in the control treatment. This implies that people are willing to accept real losses in return for behaving in a morally responsible way, even if the result is economically inefficient.

Thus, we contribute to the literature in two ways. First, to our knowledge, we are the first to present direct experimental evidence for the existence of a moral motivation for environmental behavior. Second, we show that these moral concerns are quite substantial; in our study they lower economic efficiency (i.e., total payments) by approximately 20 percent. Our results shed light on behavioral constraints that should be considered for the design of environmental policies and the debate between price-based and quantity-based environmental policies.

2. Literature Review

Our study builds on a large literature in environmental economics on market-based instruments. One strand of this literature focuses on the differences between market-based and command-and-control measures (Fischer et al. 2003, Goulder et al. 2016). A second strand of investigation concerns the question of whether to prefer quantity- or price-based mechanisms to regulate pollutants like carbon emissions (Weitzman 1974, Pizer 2002, Hepburn 2006). This strand of literature generally agrees that market instruments should be preferred over command-and control, but, to our knowledge, has not discussed the issue of moral responsibility.

Various policy instruments have been studied with the help of laboratory and field experiments. An early tradition in experimental economics emphasizes that people tend to be more cooperative than predicted by standard economic theory (Mason and Phillips 1997; Casari and Plott 2003), thereby alleviating collective action problems and affecting optimal policy. More recent studies focus on the performance of classic policy instruments in terms of environmental effectiveness and economic efficiency (e.g., Ambec et al. 2014). Relatedly, field experiments have been employed to develop and test policy instruments when consumers respond to social information (Allcott and Rogers, 2014) or are biased (Allcott and Taubinsky, 2015). Building on this literature that takes human behavior into account when designing environmental policies, we examine how the acceptance and effectiveness of traditional market-based policy instruments may be affected by behavioral factors (namely moral concerns) that have so far been neglected in the literature.

There is relatively little empirical evidence for the role of moral motivations for environmental behavior. In a survey of Polish households, Czajkowski et al. (2014) find that people express some preference for sorting waste themselves instead of relying on a specialized sorting facility, even though they apparently understand that their choice is economically inefficient. Using representative survey data from Germany and the US, Schwirplies and Ziegler (2015) find that a 'green identity' and social norms are important motivations for pro-environmental behavior.

Our study is also related to the large experimental literature that investigates non-selfish motivations. These studies show that people are often willing to give up part of their own pay-offs in order to help another participant, decrease inequality, or reciprocate earlier actions (e.g., Rabin, 1993; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). By contrast, we study a setting where the incentives of the two participants are perfectly aligned, and both participants share the proceeds equally. Nevertheless, moral responsibility may prevent participants from implementing the payoff maximizing allocation. This is related to

Erat and Gneezy (2012), who find that participants are unwilling to increase their own payoff and the payoff of another person if doing so involves telling a lie.

Our experiment also contributes to studies that emphasize that the moral quality of an action is not exclusively determined by its outcomes, as would be the case under a consequentialist logic (Messick 1999). Certain markets, such as prostitution or trade in organs, are often regarded as morally unacceptable even if the parties involved willingly participate in the transaction (Roth 2007). A similar concern with *how* results are obtained is at the core of the situation that we study in this paper. In the spirit of the Kantian categorical imperative, one strand of moral philosophy emphasizes the importance of behavioral rules that, if followed by everyone, would benefit the whole society. Milkoreit (2015) highlights the relevance of such 'deontological' considerations for climate policy. A second strand focuses on 'virtues', arguing that certain actions can affect one's sense of identity. The question of how identity affects economic outcomes has recently received considerable attention in the literature (Akerlof and Kranton 2000). Brekke et al. (2003) and Bénabou and Tirole (2006) extend these insights to study the provision of public goods and pro-social behavior; Nyborg et al. (2006) explicitly apply them to green consumption. Eyckmans and Kverndokk (2010) construct a model in which concern for a 'green' identity can hamper the establishment of a market for tradable emission permits. Feelings of moral responsibility may be part of such a green identity, and may therefore be triggered in settings where the green identity is salient.

More generally, it has been argued that markets propagate instrumental motivations and thus do not foster intrinsic values and motivations (Anderson 1993) or even destroy such values (Sandel 2012). A growing empirical literature has emerged on the question whether markets erode social responsibility and moral concerns (Falk and Szech 2013; Bartling, Weber and Yao 2015). We investigate the opposite question, namely whether moral concerns can reduce the efficiency of markets.

Perhaps most closely related to our study is a recent experiment by Braaten et al. (2015). They study emissions trading using a common pool resource, where participants differ in the benefit of extracting, but extraction always harms the overall payoff of the group. To mimic emissions trading, each participant is assigned extraction rights that can be sold to other participants. The authors find that even though the majority of participants oppose emission trading in the real world, they do not oppose to "trading to do something wrong" in the experiment. One possible explanation for this result, they argue, is that the monetary externalities involved were too abstract to incite moral concerns. This suggests that it may be important to use a task that is closer to actually using up a natural resource or polluting the environment and therefore more likely to raise feelings of moral responsibility. This is what we do in this study.

3. Experimental Design

The goal of our experiment is to capture the trade-off between efficiency and moral responsibility. In order to capture moral responsibility, lab experiments are an important tool because they can help us separate moral responsibility from alternative considerations. For this purpose, we used a simple and stylized setup, and did not design our experiment to fit any particular market mechanism. Using a stylized setting provides us with clean evidence

of moral responsibility, which may then also apply in other settings. For example, the moral considerations we capture in the experiment may parallel the opposition to emissions trading observed in the real world.

3.1 Overview of the experiment

The experiment was set up to study a conflict between economic efficiency and moral responsibility. Participants in the experiment were matched into groups of two. In part one of the experiment, both participants engaged in individual real-effort tasks. We sought to induce moral responsibility by letting the first group member (participant A) engage in a chickpea-throwing task. Meanwhile, the other group member (participant B) engaged in a standard real-effort task with piece-rate incentives (solving addition problems).

For the chickpea task, participant A was given a bowl with 300 chickpeas and had four minutes to throw chickpeas into a deep plate from several feet away, see Figure 4 in the Appendix. We expected most chickpeas to miss the target, resulting in a considerable mess. Indeed, the goal of part one was to induce participant A to feel morally responsible for the chickpeas on the floor, allowing us to study the effect of moral responsibility on efficiency in part two of the experiment. Hence, the chickpea task in part one forms a crucial part of our design.

The goal of part two was to identify the effect of moral responsibility on efficiency. For this purpose, participants worked in groups of two, with perfectly aligned incentives. Each group had two tasks: cleaning up the chickpeas, and moving sliders on a computer screen (the slider task). Each group was paid 20 cents for every slider completed by participant A, and 10 cents for every slider completed by participant B, split evenly across the two participants. Importantly, failing to clean up the chickpeas meant that both participants earned nothing for this part of the experiment. Given these incentives, the payoff-maximizing strategy is for both participants to complete as many sliders as possible, and for participant B to clean up the mess. However, if participants A feel responsible for creating the mess, they may elect to personally clean it up, reducing the group's payoff. Note that when throwing the chickpeas, participants A did not know that either they or participant B would have to pick them up later.[1]

3.2 Experimental procedures

Each session consisted of exactly four participants. To make sure that enough people showed up, we invited six participants per session, randomly selected four of them, and dismissed any extra participants after paying them their five Euro show-up fee. Upon being selected to participate, participants were randomly assigned to a computer desk, anonymously matched in groups of two and assigned to one of the two roles. Participants were then given printed instructions that were identical for all participants. They were also informed that the experiment consisted of two parts, and that they would receive

[1] We chose this design to parallel the situation that developed countries have emitted large amounts of greenhouse gases in the past decades without anticipating that this behavior would negatively affect the climate.

instructions for part two after completing part one. After having read the instructions, participants were asked to raise their hand so we could answer any remaining questions.

Part one started by moving the two participants A to separate rooms (one for each participant), located next to the main lab. They were then given a bowl with 300 chickpeas and had four minutes to throw as many as they could into a deep plate from several feet away, see Figure A1 in the Appendix. The plate was placed on the ground ("A" in Figure A1), and the minimum throwing distance was clearly indicated by a line on the floor ("B" in Figure A1). We placed several tissues in the plate to lower the probability that chickpeas hitting the target would bounce out. During this part, participants were not allowed to pick up any chickpeas from the floor, and therefore had only one chance to hit the target with each chickpea. A research assistant, who remained in the background, was present in each separate room to make sure the participants followed the instructions and to keep track of the remaining time.

After four minutes, the research assistant counted the number of chickpeas in the plate, and recorded this number on a sheet of paper. The participants were asked to pay close attention, to ensure that the counting process happened correctly. Participants earned 10 cents for each chickpea in the plate at the end of the four-minute period. We then entered their score into the database, and escorted the participants back to the main laboratory.

Meanwhile, participants B remained in the main lab and had to add sets of three two-digit numbers for four minutes. This task was computerized using Ztree (Fischbacher, 2007). Participants received 10 cents for each exercise completed successfully. After all participants A had completed the chickpea task and had returned to the main laboratory, all participants received feedback about their own earnings as well as the earnings of their teammate.

The experiment then moved to its second part, for which participants were given a second set of instructions, and again had to work on real effort task. Since we did not want to use the same task as in part one, we used the slider task (Gill and Prowse, 2012). Participants were confronted with 40 sliders presented on a computer screen. The position of each slider was randomized; the goal of the task was to move each slider to the middle (50-50) position. The group received 20 cents (10 cents) for each slider correctly positioned by participant A (B). We made sure that both participants understood this information. Total earnings for part two were equally divided between the two group members.

Importantly, the earnings in part two were only paid out if one of the team members cleaned up the room.[2] Otherwise, both participants earned zero for part two of the experiment. This was emphasized in the instructions, ensuring that all subjects were informed about this. Importantly, participants who decided to clean up the room had to do the cleaning first, and could only start the slider task after they had finished the cleaning. This ensured that all cleaning had to be done by one person, i.e., the burden could not be split.

After reading through the instructions, participants had the opportunity to practice the slider task with 10 sliders on their computer. After all participants had completed the practice task

[2] In the instructions, we did not use the word 'cleaning'. Instead, we used 'picking up chickpeas' and 'returning the room to its initial state'.

and no one had any remaining questions, we moved participants A back to their respective room from part one, in which the floor was still covered in chickpeas. We directed participants A to a computer terminal. The screen informed them that they had to decide whether to clean up the chickpeas from the floor or start working on the slider task on the computer right away (thus leaving the chickpeas on the floor to participant B). Irrespective of their choice, we asked participants to press a 'start' button on the computer screen when ready.

Participants who decided to first clean up were instructed to pick up *all* chickpeas from the floor and put them into a bowl. The research assistant informed the participant when the cleaning was done, after which the participant was allowed to proceed with the slider task for what remained of the four minutes.

At the end of the four minutes, we moved the participants A back to the main laboratory. When both participants A had returned, we guided their teammates (participants B) to their team's respective room. Once again, participants were directed to the terminal and asked to start the four-minute timer before working on the task(s). Naturally, participants could only opt to clean the room if their teammate had not already done so.

At the end of the four minutes, we moved participants B back to the main laboratory. All participants were subsequently notified of their earnings in part two and their total earnings. Total earnings per person consisted of a show-up fee (5 Euros), the individual earnings from part one and the group earnings from part two divided equally over the two participants. Participants were then asked to answer a small questionnaire with basic demographic questions as well as several questions concerning their attitudes towards emissions trading, the environment, and the market economy (see Appendix). After completing the questionnaire, participants were paid individually and left the laboratory. In total, a session lasted about 35 to 40 minutes.

3.3 Additional treatments

The payoff-maximizing strategy in the experiment is for participant A to work only on the slider task and to let participant B clean up the chickpeas. This is a corner solution, from which deviations may be observed for a number of different reasons. Participants A may, for example, fear that B will refuse or forget to do the cleaning. They may also be afraid that the other person will not have enough time to finish all the cleaning or may dislike the slider task enough to be willing to give up money in order to clean instead. Cleaning up can also be rational for participants A who believe that their teammates are twice as good at the slider task, which would fully offset the difference in piece rates. In addition, participants A may also clean up by mistake, for example because they misread the instructions.

In order to separate these reasons from moral responsibility, we ran a control treatment (ThirdParty). In this treatment, *both* participants solved exercises in part one while the chickpeas were thrown on the floor by a third party (a research assistant). As a result, participant A is no longer responsible for the chickpeas on the floor. This treatment therefore eliminates the role of moral considerations, while not affecting the alternative reasons mentioned above. As a result, it allows us to distinguish between these alternative mechanisms and the moral considerations that form the main focus of the paper.

In the first five sessions of the main treatment, the majority of participants A used up all their chickpeas, hitting approximately 20 on average. In treatment ThirdParty, we therefore asked the research assistants to also use all 300 chickpeas and put approximately 20 chickpeas in the deep plate. This ensured that the number of chickpeas on the floor was similar across the two treatments. Otherwise, all procedures were identical to the main treatment.

Finally, we ran a third treatment (BFirst) where we reversed the order of moves in part two. In this treatment, participants B were therefore the first ones to decide whether to pick up the chickpeas. Note that participants B were not responsible for the chickpeas on the floor. They should therefore not be influenced by moral responsibility, and may as a result be more likely to choose the efficient allocation (i.e., clean up themselves). On the other hand, participants B may be unwilling to clean up if they feel that cleaning is A's responsibility. This treatment will therefore allow us to see whether the efficiency loss that may occur in the main treatment is mitigated by changing the order of moves. The three treatments are summarized in Table 1.

	Main	**ThirdParty**	**BFirst**
Chickpeas thrown by	Participant A	Research Assistant	Participant A
Decision to clean by	Participant A	Participant A	Participant B

Table 1: Overview of the three treatments.

Participants were recruited using ORSEE (Greiner, 2015). We ran 45 sessions at the Technical University of Berlin between May and September 2015, with a total of 180 participants (60 in each treatment, 46% women). The average age was 25 and 96% of participants were students, with the largest proportions majoring in science (25%), engineering (22%) and double majoring in economics and engineering (19%). The average participant earned approximately €14.40 Euro (including the show-up fee), with a minimum of €5.90 and a maximum of €20.70.[3] As shown in Table A1 in the Appendix, the three treatments are well balanced on all demographic variables and in terms of performance.

4. Results

In this section, we first present the performance of the subjects in the three different tasks (solving additions, throwing chickpeas, and setting sliders). Next, we focus on the cleaning decisions. This allows us to identify the importance of moral responsibility, and to evaluate the efficiency of the outcome with respect to the earnings of the participants. In a final step, we show that income differences in part one of the experiment are unlikely to account for the results.

[3] We omit the data from one pilot session (four participants) with 200 chickpeas (instead of 300). We also omit the data from a session in which participants were mistakenly given the instructions for the wrong treatment in part two. In addition, we ran two pilot sessions to delve deeper into the reasons for the observed behavior, but failed to get meaningful results.

4.1 Aggregate performance

The performance in the tasks we employed was measured by the number of additions solved correctly, the number of chickpeas that hit the target, and the number of sliders positioned correctly.

	Overall	Main	ThirdParty	BFirst
Addition task	16.2	16.0	16.2	16.5
	(6.0)	(6.1)	(5.9)	(6.3)
Chickpea task	21.3	22.4	NA	20.1
	(14.7)	(16.1)	(NA)	(13.2)
Slider task (with cleaning)	27.7	26.9	29.1	27.0
	(12.1)	(14.5)	(11.8)	(9.6)
Slider task (no cleaning)	48.2	41.2	54.7	48.4
	(20.9)	(12.5)	(26.4)	(19.3)
Fraction of groups cleaned	.97	1	.93	.97
	(.18)	(.0)	(.25)	(.18)
Cleaning time (seconds)	86	84	79	94
	(30)	(30)	(26)	(32)
Observations	180	60	60	60
Groups	90	30	30	30

Table 2: Descriptive statistics.

Note: The table displays means; standard deviations are shown in brackets. "Addition Task" is the average number of correct answers in the addition task. "Chickpea task" is the average number of chickpeas that hit the target in the chickpea task. "Slider task" is the average number of sliders moved in the slider task, separately for those who cleaned up the room, "(with cleaning)", and those who did not, "(no cleaning)". The percentage of groups who cleaned is the percentage of groups for which either participant A or participant B cleaned the room. "Cleaning Time" is the average time used to clean up the room (in seconds), as recorded by the research assistants. This variable was not recorded for the first three sessions, and is not defined for groups that did not clean up at all.

Table 2 summarizes the performance levels separately for each treatment and for all treatments combined. For each of the three tasks, the performance levels are similar across treatments. In addition, the performance in the chickpea task was similar in both rooms (p=.34, Mann-Whitney); participants threw 272 out of 300 chickpeas on average, with most participants (67%) using all 300. Comparing the chickpea and the addition task, the *median* performance in the two tasks was nearly identical with 16 and 16.5 respectively (not displayed in the table; p=.351, Mann-Whitney). However, the *average* performance was better in the chickpea task (average: 21.3) than in the addition task (average: 16.2, p=.016, t-test). As we show below, this difference is driven by the upper part of the distribution, which is highly skewed for the chickpea task but not for the addition task.

4.2 Cleaning Decisions

Given that participants A and B are randomly assigned to their roles and hence do not systematically differ in their ability in the two tasks, payoff maximization predicts that Participant A delegates the cleaning task to participant A in the main treatment. However, this is not what we observe. In the main treatment, 60% of participants A decide to pick up the chickpeas. Thus, 60% of participants A in the main treatment are willing to forego part of

their earnings in order to do the cleaning themselves. This is consistent with our hypothesis that participants A feel a moral responsibility to clean up, and it seems inconsistent with the idea that participants are solely maximizing their income.

While our results can be explained by moral responsibility, there are other mechanisms that may also have played a role, such as participant A's fear that participant B may refuse to clean up. Treatment ThirdParty eliminates moral responsibility while retaining the potential other reasons for which A may pick up the chickpeas. If moral responsibility is important, fewer participants A should therefore elect to clean in treatment ThirdParty. Indeed, we find that only 30% of participants A pick up the chickpeas in this treatment. The difference relative to the main treatment is statistically significant (p=.019, test of proportions). Taking these results together, the data from treatment ThirdParty suggest that around 30% of participants A elected to clean up for reasons unrelated to moral concerns. The comparison between the two treatments suggests that a further 30% of participants A picked up the chickpeas out of a moral obligation.

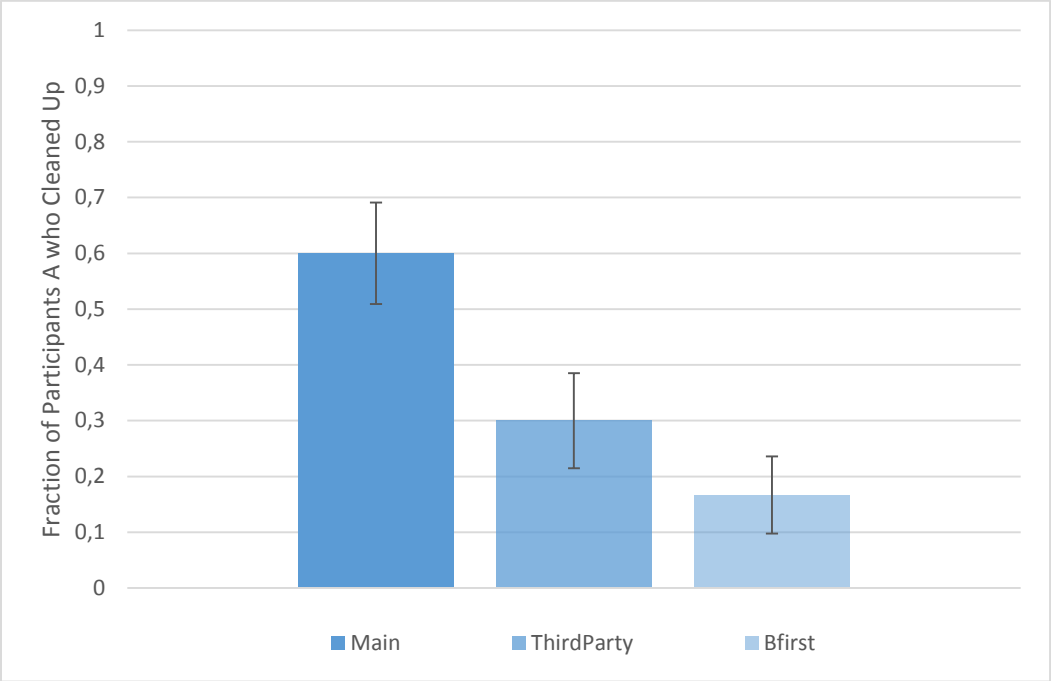

Figure 1: Fraction of participants A who cleaned up in the different treatments.
Note: the whiskers indicate one standard error.

Interestingly, such moral considerations appear to be unimportant for participants B. No participant B in the main treatment refused to clean up the chickpeas after A had delegated the task (N=12). However, the cost of a refusal is higher for participant B than for participant A, rendering a direct comparison impossible. In order to investigate the motives of participants B, we ran our third treatment, BFirst, where participant B was the first to decide whether to pick up the chickpeas. In this treatment, 25 out of 30 participants B (83%) decided to clean up themselves. As a result, participants A cleaned up significantly less often in this treatment relative to the main treatment (p<.001, test of proportions) but not relative to treatment ThirdParty (p=.222, test of proportions).

Thus, participants B did not appear to mind cleaning up the chickpeas thrown by participant A enough to outweigh the loss in payoffs from leaving the chickpeas on the floor. This may in part be explained by the fact that it was the experimenter who instructed participant A to throw chickpeas in the first part of the experiment. Thus, while participant A's behavior is the source of the chickpeas on the floor, it could be argued that his/her action was not irresponsible, especially because participants A did not know that either they or participant B would have to pick up the chickpeas later. The experimental results imply that in this situation, a more efficient outcome is obtained when participant B, i.e., the person who did not throw the chickpeas, has the ability to decide first.

Note that the difference between the cleaning decisions of participants A in the main treatment and in treatment ThirdParty may result from two related but distinct motives. First, participants A might clean up because of personal (i.e., 'first order') feeling of moral responsibility. Second, participants A might expect participants B to hold them accountable for the chickpeas on the floor. If such 'second order' moral responsibility is strong enough, participants B might refuse to clean up the mess altogether, even if it destroys their own payoff. Anticipating this reaction could lead participants A to refrain from delegating the task to participants B.

Since treatment ThirdParty eliminates both first- and second-order feelings of moral responsibility, it does not allow us to disentangle the two types of moral responsibility. However, our data do not provide much support for second-order moral responsibility[4]. Specifically, we already saw that the majority of participants B (83%) chose to clean up in treatment BFirst and all participants B in the main treatment cleaned if the participants A did not. At the same time, we cannot exclude that some participants A did, mistakenly, expect B not to clean up in the main treatment, which could (partially) explain our treatment effect. In the end, our data are therefore consistent with both first-order and second-order moral responsibility.

In Table 3, we analyze our data using regressions. Column (1) of Table 3 compares the fraction of participants A cleaning up the chickpeas across treatments, and replicates the results of our non-parametric tests. Column (2) shows that we obtain similar results when controlling for the first mover's performance (the number of exercises or chickpeas) in part 1. (Note that the first mover is A in treatments Main and Thirdparty, while it is B in BFirst.) Column (3) also controls for the first mover's gender. Female participants A are more likely to clean up in treatment ThirdParty (p=.076), but there is no gender effect in the other two treatments. As a result, the treatment dummy for treatment ThirdParty (which is now estimated only on the men) is larger and significant at the 1% level. Since these effects were not part of our original hypotheses, we only mention them in passing.

[4] Answers by participants in a post-experimental questionnaire also hint at 'first-order responsibility'. For example, one participant stated that "[emissions rights] should not be tradable as the environment would still be damaged and companies with a lot of money could buy themselves out of their responsibility" (translated from German by the authors).

	(1)	(2)	(3)	(4)
	Dependent Variable: first mover assigns cleaning task to A			
Treatment BFirst	-0.400***	-0.414***	-0.435***	-0.404***
	(0.001)	(0.001)	(0.007)	(0.001)
Treatment ThirdParty	-0.300**	-0.284**	-0.520***	-0.301**
	(0.018)	(0.033)	(0.002)	(0.013)
Performance (Part 1) X Main		0.000	-0.001	
		(0.996)	(0.851)	
Performance (Part 1) X BFirst		-0.008	-0.008	
		(0.369)	(0.367)	
Performance (Part 1) X ThirdParty		-0.014*	-0.006	
		(0.095)	(0.473)	
Female X Main			-0.173	
			(0.377)	
Female X BFirst			-0.156	
			(0.261)	
Female X ThirdParty			0.309*	
			(0.076)	
Female				-0.055
				(0.589)
Age				-0.005
				(0.522)
Governments should support equal income/wealth				-0.061
				(0.183)
Governments should support individual liberty				-0.093*
				(0.067)
Governments should protect the environment				0.023
				(0.678)
Taxes for rich people should be low				0.086*
				(0.080)
Individual responsibility important to prevent climate change				0.141***
				(0.001)
Constant	0.600***	0.600***	0.672***	0.474
	(0.000)	(0.000)	(0.000)	(0.177)
Observations	90	90	90	90
R-squared	0.124	0.139	0.187	0.303

Table 3: Regression results.

Notes: The table presents the regression coefficients, p-values are shown in brackets. We only use the initial decision maker in each treatment: participant A in the main treatment and ThirdParty, participant B in BFirst. Performance (Part 1) refers to the number of chickpeas that hit the bowl (Main) or exercises solved (BFirst, ThirdParty) in the first part of the experiment. Age is expressed in years. The bottom five variables are 5-point Likert scale variables elicited as part of the questionnaire. P-values are calculated using robust standard errors.

Finally, column (4) controls for the age and gender of the first movers (A in treatments Main and ThirdParty and B in BFirst) and their responses to several post-experimental questions. Controlling for these variables does not affect the treatment coefficients, which are similar to columns (1) and (2). Moreover, we find an interesting correlation between one of the questionnaire items and observed choices. Specifically, the regression shows that participants A who agreed with the statement that "individual responsibility is an important part of preventing climate change" were more likely to clean up if they were the ones deciding on the cleaning (i.e., in the main treatment and in treatment ThirdParty). Likewise, participants B who agreed with the above statement were more likely to delegate the task to participant A (in the Bfirst treatment).[5] While this correlation is intuitive for the treatments in which A has thrown the chickpeas on the floor (Main and BFirst), it also appears in the treatment ThirdParty, in which none of the participants is responsible. One explanation is that participants A in this treatment feel some responsibility by virtue of being the first to decide. If this was true, it would imply that our comparison between ThirdParty and the main treatment underestimates the importance of a moral responsibility.

4.3 Efficiency and Earnings

What is the loss in earnings when participant A collected the chickpeas on the floor? We calculate the loss in terms of opportunity costs. Cleaning up took around one minute and 26 seconds on average. As a result, participants who cleaned up solved 27.65 sliders, relative to 48.24 sliders for those who did not clean (p<.001, t-test). Figure 2 shows the distribution of the number of sliders solved by those who cleaned and those who did not clean.

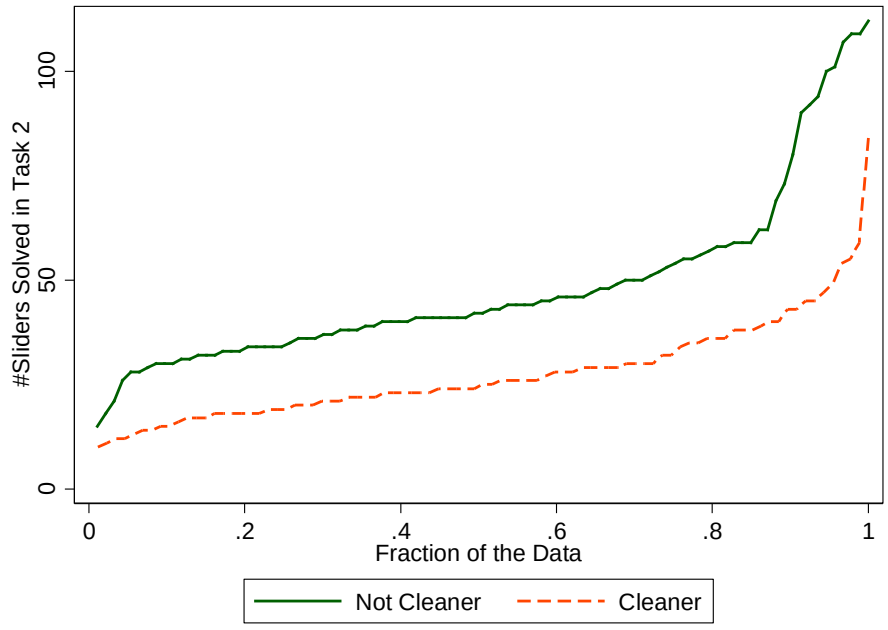

Figure 2: Sliders solved by subjects who cleaned or did not clean the room.
Note: The figure uses data from all three treatments.

[5] If we run this regression separately for each treatment, the coefficients are similar (ranging from 0.10 to 0.14).

Given these differences in performance, groups in which participant A cleaned up missed out on (48.24-27.65)*(€0.2- €0.1)=€2.06 (€1.03 for each person), or 18% of the average income in part 2. Over all treatments, groups earned more when B did the cleaning (p=.021). This implies that participants in treatment BFirst and ThirdParty earned significantly more than participants in the main treatment (p=.004 for ThirdParty, p=.018 for BFirst, Mann-Whitney).

4.4 Robustness: Income inequality and cleaning decisions

We previously observed that the mean earnings were larger in the chickpea task than in the addition task. To evaluate whether this difference could drive the observed cleaning decisions, we examine the distribution of earnings in the two tasks across the Main treatment and BFirst in Figure 3. (Note that these two treatments are identical in part one, and the data from part one also turn out to be statistically indistinguishable.) In both treatments, the bottom 50-60% earned similar amounts, but there is a large difference in the earnings of the top performers. For example, 11 performers in the chickpea task (18%) earned more than the best performer in the addition task.

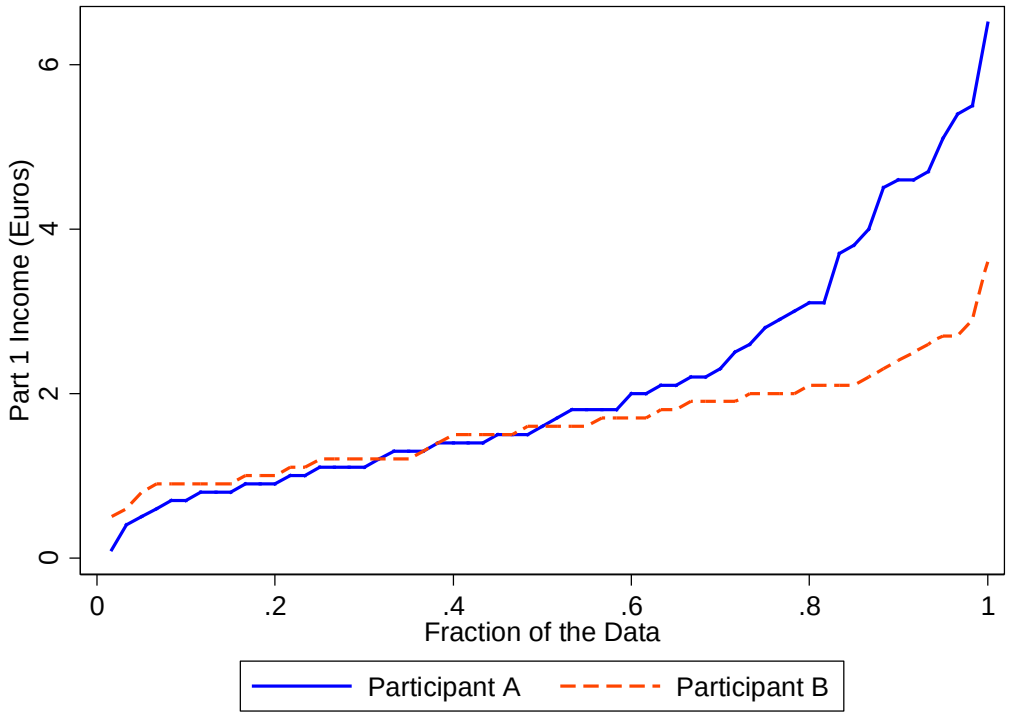

Figure 3: Individual earnings of participants throwing chickpeas (A) or solving additions (B).
Note: The figure uses data from the main treatment and treatment BFirst.

By contrast, participants in treatment ThirdParty both worked on the addition task, and therefore earned similar amounts. Thus, the income difference between A and B could provide an alternative explanation for the difference between cleaning choices observed in these treatments. Note, however, that since participants cannot change the income distribution in part two, inequality aversion defined over payoffs cannot explain treatment differences in cleaning choices. However, it is conceivable that richer participants feel more

willing to clean up if they believe that picking up the chickpeas is associated with a lower utility than only working on the slider task.

To check whether this form of (utility-based) inequality aversion can explain our results, we first examine whether participant A or B was the high earner in each group, and whether this varied across treatments. It turns out that participant A was the high earner 15 times (50%) in the main treatment, 16 times (53%) in BFirst and 17 times (57%) in ThirdParty. Thus, participants A were not more likely to be the high earner in the main treatment (or BFirst) relative to treatment ThirdParty. Conditional on A being the high earner, however, the income difference was larger in the main treatment (1.96 Euro) than in treatment ThirdParty (0.77 Euro; p=.010, Mann-Whitney). For this to explain our treatment effect, it would need to be the case that participants A who were high earners were more likely to clean than low earners. In fact, we find the opposite. Participants A who were high earners cleaned 40% of the time, relative to 80% for low earners.[6] The reason could be that high performers in the chickpea task were those who better understood the efficiency implications, or expected to be more productive in the slider task.

Overall, due to the skewed performance distribution in the chickpea task, we find that income differences between participants A and B varied across the main treatment and treatment ThirdParty. However, these income differences cannot explain the treatment effect, since we find that richer participants (who are more common in the main treatment) clean up less often. If anything, if a higher income indeed induces people to be less likely to clean, our treatment effect would underestimate the importance of a moral responsibility.

5. Conclusions

Ever since Max Weber's (1930) seminal analysis of the role of protestant ethics for capitalism, social science has argued that moral convictions affect economic outcomes. This paper confirms this hypothesis for the case of environmental policy design. The experiment presented in this paper yields evidence that subjects experience a trade-off between what is economically efficient and what they deem to be morally right. Our main result is that the majority of participants tend to clean up when they are responsible for the chickpeas on the floor, even though delegating the task would have yielded a higher payoff not only for themselves, but also for their teammate. Specifically, they are willing to accept a payoff that is roughly 20% lower than what they could have earned otherwise. Interestingly, participants who were not responsible were more likely to choose the economically efficient solution. Taken together, these findings suggest that there is a moral responsibility to "clean up one's own mess", but no reluctance to clean up for someone else if this increases one's own and the other participant's payoff.

Our results are derived from a novel experimental design. This design is not meant to precisely capture any specific market institution, but rather allows us to identify the effect of

[6] A t-test yields p=.05. However, regressing the choice to clean up by participants A in the main treatment on the difference in payoffs with participant B, the regression coefficient is small and not significant (p=.41). When also including a quadratic term, the results of both coefficients are significant and suggest that higher relative performance makes cleaning less likely though the effect is weaker for very high performers.

feeling morally responsible on choices while controlling for other relevant factors. To our knowledge, we are the first to establish the existence of a moral responsibility to eliminate waste one feels responsible for with the help of lab experiments.

Moral responsibility as used in this paper could be an expression of a social norm or even a moral obligation, or it could be a mere convention. Further experiments are needed to disentangle these possible sources of behavior. However, the finding that those participants who indicated that individual responsibility is important to fight climate change in the post-experimental questionnaire tend to clean up more, hints at a moral responsibility and not a mere convention to clean up.

Feelings of moral responsibility may also be behind some of the resistance to market-based schemes in environmental policy. While we are able to identify the importance of such motives in our experiment, it remains to be investigated how strong these motives are in the real world. For instance, in our experiment, the chickpeas are visible and have a direct effect on the number of sliders that can be placed, whereas many environmental externalities, such as greenhouse gas emissions, have effects that occur in the far future and are subject to some degree of uncertainty, hence making them 'psychologically distant' (Spence et al. 2012). We did, however, find evidence of a link between the choices in our experiment and the participants' attitudes regarding how to fight climate change, as elicited by the post-experimental questionnaire. This is consistent with the idea that the motives we capture in the lab may also be relevant for behavior outside of the laboratory.

Our findings have a number of ramifications for the implementation of environmental policies. They document that Pareto-improving policies might be resisted because of moral concerns, not only because of a lack of understanding of their economic rationale, or because of the view that economic models of cap-and-trade systems are flawed or not applicable. For this reason, policy-makers could be required to adopt less efficient, but morally more acceptable policies. This, in turn, would increase the costs of environmental protection beyond cost estimates derived from first-best economic analyses building on the assumption that economic agents maximize their consumption utility without taking into account moral considerations.

This paper also opens up a new perspective on the long-standing debate on 'prices vs. quantities' for the choice of environmental policies. Previous research (summarized in Goulder and Parry, 2008) has identified advantages and drawbacks of price-based (e.g., a tax on pollution) and quantity-based (e.g., tradable permit schemes) environmental policies. This research, however, has not taken into account the role of moral concerns for instrument choice. Since a trading scheme has the flavor of paying one's way out of reducing emissions, a pollution tax may be morally more acceptable. Further research could investigate which instruments in environmental policy do not raise ethical concerns in the way that trading schemes do.

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Appendix

Appendix A: Additional tables and figures

	Overall	Main	BFirst	ThirdParty
Economics/Business	.12	.15	.10	.12
	(.33)	(.36)	(.30)	(.33)
Econ/Engineering	.19	.13	.23	.20
	(.39)	(.34)	(.43)	(.41)
Other Social Science	.04	.03	.05	.05
	(.21)	(.18)	(.22)	(.22)
Humanities	.13	.12	.12	.17
	(.34)	(.33)	(.32)	(.38)
Engineering	.22	.22	.27	.17
	(.41)	(.42)	(.45)	(.38)
Science	.19	.27	.12	.18
	(.39)	(.45)	(.32)	(.39)
Mathematics	.06	.07	.05	.07
	(.24)	(.25)	(.22)	(.25)
Other	.04	.02	.07	.05
	(.21)	(.13)	(.25)	(.22)
Female	.46	.45	.40	.53
	(.50)	(.50)	(.49)	(.50)
Age	24.8	23.8	25.3	25.2
	(4.9)	(4.2)	(5.9)	(4.4)
Observations	180	60	60	60

Table A1: Demographic variables across treatments.

Notes: The different majors of participants are summarized into several categories "Econ/Engineering" are participants double-majoring in economics and engineering. The variable "Other" contains participants who did not indicate a major or indicated that they are not students.

Figure A1: Photo of the room after a chickpea throwing session.
Notes: Arrow "A" indicates the bowl where chickpeas were thrown into. All participants threw chickpeas from the line on the ground indicated by arrow "B".

Appendix B: Instructions and post-experimental questionnaire

This section provides an English translation of the experimental instructions for the main treatment. The original German instructions are available upon request. The instructions for the other two treatments are similar.

Instructions

Welcome to the experiment!

For your participation you will receive 5 Euros. In the course of the experiment, you can earn additional money as a result of your decisions.

During the experiment, you are not allowed to use electronic equipment or to communicate with other participants. Please use only the experimental software. Please do not talk to the other participants. If something is unclear to you while reading, or if you have other questions, please let us know by raising your hand. We will then answer your questions individually. If the question is relevant to all participants, we will repeat and answer it aloud. If you violate these rules, we have to exclude you from the experiment, and you will not receive any payment.

Instructions

In the experiment you will form a team with another participant. This team will remain the same throughout the experiment.

The experiment consists of two parts. In the first part, you and your team partner, who will be called participant A and participant B, work on individual tasks. The performance in these tasks affects how much money you will earn. This also applies to your team partner.

You are either participant A or participant B. Which of the two participants you are will be displayed on the computer screen. Participant B will work on his task in this laboratory while participant A will work in an adjacent room.[A1]

Task Description Participant A

The task for participant A is as follows. Participant A receives a small bag of chickpeas and will try to throw them from a certain distance into a small bowl. He will have four minutes to

[A1] For reasons of legibility, we will only use the male pronouns in the following, but of course we mean bothfemale and male participants.

complete this task. Participant A earns 10 cents per chickpea that ended up in the bowl. Chickpeas which are not in the bowl do not yield any profit. Each chickpea can only be thrown once, even if the goal was missed. Each chickpea can be thrown separately, but it is also possible to throw several chickpeas at once. An experimenter will be present to see how many chickpeas have landed in the bowl after four minutes.

Task Description Participant B

The task of participant B is as follows. The display shows three two-digit numbers (see the example below). Participant B's task is to calculate the sum of these three numbers. For each correct answer, participant B receives 10 cents. He does not get money for a wrong solution. After solving an exercise, participant B automatically receives the next one. This part of the experiment takes a total of four minutes. During these four minutes, participant B can solve as many tasks as he wants. The clock at the upper right of the screen will indicate how much time is remaining. The number of tasks that participant B answered correctly and incorrectly is displayed on the screen below the current task. In addition, it is indicated whether the previous task has been solved correctly or incorrectly.

End of instructions

Please raise your hand when you have finished reading the instructions. An experimenter will come to you and ask whether you have any questions. Part 1 will begin as soon as all participants have finished reading.

Instructions – Part 2

This part of the experiment consists of two tasks. The tasks are to (1) place sliders on the computer screen in the correct position, and (2) to pick up the chickpeas on the floor. Each participant has four minutes to work on these tasks.

The first task is to move the sliders to the correct position on your computer screen. 48 sliders are displayed on the screen. Each slider is in the initial position (zero) and can be moved up to the number 100. Next to each slider is a number indicating where the slider is located. You can use the mouse in order to move the slider. Your task is to set each slider exactly to the number 50. You can adjust the position as often as you like. After one minute, you will automatically be redirected to the next screen with sliders. All the sliders that you have placed in the correct position count for your payout at the end. There will be four screens with sliders. When you select this task, you must work on this task for the entire four minutes.

The second task is to pick up the chickpeas. For this, all chickpeas must be picked up from the ground and put back into a bowl. The experimenter will inform you when the cleaning of the room is complete and no more chickpeas are lying on the floor.

Participant A will be the first to go into the adjacent room and decide which task he would like to work on. If he decides to work on the slider task, he will work on the task for the full four minutes and then return to the lab.

If participant A decides to collect the chickpeas from the ground, he must complete this task. If there is still time left of the four minutes, he can still work on the slider task at this time. After four minutes, he returns to the lab.

After participant A has returned to the lab, it is the turn of participant B to go to the adjacent room and work on the tasks. If A has already picked up the chickpeas, B must work on the sliders. Otherwise, participant B - similar to A before him - can select which task he wants to work on.

Payments

The payment for the second part of the experiment is divided between you and your team partner as follows:

The team gets 20 cents for each slider put in the right position by participant A. That is, you and your team partner will each receive 10 cents per slider placed by participant A.

The team gets 10 cents for each slider put in the right position by participant B. That is, you and your team partner will receive 5 cents per slider placed by participant B.

If neither you nor your team partner has picked up the chickpeas from the floor, your team will lose all the payoffs earned in the second part of the experiment.

At the end of the experiment, the team's winnings are split evenly between the two of you.

Example

Imagine that participant A has correctly positioned 35 sliders, and participant B has correctly positioned 33 sliders.

This means that the group will receive 20 cents * 35 sliders = 7.00 Euro for the sliders of participant A and 10 cents * 33 = 3.30 Euro for the sliders of participant B.

If the team has returned the room to its initial state, it will earn 10.30 Euro, divided equally between the two (a total of 5.15 dollar for each participant). If neither of the two participants has picked up the chickpeas, each team member will earn 0 Euro in this second part.

Each participant will also receive his personal earnings from the first part as well as the 5 Euro for showing up at the experiment.

Before we begin the experiment, you have time to try out the slider task. Please start the exercise session on the screen. The exercise round is completed for you as soon as you have set five sliders correctly.

Post-experimental questionnaire

Field of study:

Age:

Gender:

- If you are participant A, please explain briefly your decision to pick up the chickpeas or to work on the sliders right away.
- If you are participant B, how did you feel about the decision of participant A?
- On a scale from 1 (do not agree at all) to 5 (strongly agree) how would you evaluate the following statement?

  According to the EU Emission Trading Scheme (EU ETS), power plants and industrial companies must deliver an emission certificate for every ton of greenhouse gases emitted. The total amount of emissions is determined by the so-called 'cap', and certificates are often distributed free of charge to companies. Emission allowances can be traded on a market. As a result, companies whose emissions are below the emission rights granted to them can sell their remaining allowances, while companies whose emissions are greater than the number of their allowances can buy additional emission rights. This arrangement results in emission reductions being carried out where they can be achieved at the lowest cost.

- Do you believe that a capitalist or market-oriented economic system is inconsistent with environmental protection? (YES/NO)
- Do you think that the right to generate emissions should be tradable? Why/why not?

  - If you have answered the previous question with NO, which alternative measures to reduce emissions do you prefer?
  - If you have answered the previous question with YES, do you think emissions trading should be employed on a global scale? (YES/NO)

- Do you think that the possibility to buy emission permits reduces the willingness to behave in an environmentally responsible manner? (YES/NO)
- On a scale from 1 (do not agree at all) to 5 (strongly agree), please briefly answer the following questions.

  - Income and wealth should be distributed as evenly as possible. The government should use the appropriate tools to ensure this.
  - Individual liberty, when in doubt, is to be valued higher than other social goals, e.g., the fight against crime.
  - Animal and environmental protection should be a primary objective of German politics.
  - The tax burden for high-income earners should be as low as possible to allow for investment and economic growth.
  - The reduction of individual consumption (e.g., eat less meat, less or no air travel) is an important instrument to fight climate change.

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