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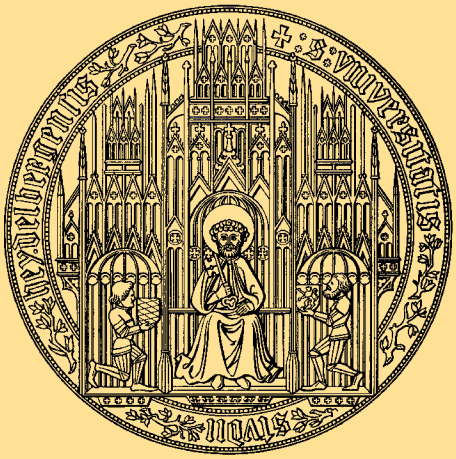

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Motivational Drivers of the Private Provision of Public Goods: Evidence From a Large Framed Field Experiment

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Motivational Drivers of the Private Provision of Public Goods: Evidence From a Large Framed Field Experiment*

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Abstract

Disentangling the motivational drivers of individuals is frequently regarded a key step in reconciling theory and empirical evidence on the voluntary provision of public goods. We present results of a large online field experiments with 12,624 contribution choices by members of the Internet-using German population. Subjects are assigned to six treatments targeted at motivations such as altruism, "warm glow", image motivation, or equity concerns. While evidence on treatment effects is mixed, the data point to significant effects of framing and the sequence of presenting options. Exploiting variations within the highly heterogeneous sample, the results confirm previous results from a subset of the data on sociodemographics and exogenous environmental conditions as determinants of subjects' choices and add additional evidence that females and older subjects are more inclined to give to the public good.

JEL Classifications: C93, D03, H41

Keywords: private provision of public goods; online experiment; field experiment; warm glow; social norms; equity field experiment; online experiment

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1 Introduction

The question of the underlying drivers of the private provision of public goods has spawned a still ongoing discussion in the literature. Since both empirically and experimentally, consumers voluntarily contribute to public goods at higher levels than the standard theory predicts, several extensions of and alternatives to the traditional theoretical formulation of the problem have been discussed. Most extensions concern additional sources of utility over and above the "purely altruistic" setup, in which, besides consumption, the overall level of the public good is the only argument in the utility function, no matter how it is provided (Samuelson 1954, Bergstrom et al. 1986).

Among the additional drivers discussed, "warm glow", image motivation, and moral norms have received a considerable amount of attention. Commonly, the *"warm glow"* of giving is defined as any private utility gains from the act of giving itself regardless of its impact on the aggregate level of the public good (Cornes and Sandler 1984, Andreoni 1989, 1990). Also, it is assumed to increase in the size of one's contribution. *Image motivation*, in turn, is characterized by (1) the visibility of the contribution or pro-social action and (2) by some (perceived) norm causing external (social) approval or sanctioning (Akerlof 1980, Hollander 1990, Benabou and Tirole 2006, Ariely et al. 2009). We may therefore also call image motivation a *social* norm. In contrast, a norm where sanctioning takes place internally, i.e. within the subject, may be called a *moral* norm (Brekke et al. 2003, Konow 2003). One may view the particular moral norm considered in the present paper as a norm of distributive fairness or a concern for equity.

This paper reports results from five additional treatment groups in the experiment reported in our articles "To Give or Not to Give: The Price of Contributing and the Provision of Public Goods" and "Willingness to Pay for Voluntary Climate Action and Its Determinants: Field-Experimental Evidence".[1] Treatments were designed to disentangle, in a uniform, controlled procedure, the presence and strength of the four motivational drivers mentioned above in the propensity to contribute a 1 ton carbon emissions reduction to the global pure public good of climate change mitigation. In total, the data

[1] Both papers are part of this dissertation. The latter is also available under Diederich and Goeschl (2013).

set contains 12,624 contribution choices made by 6,312 subjects.

Main results regarding a successful disentanglement of the targeted motivations through the treatments are ambiguous. On the one hand, we find that when removing altruism from subjects' set of motivations, contribution probabilities do not differ, while when adding image motivation, there is weak evidence for an increase. Both findings are plausible and in line with theory. On the other hand, several findings point to difficulties of the experimental design to successfully operate: First, there is evidence for strong framing effects as two theoretically equivalent treatments delivered significantly different contribution probabilities from slight changes in the information given. Second, results from an ex-post control questions suggest that the treatments removing altruism from subjects' set of motivations have not been well understood and thus may have failed. Third, we find in a treatment combining the removal of altruism and the activation of image motivation that contribution probabilities increase relatively strongly which is difficult to reconcile with the result of the two single treatments mentioned above.

In addition to treatment effects, the set of available covariates provides an opportunity to check previous results on determinants of contributions based on a subsample of the full sample. Results confirm previous findings on sociodemographics such as a highly significant correlation with education. Due to the larger statistical power, results add evidence for a positive correlation of age and being female with the probability to contribute to previously insignificant estimates. Lastly, additional evidence for a positive causal effect of outdoor temperatures, matched to subjects' choices by experimental day and region of residence, on the probability to contribute can be provided.

2 Theoretical framework

The following presents a simple linear model to illustrate the treatment design. The model is based on the standard impurely altruistic public good model (Andreoni 1989, 1990) and also draws from Benabou and Tirole (2006). Let utility be additively separable

and expressed as

$$\begin{aligned} U_i =& v_i^x x_i + v_i^G G + v_i^g g_i \\ &+ \eta \left[\gamma_i^G E_{-i} \left(v_i^G | g_i, \mathbf{p} \right) - \gamma_i^g E_{-i} \left(v_i^g | g_i, \mathbf{p} \right) \right] \end{aligned} \tag{1}$$

where x_i denotes i's consumption of a monetary numéraire, g_i is i's contribution to the public good, and $G = G_{-i} + g_i$ with G_{-i} being contributions by others. The vector $\mathbf{v}_i = \left(v_i^x, v_i^G, v_i^g \right)$ denotes the individual's valuations for money, the overall level of public good, and own contributions, respectively. Thus, the second (third) term in (1) is the altruistic ("warm glow") component of utility. The last term represents image motivation where $\eta \in [0, 1]$ is a parameter of the visibility of the act of contributing to others, and the vector $\boldsymbol{\gamma}_i = (\gamma_i^G, \gamma_i^g)$ denotes individual i's concerns for being perceived by others as altruistic and for being perceived as *not* interested into "warm glow" (the latter corresponding to the "private reward" in Benabou and Tirole 2006). We assume that the way expectations on $\mathbf{v}_i$ are formed is common knowledge. Let the individual be endowed with wealth w_i and maximize utility with respect to a budget constraint $w_i = x_i + \mathbf{p}\mathbf{y}_i$ where $\mathbf{p}$ denotes an M-dimensional vector of prices representing M available technologies which convert the numéraire into a unit of public good. Lastly, $g_i = \sum_{j=1}^{M} y_{ij}$.[2]

[2]The model would owe realism a potential but, for our purposes here, unnecessary extension. One property of the specific public good used in the experiment is that contributions will *offset* concurrent negative contributions since carbon emissions are a by-product of consumption in most economies (Kotchen 2009). Drawing from Kotchen's model, we could write *net contributions* as

$$g_i = \sum_{j=1}^{M} y_{ij} - \delta x_i, \ \delta \in [0, 1]$$

where we assume a linear externality of private consumption on the public good, δx_i. Thus, i's direct contributions now (partly) offset or exceed the harm done through consumption. Note that G_{-i} may now include some initial level of the public good provided by nature, and that the individual can boost G also by reducing consumption. As an additional extension, one could assume δ to be individual-specific and to represent the individual's *perception* of the impact of consumption. We follow up on this issue through questions in the post-experimental survey.

The first-order derivative of (1) with respect to contribution technology j is

$$\frac{\partial U}{\partial y_{ij}} = - p_j v_i^x + v_i^G + v_i^g + \eta \left[\gamma_i^G \frac{\partial E_{-i}\left(v_i^G | \sum_{j=1}^M y_{ij}, \mathbf{p} \right)}{\partial y_{ij}} - \gamma_i^g \frac{\partial E_{-i}\left(v_i^g | \sum_{j=1}^M y_{ij}, \mathbf{p} \right)}{\partial y_{ij}} \right]. \quad (2)$$

Obviously, the solution of the simple linear model will not be interior but fully depend on the relative weight of the additive motivational components. In our experimental design, we investigate whether a subject is willing to contribute *one* more unit to the public good. That is, whether utility is increasing in y_{ij} at the current level of contributions.[3]

Note that the image term in (2) comprises of two effects: the change in others' posterior expectation of i's altruism and the change in their posterior expectation of i's interest in personal reward from giving. Both effects should be expected to be positive from an increase of giving (Benabou and Tirole 2006). Hence the net effect of increasing visibility η is unclear ex ante.

Differentiating between the four different components of utility is straightforward formally. In order to isolate "warm glow" one needs to ensure anonymity, $\eta = 0$, and exogenously keep G invariant to g_i.[4] In this case, net marginal utility, $v_i^g - p_j v_i^x$, is either increasing or decreasing in y_i which determines i's experimental choice. This will be the condition of our experimental "Warm glow" treatment. If we let G vary with g_i, this will correspond to the "Baseline" condition where both the "warm glow" and the altruistic components are active. In the "Image" condition, $\eta > 0$. Comparison to the Baseline will reveal whether the net effect of the image term is positive or negative.

Note that the production technology is constant across treatment conditions so far. Different technologies can have different (perceived) by-products of producing the unit of public good, however. It is clear that differences in attributes of the otherwise identical good may affect utility of contributors (Hanley et al. 1998). We make use of this by offering, in one treatment, another contribution technology which differs from production

[3]The possibility of field price censoring has been discussed at length in the article "To Give or Not to Give: The Price of Contributing and the Provision of Public Goods" (this dissertation).

[4]Note that v_i^g will, as a residual category, capture every source of utility that only depends on the size of personal giving. This is "warm glow" by definition but may also relate to other motivations that one would rather categorize into more complex moral reasoning (Brekke et al. 2003).

via EUAs particularly with respect to equity effects due to the geographic region in which the contribution would be produced (in a developing country instead of within the EU). One attribute of the technology made explicit to subjects was that production in a developing country would generate positive side benefits to the local population and environment.[5] In the model, we therefore assume for simplicity that the production technologies of G differ only with respect to their impact on equity. Without explicit functional specification, we may add a technology-dependent concern for equity, Q, to utility. (1) becomes

$$U_i = U_i \left(v_i^x x_i + v_i^G G + v_i^g g_i + \eta R(\boldsymbol{\gamma}_i, g_i, \mathbf{p}); Q(\mathbf{y}) \right) \tag{3}$$

where $R(\cdot)$ denotes the image term in (1). Thus, Q plays only a role for treatment effects when the technology changes.

3 Treatment Design

Inspired by the model above, the treatment design of the experiment (incompletely) varies three factors: (1) whether the choice of the emissions reduction actually has an impact on total emissions, (2) whether the choice is to some extent visible to others, and (3) whether the choice has different distributional impacts (Table 1). This gave six treatments in total. Treatments were administered to subjects in a two-stages counterfactual design in order to allow for both between-subjects and within-subjects comparison of behavior (Table 2).[6] One reason for adding a within-subject component in design was to exploit any coherence of treatment effects within subjects and to immunize treatment effects against any arbitrariness in valuation or constructed preferences that could manifest in between-subjects comparison (Ariely et al. 2003, Hanley et al. 2009).

At the beginning of the experiment[7] subjects were informed that they would par-

[5] Following up on footnote 2, one explicit attribute of the baseline EUAs compared to the alternative technology was that domestic production would contribute to emissions reductions in the region where subjects' personal negative contributions have occurred.

[6] Thus, the full sample of the Baseline treatment (excluding sceptics) analyzed in the two other papers on this experiment consists of the pooled first-stage choices of experimental groups 1, 3, and 5.

[7] The reader is referred to the two articles "To Give or Not to Give: The Price of Contributing and the Provision of Public Goods" (this dissertation) and "Willingness to Pay for Voluntary Climate Action

Table 1: Partial three-factor design of treatments

	Factor 1: Impact on total contributions	
Factor 2 (Factor 3):	Has impact	Has no impact
Private contribution (domestic)	Base/EUA	WG
Visible contribution (domestic)	Image	WGI
Private contribution (developing country)	CER	–

Notes: Base: Baseline treatment. WG: Warm Glow treatment. WGI: Warm-Glow-Image treatment.

Table 2: Two-stages counterfactual design of the experiment

Stage	Experimental group								Total
	1	2	3	4	5	6	7	8	
1	Base	WG	Base	Image	Base	WGI	EUA	CER	
2	WG	Base	Image	Base	WGI	Base	CER	EUA	
# of subjects:	779	778	784	796	792	798	788	797	6,312

Notes: Base: Baseline treatment. WG: Warm Glow treatment. WGI: Warm-Glow-Image treatment.

ticipate in two consecutive lotteries. Following the first prize choice and, if applicable, the FPC "filter" screen, subjects made a second choice based on another version on the *decision screen* that administered a treatment condition by containing a different description of how the public good would be provided, as described below. In two treatments (EUA and CER), also a second *information screen* was shown that differed in wording. If subjects opted for the cash prize in their second choice, a second FPC "filter" screen identical to that used in the first choice appeared. The following describes the particular design and wording on the *decision screen* and, partially, the *information screen* for each treatment condition.[8]

Baseline treatment. The Baseline treatment most closely corresponded to the situation known from laboratory public good experiments, but in a framed field experiment (Harrison and List 2004) with a real public good and non-student subjects. In particular, subjects' choices were completely private information and affected total contributions.

and Its Determinants: Field-Experimental Evidence" (this dissertation and Diederich and Goeschl 2013) for a full account of the experimental procedure.

[8]See the appendix for screenshots of these two experimental screen for each treatment (in German).

Instructions on the *decision screen* described that winners would be notified via email and that the deletion of the EUA, if they chose this prize, would be verifiable on a Heidelberg University[9] web page via a web link embedded in the notification email.

Warm Glow treatment. Differentiating "warm glow" from altruism and other motives is not a straightforward task. Most of the experimental designs in the laboratory exogenously vary the individual opportunity cost of contributions and the marginal value of the public good to separate between altruism and "warm glow" (Andreoni 1993, Palfrey and Prisbrey 1997, Goeree et al. 2002, Eckel et al. 2005). However, the marginal benefit of a real public good is fixed. We therefore used a variant of a design by Crumpler and Grossman (2008) which mimics a complete crowding out of contributions.[10] In their experiment, subjects were informed that the charity they select would receive \$10 from the experimenter. Subjects were then endowed with \$10 and asked to indicate how much of their endowment they would like to pass to the charity. Instructions stated that "The amount contributed by the proctor to your selected charity WILL be reduced by however much you pass to your selected charity. *Your selected charity will receive neither more nor less than \$10.*" Having made sure that subjects understood the procedure, the authors find a stable average contribution rate of around 20% among 150 subjects. We adapted this design by stating on the *decision screen* of the Warm Glow treatment:

> "In this lottery, a certain number of emission allowances will definitely be bought and deleted. The emission allowance offered to you today is part of these allowances. This means that regardless of your choice, the number of allowances to be deleted will not change. However, you have the opportunity to personally contribute to this emission reduction. You can do so by foregoing the cash prize and selecting the emission reduction instead."

One limitation of the design by Crumpler and Grossman (2008) is that it may allow for an experimenter demand effect or a desire to give to the experimenter. The fact

[9] This mentioning of our home institution was the only hint to the identity of the experimenters in the experiment and intended to increase credibility of the deletion confirmations to subjects. Confirmation certificates of the deletion were official transaction protocols by the German Emissions Trading Authority (DEHSt).

[10] Hence, this design corresponds to holding G constant in the model.

that the experimenters' identity was much less clear in our field setting mitigates this problem: First, there was no personal interaction. Second, it was much less clear whose financial burden would be reduced from contributing.

Image treatment. In order to boost visibility of a winners' contribution compared to the Baseline treatment, the decision screen described that the reduction-choosing winner would be personally contacted by a staff member via email to arrange the EUA deletion and to ask for the consent to publish the winners' name on a section of YouGov's website dedicated to this purpose. This procedure increased visibility of the subject's pro-social choice while cash choices remained private. The more personal interaction for deletion contrasts the anonymous aggregate deletion procedure announced in the Baseline treatment. In order to account for potentially higher demands for data privacy in an environment such as the Internet, subjects were informed that their names would be published only with first name, the first letter of the surname, and city.

When designing the Image treatment, we deliberately decided not to increase visibility by issuing personalized certificates (hard copy or electronic) that confirm the deletion (e.g Löschel et al. 2010). The reason is that such certification can generate additional private utility even if not shown to others. Thus, this option seemed unlikely to increase visibility without activating additional sources of utility. Instead, subjects in the Image treatment were informed, just like in the Baseline treatment, that the deletion would be verifiable on a Heidelberg University website. In implementing this, winners of the Image treatment were assigned a single EUA number in the notification email and could verify that "their" EUA number fell within a range of EUA numbers for which a single official deletion confirmation was provided on a Heidelberg University webpage.

Another feature in treatment design of the Image treatment comes out of the theoretical model. Since the size of the net image effect in eq. (2) is likely to depend on $\mathbf{p}$, we "wash out" these second order effects by concealing the price a winning contributor has faced. Therefore, instructions noted that the alternative cash prize of a winner would not be made public and that other participants may face different trade-offs.

Warm Glow Image treatment (WGI). This treatment exactly combined the instructions of the Warm Glow and the Image treatments. Thus, we added publicity to the barebone "warm glow" motivation to contribute in the Warm Glow treatment. The text of the *decision screen* made clear which informations would be published, thus subjects could conclude that the information on whether their EUA was pre-bought or not would not be disclosed.

EUA and CER treatments. These treatments were designed to facilitate a change in abatement technologies. Thus, the CER treatment offered a Certified Emissions Reduction (CER) based on the Clean Development Mechanism (CDM) of the Kyoto Protocol instead of an EUA. The CER was of the "Gold Standard" quality.[11] Instructions explicitly mentioned the differences between both technologies along two dimensions: (1) region of abatement and (2) region of investment. We expected both to give rise to specific equity concerns or moral considerations. While the former can trigger a polluter-pays motivation in favor of domestic abatement through an EUA, the latter can trigger distributional concerns due to the side-benefits of Gold Standard CERs which require the carbon offset project to benefit the local community and local environment in a developing country.[12] Both motivations can be found in anecdotal evidence.[13] For the experimental implementation, presentation of the two technologies required not only two different *decision screens* but also two different *information screens*. For the EUA treatment, both screens closely corresponded to the Baseline treatment, with minor differences (see the results below).

4 Results

Before turning to treatment effects, we compare (independent) behavior in the first lottery of subjects in the pooled Baseline groups 1, 3, and 5 with that of subjects in the EUA group 7. Since both treatments correspond to the same combination of factors

[11] http://www.cdmgoldstandard.org

[12] Thus, the difference between both technologies may be interpreted as a normative conflict between equality and equity (Konow 2003, Nikiforakis et al. 2012).

[13] For example, Carbon Retirement, a commercial UK based service for deleting EUAs, advertises with the feature of domestic abatement for moral reasons.

(Table 1), behavior should not differ. The result is, however, that contribution choices of the EUA treatment significantly exceed those in the Baseline treatment ($p = 0.01$ for a two-sided Mann-Whitney U test and student's t test), by about 3.8%. Thus, minor changes in framing of the screens had a remarkably significant impact: The *information* and *decision screens* of both theoretically identical treatments differed only slightly at three places in the text. First, in presenting the two options in headlines on the *information screen*, the option of "reduction of carbon (CO_2) emissions by 1 ton" added "within the European Union" in the EUA treatment. Second, within the text below, it stated that this would reduce "domestic emissions in Germany and other EU countries, to which your personal energy use contributes" instead of only saying that this would reduce "emissions in Germany and other EU countries" as in the Baseline treatment. Third, the *decision screen* in the baseline noted that the deletion of EU allowances would take place through a "joint order" for all winners choosing this option. The first two differences were intended to help contrasting the EUA treatment from the CER treatment, the third difference was intended to help contrasting the Warm Glow and Image treatments from the Baseline, which was not necessary in the EUA treatment. Since all three differences occurred simultaneously, we cannot further differentiate between the possible causes of this framing effect. The following will therefore present results for the EUA and CER treatments separately from those of the other treatments.

In the analysis, choices in the first lottery, which are completely independent from each other, can be directly compared between-subjects. To exploit both choices each subject made, analysis through panel regressions will account for between- and within subject effects. Table 3 reports results of Probit regressions of the choice of the emissions reduction comparing the Baseline treatment with the treatments Warm Glow, Image, and WGI. Columns (1) to (3) are Probit regressions reporting between-subjects differences of choices in the first lottery. Columns (4) to (6) account for the panel structure of the two-lottery counterfactual design and report results of random-effects Probit regressions. Columns (4) to (6) thus also take into account within-subject treatment effects as well as a "time" trend. Some specifications control for subjects' characteristics and for matched exogenous environmental conditions used in previous analyses. Table 4 restates

descriptions of these variables and provides summary statistics for the full experimental sample.

Coefficient estimates of treatment effects are positive throughout. However, estimates are mostly insignificant with the exception of the WGI treatment (marginal effect up to 3.5%) and, for one specification only, the Image treatment (marginal effect 2.8%).

The insignificant difference between Baseline and Warm Glow treatments would imply that altruism was a negligible motivational component in subjects' choices. However, evidence for a lack of understanding of the treatment design of the two "warm glow" treatments comes from a control question in which we asked subjects in treatment groups 1, 2, 5, and 6 for the number of lotteries ("both", "one", or "none of the lotteries") in which a winner's prize choice would influence the actual amount of emissions reductions. Overall, only 13.8% chose the correct answer ("one lottery").

A positive effect of visibility of the contribution, implied marginally by the results, is in line with the theoretical expectations and indicates that subjects expectation of being perceived as altruistic when observed in the act of contributing by others (the first term in eq. (2)) seems to dominate.

In light of the results of the Warm Glow and Image treatments, the comparably large positive effect of the WGI treatment appears counterintuitive, however. This is even more so as the "warm glow" component of the treatment has apparently not been well understood as the control question mentioned above indicates. Again, framing effects could be the reason for this otherwise inconclusive effect: In exactly combining the wording of the two other treatments, the WGI treatment contained the largest amount of text of all treatments. Potentially, an apparently more detailed description, compared to the Baseline, may have increased subjects' trust in the procedure, or made the option more interesting from an hedonic point of view.

In contrast to the weak evidence on treatments, the results show a highly significant effect of repetition. Estimated at the margin, subjects are up to 57.8% more likely to choose the emissions reduction in the second lottery.

Estimates of other covariate effects confirm previous analyses of the Baseline subsample but also add additional evidence based on the increased statistical power of the full

Table 3: Probit coefficient estimates comparing Baseline, Warm Glow, Image, and WGI treatments. Dependent variable: choice of emission reduction.

	Between-subjects			Between- and within-subjects		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment:						
Warm Glow	0.065	0.055	0.057	0.027	0.106	0.125
	(0.061)	(0.069)	(0.070)	(0.088)	(0.103)	(0.106)
Image	0.069	0.112*	0.101	0.074	0.051	0.081
	(0.060)	(0.067)	(0.068)	(0.087)	(0.102)	(0.105)
WGI	0.132**	0.124*	0.118*	0.157*	0.118	0.146
	(0.059)	(0.067)	(0.068)	(0.085)	(0.100)	(0.103)
Lottery 2	–	–	–	0.578***	0.445***	0.451***
				(0.055)	(0.065)	(0.067)
Cash prize	–	-0.004***	-0.004***	–	-0.020***	-0.021***
		(0.001)	(0.001)		(0.001)	(0.002)
Female	–	0.084*	0.081	–	0.311**	0.298**
		(0.050)	(0.051)		(0.127)	(0.130)
Age	–	0.003*	0.003*	–	0.004	0.005
		(0.002)	(0.002)		(0.004)	(0.005)
Education	–	0.051***	0.052***	–	0.139***	0.143***
		(0.007)	(0.008)		(0.021)	(0.021)
Income	–	-0.011	-0.013	–	-0.034	-0.038
		(0.015)	(0.015)		(0.038)	(0.039)
Ambient temperature	–	–	0.009	–	–	0.034**
			(0.006)			(0.017)
Media coverage	–	–	-0.001	–	–	0.001
			(0.001)			(0.002)
Constant	-0.985***	-1.595***	-1.661***	-4.190***	-5.179***	-5.974***
	(0.031)	(0.138)	(0.236)	(0.117)	(0.367)	(0.625)
N	4727	3866	3763	9454	7732	7526
Log-likelihood	-2179.660	-1737.092	-1691.138	-3866.061	-3053.855	-2963.011
χ^2	5.389	75.290	81.157	114.634	290.534	283.337
D.f.	3	8	10	4	9	11
Pseudo R^2	0.001	0.021	0.023			
AIC	4367.319	3492.184	3404.276	7744.122	6129.711	5952.022
BIC	4393.164	3548.524	3472.838	7787.047	6206.195	6042.062

Notes: Columns (1)-(3) are Probit coefficient estimates of the choice of emission reduction in the first lottery. Columns (4)-(6) are random-effects Probit estimates of choices in the full panel, reported as marginal effects at the sample means. Standard errors are shown in parentheses. Stars indicate significance levels (* 10%, ** 5%, *** 1%).

Table 4: Summary statistics of subjects' characteristics ($N = 6,312$)

Variable	Description	Mean	SD	Min	Max
Sociodemographic characteristics					
Female	1 if female	0.475	0.499	0	1
Age	Subject's age (years)	45.73	14.57	18	91
Years of education	Years based on subject's stated highest educational degree	12.26	3.222	9	22
Income	Midpoint[a] of subject's reported monthly household net income category (Euros)	2,508	1,681	450	8,000
Environmental controls					
Ambient temperature	Mean ambient outdoor temperature in subject's region of residence[b] (°C)	15.08	4.089	8.05	25.8
Media attention	Number of hits for a climate change related keyword search[c] in German print and online media[b]	135.7	29.34	69.5	160

Notes: [a] In our income approximation, for the 'less than €500' category, we assume €450. For the two categories above €5,000, we assume €8,000 for compatibility with German census data. The remaining categories have widths of €500. [b] The variable is the moving 2-day average of the daily values of the day at which the subject took the experiment and the day before [c] Keywords used: '*climate change*', '*climate protection*', '*global warming*', '*carbon dioxide*', 'CO_2'. Database: LexisNexis [d] Answer categories 1=disagree, 2=tend to disagree, 3=tend to agree, 4=agree [e] Median is 10 [f] Median is 50

sample. Results for the effects of price, education, and income corroborate the estimates in our article "To Give or Not to Give: The Price of Contributing and the Provision of Public Goods" (this dissertation) in sign, size, and significance. In addition, the higher statistical power of the full sample reveals some evidence for positive correlations of being female and older with the choice of the contribution (marginal effect up to 31% for being female and up to 0.1% per year for age). This finding is in accordance with some previous works, while others have found insignificant effects.[14]

In exploiting the statistical power of the full sample, there is also evidence in support of the effects of matched environmental controls analyzed in our article "Willingness to Pay for Voluntary Climate Action and Its Determinants: Field-Experimental Evidence" (this dissertation and Diederich and Goeschl 2013): Higher ambient outdoor temperatures in a subject's region of residence around the time the subject took part in the experiment caused a higher probability of choosing the emissions reduction. The effect is significant in the panel regression only, however (marginal effect 3%).

Finally, Table 5 reports the same model specifications in comparing EUA and CER treatments. Estimates of the treatment effect are ambiguous with some weak within-

[14] See the original article for references.

Table 5: Probit coefficient estimates comparing EUA and CER treatment. Baseline: EUA treatment. Dependent variable: choice of emission reduction.

	Between-subjects			Between- and within-subjects		
	(1)	(2)	(3)	(4)	(5)	(6)
CER treatment	-0.022	-0.057	-0.050	0.124*	0.070	0.085
	(0.072)	(0.082)	(0.083)	(0.075)	(0.085)	(0.087)
Lottery 2	–	–	–	0.615***	0.563***	0.550***
				(0.080)	(0.091)	(0.092)
Cash prize	–	-0.001	-0.001	–	-0.012***	-0.011***
		(0.001)	(0.001)		(0.002)	(0.002)
Female	–	0.020	0.010	–	0.056	0.056
		(0.087)	(0.088)		(0.166)	(0.169)
Age	–	0.008**	0.007**	–	0.011*	0.010
		(0.003)	(0.003)		(0.006)	(0.006)
Education	–	0.045***	0.045***	–	0.092***	0.090***
		(0.013)	(0.013)		(0.026)	(0.026)
Income	–	0.031	0.032	–	0.077	0.074
		(0.025)	(0.026)		(0.050)	(0.051)
Ambient temperature	–	–	0.002	–	–	-0.018
			(0.011)			(0.022)
Media coverage	–	–	-0.000	–	–	-0.003
			(0.002)			(0.003)
Constant	-0.840***	-1.777***	-1.730***	-2.675***	-3.864***	-3.092***
	(0.051)	(0.245)	(0.416)	(0.190)	(0.518)	(0.821)
N	1585.000	1256.000	1230.000	3170.000	2512.000	2460.000
Log-likelihood	-787.516	-605.400	-596.333	-1492.148	-1171.425	-1146.591
χ^2	0.091	25.989	24.333	62.349	90.271	84.913
D.f.	1.000	6.000	8.000	2.000	7.000	9.000
Pseudo R^2	0.000	0.021	0.020			
AIC	1579.031	1224.800	1210.666	2992.296	2360.851	2315.182
BIC	1589.768	1260.749	1256.699	3016.542	2413.310	2379.069

Notes: Columns (1)-(3) are Probit coefficient estimates of the choice of emission reduction in the first lottery. Columns (4)-(6) are random-effects Probit estimates of choices in the full panel, reported as marginal effects at the sample means. Standard errors are shown in parentheses. Stars indicate significance levels (* 10%, ** 5%, *** 1%).

subject evidence for a preferring the CER through an offset project in a developing country (marginal effect 12%). Other estimates are qualitatively similar but statistically weaker than in Table 3 due to smaller size of the subsample.

5 Conclusion

Following up on previous analyses, this paper presented additional results of treatments targeted at contribution motives known from the literature such as "warm glow", image motivation, and equity concerns based on a framed field experiment on giving to

a real and global public good: climate change mitigation. Results regarding the disentanglement of these motives are ambiguous: On the one hand we find an insignificant presence of altruism compared to a "warm glow" of giving and a slightly positive image motivation, which is in line with theoretical predictions.[15] On the other hand, these results do not align with our finding of a relatively strong positive effect when simply combining these two treatments, i.e., removing altruism and adding image motivation in a combined treatment. Also, the two altruism-removing "warm glow" treatments were apparently not well understood by subjects. Besides, there is evidence for framing effects such that slight changes in wording had significant impacts. Other than treatment effects, a strong result is that subjects are much more inclined to choose the emissions reduction if presented with a second chance. Regarding covariate effects, results of the previous analyses are confirmed. In addition, the higher statistical power of the present sample allows us to find evidence for a positive effect of age and being female on the likelihood of contribution the emissions reduction.

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[15] While our own model does not predict signs, the model by Ribar and Wilhelm (2002), for example, predicts a dominance of "warm glow" and zero impact of altruism in very large groups.

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Appendix

Information and *decision screens*

This section contains screenshots of the actual screens used in the experiment (in German). Translations of the screens belonging to the Baseline treatment can be found in the appendix to the article "To Give or Not to Give: The Price of Contributing and the Provision of Public Goods" (this dissertation). Translations of the other treatments can be mostly found in the text above.

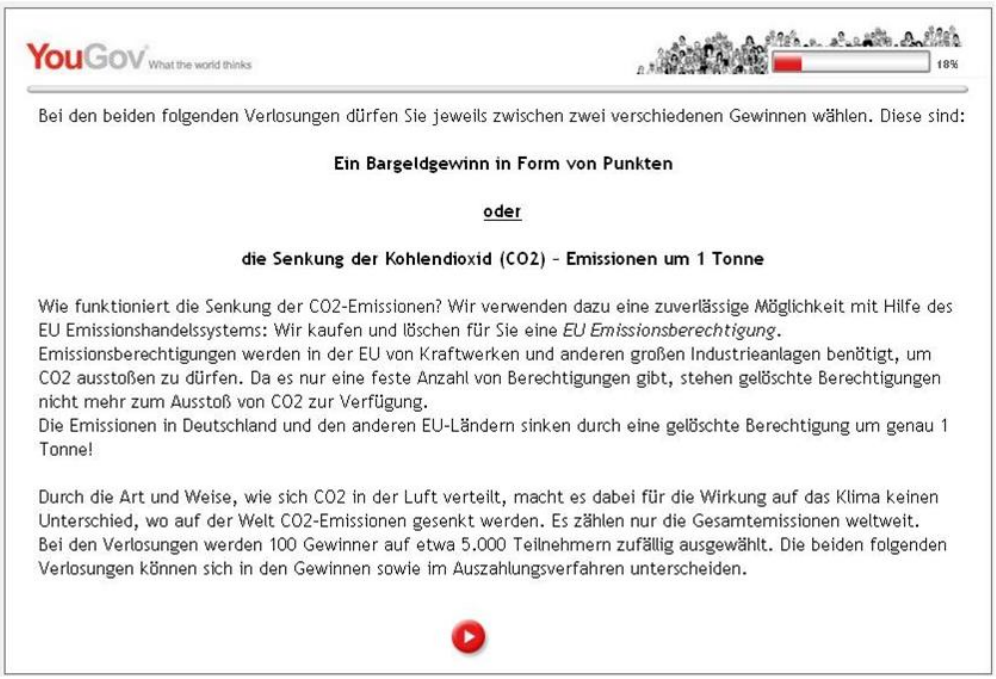

Figure 1: *Information screen* of the Baseline, Warm Glow, Image, and WGI treatments

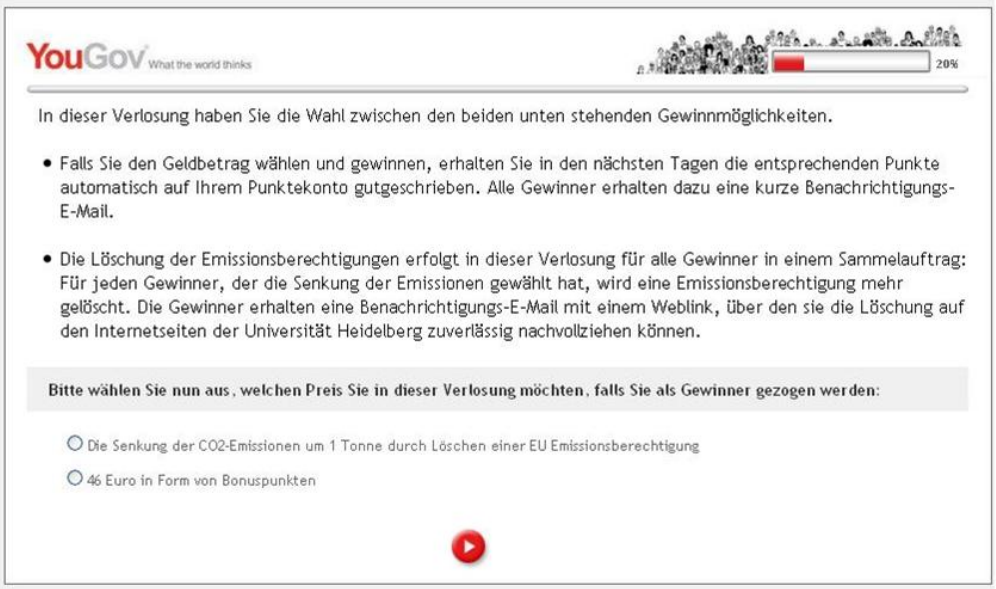

Figure 2: *Decision screen*, Baseline treatment

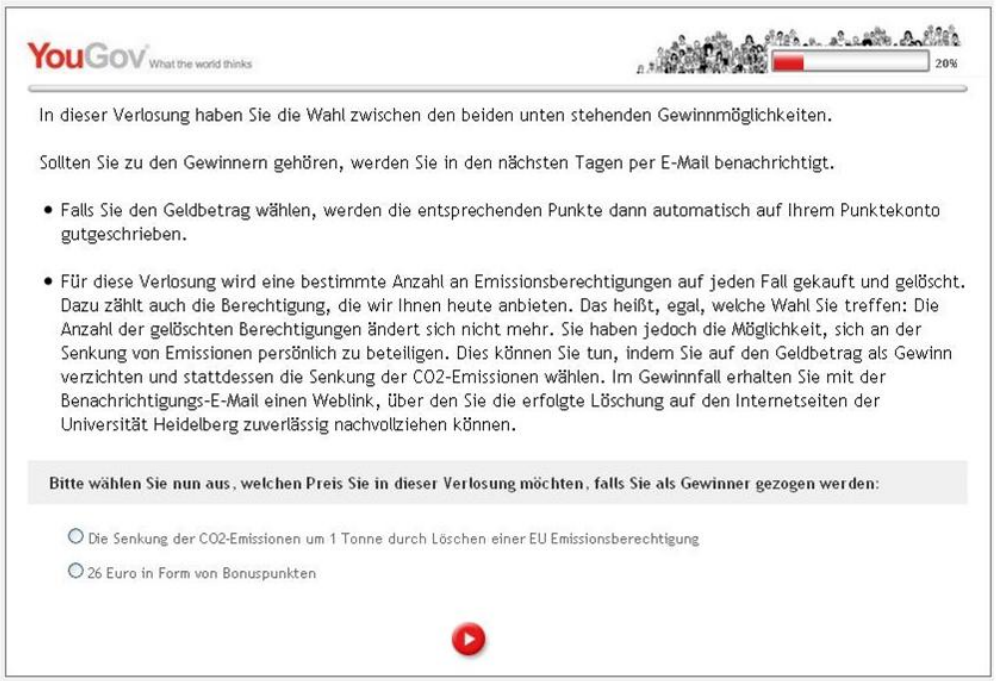

Figure 3: *Decision screen*, Warm Glow treatment

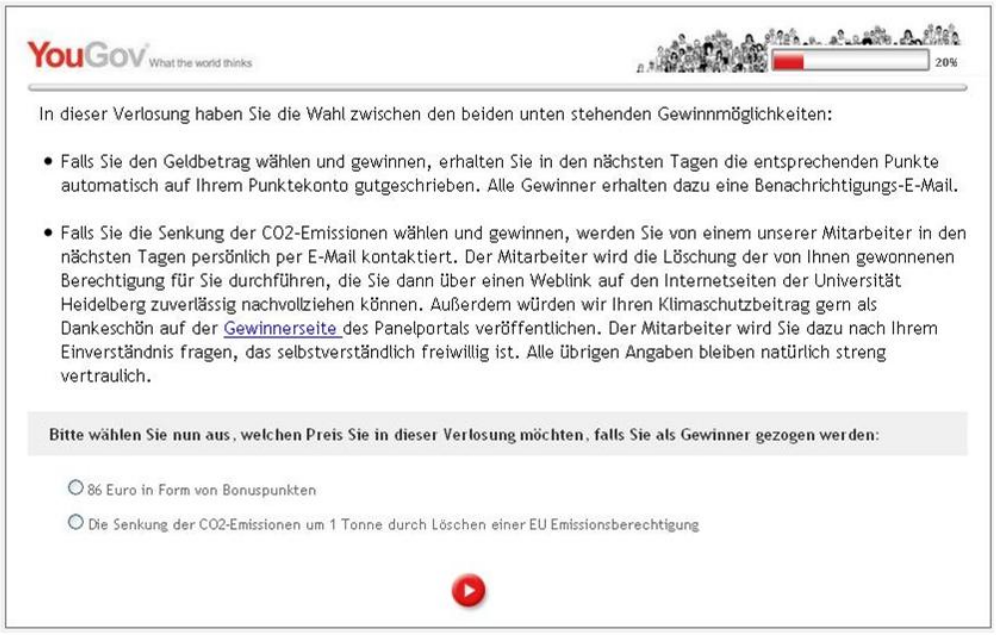

Figure 4: *Decision screen*, Image treatment

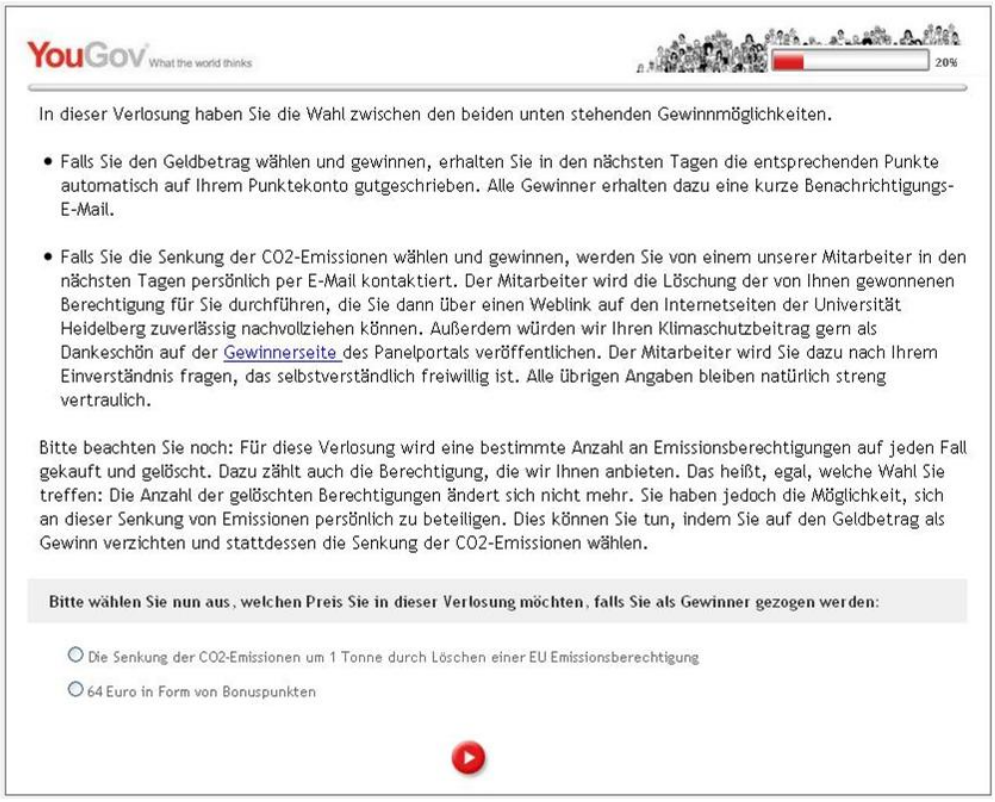

Figure 5: *Decision screen*, WGI treatment

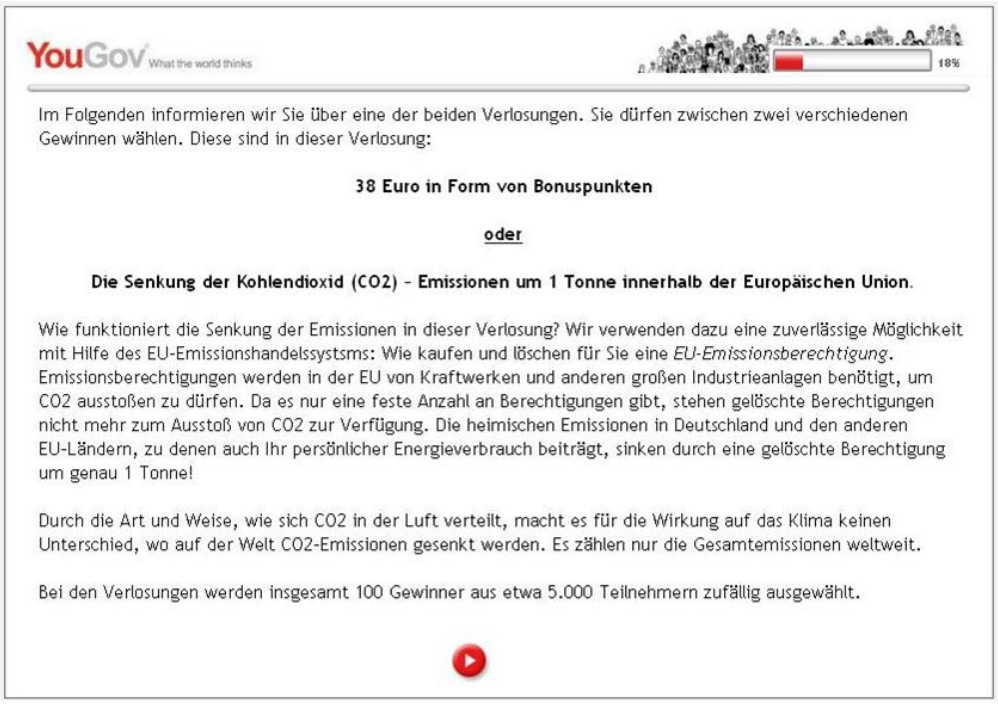

Figure 6: *Information screen* of the EUA treatment

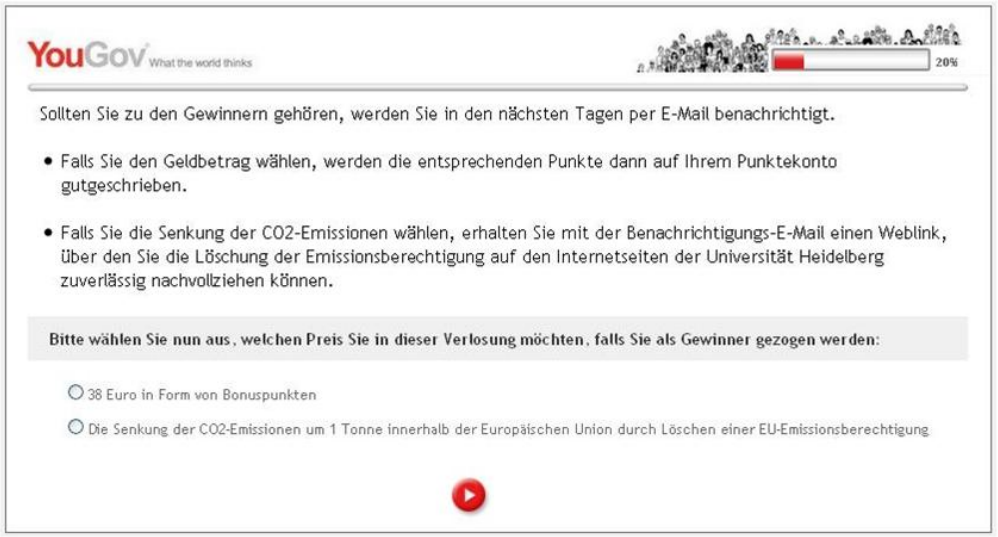

Figure 7: *Decision screen*, EUA treatment

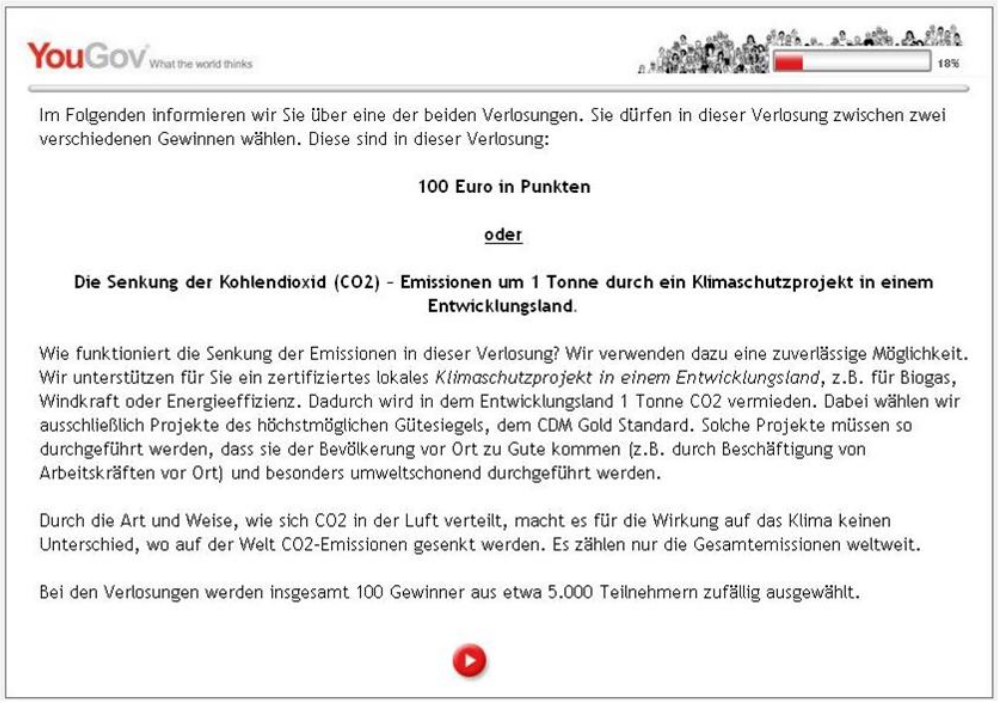

Figure 8: *Information screen* of the CER treatment

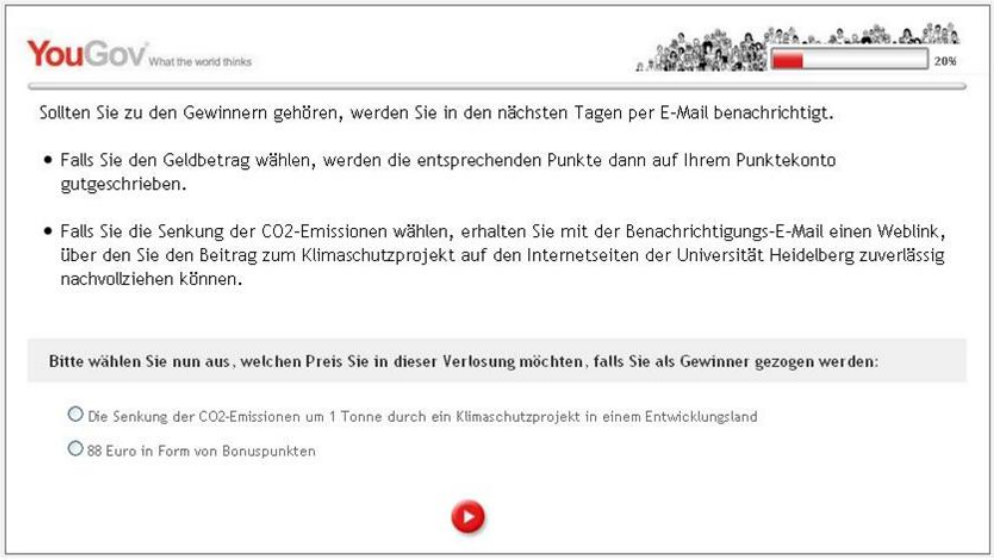

Figure 9: *Decision screen*, CER treatment