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Do Artistic Images Affect the Willingness to Buy Carbon Offsets? An Empirical Study

Robert W. Turner
Colgate University, rturner@colgate.edu

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The artwork shown in the exhibit *Sensing Change* is part of a thriving environmental art movement. There is a long history of art influencing environmental attitudes and to some extent behavior. Historically such art has used what photography critic Vicki Goldberg calls the "pastoral eulogy" approach but there is also a more recent approach that she calls a "dryly sophisticated, relatively unimpassioned, critical stance" that emphasizes the environmental damage and risk associated with human behavior (Goldberg 1991, p. 107). Sanders (1992) gives examples of art that illustrate environmental problems and educate about natural systems as well as examples of direct activist art. Environmental art, ecological art, and Eco-art are terms, each with varying and malleable definitions, used to categorize art such as that in the *Sensing Change* exhibition. Ecological artist Ruth Wallen (www.ruthwallen.net, accessed April 10, 2014) says, "Ecological art can engender appreciation, address core values, offer remediation, build relationships, advocate political action, and broaden intellectual understanding." But there is little evidence about whether people change their behavior in response to this sort of art. This chapter reports on a contingent choice survey (a kind of choice experiment) used to investigate whether exposure to particular artwork influences a particular kind of environmental behavior: the purchase of carbon offsets. Purchasing offsets finances various kinds of mitigation efforts that reduce net greenhouse gas emissions.

Curtis (2011) points out that, while there is a substantial literature in sociology suggesting that art might affect attitudes and behavior, the impact of art on environmental behavior is not usually considered. Similarly, the environmental psychology literature (see for example Steg, van den Berg, and de Groot 2013) has well developed theories and evidence about the determinants of environmental behavior, but the arts are not included. Curtis (2009) develops a theoretical model to remedy this situation; in his model, art can affect environmental behavior by creating an emotional affinity with nature, developing a cognitive interest in nature, and/or provoking emotional indignation about environmental harm. The explanations offered by Steg, van den Berg and de Groot (2013) are slightly different: they include theories of environmental behavior based on affect, reasoned choice, and social norms, although they do not explicitly discuss art.

There is almost no direct evidence of effects of art on environmental behavior. Leiserowitz (2004) and Lowe *et al* (2005) investigate whether viewing the movie *The Day After Tomorrow* influenced survey respondents' perceptions of climate change and therefore their

motivations for changing behavior. Sheppard (2005) has an extensive discussion about the potential impact of visualization and imagery on climate change perceptions, but there is little discussion of the impact on behavior and virtually no discussion of artistic imagery. Similarly, Leiserowitz (2006) uses survey results to explore the connections between imagery and both risk perception and policy support, but not on direct behavior. There is of course a long and rich history of landscape painting and landscape photography, with justifiable claims about the impact on environmental awareness. For example, in the context of American national parks the works of the Hudson River School, especially Albert Bierstadt and Thomas Moran, Ansel Adams, and others are acknowledged to have had important influence on support for national parks in the U.S. Curtis (2009) provides several examples of art works inspiring land conservation efforts in Australia and Curtis (2011) presents several case studies from Australia examining the role of the arts in changing environmental behavior. But there is no survey-based research connecting exposure to art works with changes in environmental behavior.

Contingent choice surveys are often used to analyze respondents' environmental behavior and/or the underlying preferences for environmental goods and resources driving that behavior (Hoyos 2010). In these surveys, respondents choose among a selection of hypothetical or real scenarios comprised of varying levels of different variables. Based on the choices they make, the relative importance of each of the different variables is estimated. In the survey upon which this chapter is based, respondents chose from alternative carbon offset purchase options, including the option to buy no offsets. The central questions are as follows: what would make respondents more or less likely to choose to buy no offsets, and did respondents who saw artwork as part of the survey differ systematically from those who didn't? The analysis also investigates whether the images affect the ways in which the willingness to buy carbon offsets is influenced by other factors. These other factors include the types of mitigation efforts being funded by offsets and also personal characteristics of the respondents such as age, income, and adherence to social norms.

Subsets of respondents in a choice experiment investigating willingness to buy carbon offsets were shown different artistic images related to climate change. One subset was shown photographs from the *A History of the Future* collection of The Canary Project (Susannah Sayler and Edward Morris): photographs "where scientists are studying the present impacts of climate change, vulnerability to future impacts and/or attempts to mitigate and adapt" (http://canary-project.org/2010/07/a-history-of-the-future/, accessed on April 12, 2014).[1] Another subset was shown historical images from the Wind Map: Poetry in Motion project (Fernanda Viégas and Martin Wattenberg); part of the *Sensing Change* exhibit, this project is a continually updated digital map showing wind speeds and patterns across the U.S. A control group was not shown any artistic images. This kind of split-sample survey is frequently used to investigate survey design issues of various kinds, including the amount of information presented to respondents

[1] These photographs were not part of the *Sensing Change* exhibition, though Edward Morris participated in the conference that resulted in this collected papers volume.

(Schlapfer and Schmitt 2007; Schlapfer, Schmitt, and Roschewitz 2008; Tonsor and Shupp 2011; Tonsor, Schroeder, and Lusk 2013). The current study is similar since it investigates whether including artistic images in the survey affects responses.

After some initial questions about their own consumption behavior, all respondents were given basic information about greenhouses gases and climate change, as shown in Figure 1. [Figure 1 about here.] The information stressed aspects that, for the treatment groups, would be illustrated by artistic images. But no respondent knew that the focus of the study was on the effects of those images, nor did any respondent know that some but not all of the subjects were shown images. Immediately following the basic information, the first treatment group was shown three Canary Project photographs: one showing a truck upended by Hurricane Katrina and labeled "Extreme Weather Events," one showing a forest fire in Washington State and labeled "Drought and Fires," and one showing a waterfront in Venice and labeled "Rising Sea Levels."[2] The second treatment group was shown three animated images from the Wind Map Project: one showing Superstorm Sandy, one showing Hurricane Isaac, and one showing Tropical Storm Debby.[3] The survey then continued for all respondents with information about carbon offsets in general and with explanations of the choice task and the various attributes. A "cheap talk" script (Cummings and Taylor 1999) preceded the actual choice tasks.

The experimental design was identical to that used in Blasch and Farsi (2013), to which readers are referred for details. Blasch and Farsi used the software program Ngene to create a D-efficient design of 48 choice sets divided into six blocks; each respondent was shown one of these blocks of eight choice sets. Each choice set comprised three alternative scenarios representing purchases of offsets with varying attributes plus a *status quo* (no-buy) option. Figure 2 shows a representative choice set. [Figure 2 about here.] As in Blasch and Farsi (2013), after each choice task, respondents were asked how sure they were that they would make the same choices in actual purchase situations,[4] and unless a respondent said she or he was rather sure, quite sure, or very sure (the top three choices on a six-point Likert scale) that an offset would be purchased, the choice was treated as if no offset were purchased. Thus the probability of buying an offset is probably underestimated. This approach is similar to that suggested by Ready, Whitehead, and Blomquist (1995); other approaches are possible as well (Martinez-Espineira 2012).

Brookmark Research Services administered the internet survey to a nationwide sample. In all, 2200 subjects, divided equally among the three subsamples (a control group plus the

[2] These labels correspond to those used by the Canary Project. The images can be seen at http://www.history-of-the-future.com/.

[3] On the website for the Wind Map project (http://hint.fm/wind/gallery/), historical images are labeled with both the relevant dates and, for dates on which major events occurred, the names of the events. The animations shown to respondents, however, showed only the relevant dates.

[4] All scenarios in the present study represent hypothetical situations: respondents were not asked to actually purchase offsets. Blasch and Farsi (2013) find, however, a high congruency between stated preference responses and actual purchase behavior by the respondents to their survey.

Canary Project and Wind Map Project groups), responded to the survey. Approximately 25% of each group always chose the *status quo*, no-buy option.[5] These may represent "pure" preferences for the *status quo* (that is, a reluctance to purchase offsets) or they may represent *status quo* bias (Samuelson and Zeckhauser 1988): a tendency for people in choice situations to stick with the *status quo*, no matter what it is. In any case, the artistic images clearly had no effect on these respondents so they are removed from the statistical analysis; this segment of the population is considered, however, when the statistical results are interpreted. Of the remaining respondents, a few gave incomplete responses; the final sample included over 500 respondents for each subsample. Descriptive statistics for individual characteristics used in the analysis, overall and for the three subsamples, are shown in Table 1.[6] [Table 1 about here.]

About 40% of subjects in each group said (in response to a question asked before any information about climate change was provided) that they were knowledgeable about climate change issues. Age and income are measured in intervals; because the main interest here is in comparisons across subsamples, Table 1 simply reports data for the interval codes.[7] The other three variables shown correspond to variables created by Blasch and Farsi (2013). They created a scale, based on the answers to two survey questions regarding respondents' beliefs about their family and friends, for adherence to social norms; a scale, based on the answers to three survey questions about respondents' beliefs about the importance of individuals taking actions in response to climate change, for ascribed responsibility; and a survey question about respondents' expectations about the percentage of the nationwide population who purchase offsets, which Blasch and Farsi call an index of expected cooperation. The same scales were created from respondents to the current survey. Even though respondents were assigned arbitrarily to the control and treatment groups, there are some differences across subsamples. Ages were quite similar, but the control group had somewhat higher incomes and the Canary Project group had somewhat lower incomes than the Wind Map Project group. Expectations about others' offset purchases were similar across groups, but the control group was less likely to believe individuals are responsible for taking actions in response to climate change while the Canary Project group was more likely to believe in individual responsibility and more likely to believe that social norms support offset purchases; the Wind Map Project group was the least likely to believe that social norms support offset purchases.

For each subsample, a conditional logit model was estimated using the software program NLOGIT®, relating the various attributes of the hypothetical offset purchases to the likelihood of choosing each option, including choosing the *status quo*, no-buy option. As is common in these sorts of models, the specification included an alternative-specific constant (ASC) for the

[5] The corresponding percentage in Blasch and Farsi (2013) is 15%.
[6] The sample sizes shown in Table 1 reflect the samples used in the model that incorporate individual characteristics. Sample sizes for the conditional logit models shown below, which do not include individual characteristics, are slightly larger since observations were not lost to missing data for any of those characteristics. The control group had 501 respondents, the Canary Project group had 528, and the Wind Map Project group had 531.
[7] The median age interval is 26 – 35; the median income interval is $4501 – 6000 per month.

status quo alternative. This coefficient is often used as a measure of *status quo* bias (Meyerhoff and Liebe 2009): a tendency to stick with the current situation, whatever it is. In the context of this survey, however, the *status quo* represents the decision not to purchase an offset, so the ASC and how it differs across subsamples is the prime coefficient of interest. Since the main interest is in the effects on the decision to buy offsets, i.e. not choose the no-buy option, the ASC is reported with reverse coding so that it represents the tendency to purchase offsets, holding constant the various offset attributes.

Conditional logit (and related) models are based on a theory called the random utility model: the happiness (or, in economics jargon, utility) that respondents get from a decision relates systematically to a set of variables but also depends on random (that is, unobserved by the analyst) factors; respondents are assumed to choose whatever option gives them the highest utility. Estimated coefficients, including the ASC, relate directly to utility but only indirectly to the observable variable of interest: the decision to buy an offset. So coefficients need to be manipulated in order for their magnitudes to be meaningful. Their signs and statistical significance do have meaning, though: if a particular coefficient is not statistically significantly different than zero, then the corresponding variable has no apparent effect on the utility a respondent would get from an offset purchase; if the coefficient is positive (negative) and statistically significant, then the corresponding variable increases (decreases) the utility derived from an offset purchase. Coefficients can be transformed into probability effects: in the current context, the effects (holding other variables constant) of increases in the corresponding variables on the probability of purchasing offsets. These are called partial effects and differ for every observation, depending on the values of all variables and coefficients. Following custom, Table 2 reports, along with the model's coefficients and their statistical significance, the average of the partial effects for the ASC as well as. [Table 2 about here.] The total amount, measured in metric tons (tonnes), of carbon dioxide emissions being offset is statistically insignificant, but as expected the cost of purchasing offsets is inversely related in most contexts to the net utility gained from the purchase.[8] The location of the offset project and its type (i.e. the activity reducing net greenhouse gas emissions that is funded by the offset purchase) have little influence on the tendency to buy offsets. But respondents are more willing to buy offsets from nonprofit (rather than for-profit) providers and are less willing to buy offsets if they are certified by the United Nations (the omitted category for this set of dummy variables) rather than by the Environmental Protection Agency or non-governmental organizations (NGOs). For the base case, the ASC is statistically insignificant, indicating that respondents have neither a tendency to purchase nor a tendency not to purchase offsets.

[8] The utility gained from the offset is held constant statistically by the other variables, so the coefficient on the cost variable measures the independent effect on utility of the offset costing more. The cost variable is specific to each context since the amount of carbon emissions being offset is different and so the cost per tonne might have different effects for contexts in which the total cost is higher. In the model shown, the cost variable is the total cost of the offset purchase (cost per tonne times the amount offset).

More interesting than the results shown in Table 2 are the comparisons of the ASC between the control group and the two treatment groups. The estimated coefficients and the partial effects are shown in Table 3. [Table 3 about here.] The first column replicates the results from Table 2, showing a statistically insignificant coefficient for the control group. For the treatment group that was shown the Canary Project photographs, however, the ASC is weakly statistically significantly different than zero and the average partial effect is positive. So this group is more likely to purchase offsets than is the control group. The treatment group that was shown the Wind Map Project images, however, has a statistically significant and negative ASC. These results indicate that observing the Canary Project photographs makes respondents more willing to buy offsets, but observing the Wind Map Project images makes respondents less willing to buy offsets. The magnitude of the effect of seeing the Canary Project photographs is to increase the probability of buying offsets by over four percentage points. To judge whether this effect is large or small, imagine that this effect holds for all of the adult population of the U.S. except for around 25% who will not buy offsets no matter what. There are around 240 million adults, so if 75% of them are subject to an increase in the probability of buying offsets by four percentage points, somewhat more than seven million more people would buy offsets if they saw the Canary Project photographs: a sizeable effect.

These results ignore any differences across the three subsamples other than the treatment effects. It's plausible, however, that individual characteristics might affect preferences and that they might be driving the results shown in Table 3, especially given the differences across groups shown in Table 1. Also, the effect of artistic images might well differ depending on how knowledgeable a respondent is about climate change issues. Table 4 shows separate comparisons across treatment groups of partial effects for respondents who said they were knowledgeable and those who didn't. The first column replicates the results shown in Table 3 and indicates that seeing the Canary Project photographs makes respondents more willing to buy offsets and that seeing the Wind Map Project images makes them less willing. The other columns show that the same pattern holds true for respondents who said they were knowledgeable about climate change issues and also for those that said they were not.

Other individual characteristics might affect preferences as well. Blasch and Farsi (2013) find that younger respondents are more likely to purchase offsets and that respondents' beliefs about social norms and expectations play an important role as well. The scales of social norms and ascribed responsibility and the index of expected cooperation, all described earlier, were used along with age and income in a latent class analysis. The underlying assumption of latent class analysis (McCutcheon 1987, Boxall and Adamowicz 2002) is that the population is divided into discrete groups, or classes, unobserved by the analyst (hence the terminology latent). Within each group preferences are homogeneous, but preferences differ across groups. The statistical analysis simultaneously estimates the probability that a respondent belongs to each latent class and, for each class, the parameters determining which option in each choice set a respondent will choose, conditional on belonging to each class. The probabilities of belonging to each class can

be constant across individuals or, as is the case here, they can depend on individual characteristics. The number of latent classes must be specified exogenously, but the analysis can be done for different numbers of classes and then any of several information criteria can be used to choose the specification that best explains the data.[9]

The results shown in Table 5 indicate that there is a great deal of heterogeneity in preferences for buying carbon offsets, but the overall pattern remains that respondents who saw Canary Project photographs were more willing to buy offsets than the control group. For knowledgeable respondents the Wind Map Project images had little effect on the willingness to buy offsets while for others the Wind Map Project images made them less willing to buy offsets. In results not shown, the heterogeneity was driven more by the social norms and expectations variables that Blasch and Farsi (2013) emphasize than by age or income. The latent class results indicate that the difference across treatment groups shown in earlier tables was not driven by differences in individual characteristics.

The results of this split-sample contingent choice survey indicate that respondents who were shown photographs by the Canary Project that illustrate the impacts of climate change were more likely to purchase carbon offsets than were respondents in a control group. This is even though the respondents saw these images only briefly: typically for less than a minute. Not all artistic images have this effect, though: respondents who saw animated images from the Wind Map Project that illustrate wind speeds and patterns for extreme weather events were usually less willing to buy offsets than the control group. Results indicate that preferences about buying carbon offsets are very heterogeneous, but the pattern remains that the treatment group that saw the Canary Project photos are more likely to buy offsets and the treatment group that saw the Wind Map Project images are usually less likely to buy offsets.

The sociological and psychological theories mentioned earlier suggest possible reasons for the Canary Project photos to have a different effect than the Wind Map Project images, though the provide no explanation for why the Wind Map Project images might make respondents less likely to buy offsets. The Canary Project photographs used in the survey were all fairly dramatic depictions of deleterious effects of climate change. They therefore fit into Curtis's (2009) "emotional indignation" category of factors that may influence behavior. They may also help respondents to understand the consequences of greenhouse gas emissions, though they don't provide any explanation for why emissions would have these effects. So they might also fit into Curtis's "cognitive interest" category; it is much less likely that they fit into the "emotional affinity" category. Of the theories surveyed by Steg, van den Berg, and de Groot (2013), the Canary Project photographs connect best with the theories that stress affect, though

[9] For the results shown in Table 5, the model was estimated assuming two, three, and four latent classes in each case. In some cases the model failed to converge or led to extremely large standard errors of some coefficients, a sign that there were too many latent classes (Greene 2012, p. N-435). For the remaining specifications, the Akaike Information Criterion was used to choose the number of classes.

it's possible that theories based on reasoned choice and social norms are also relevant. In contrast, if the Wind Map Project images have an impact they are more likely to work through cognitive interest and reasoned choice, though emotional affinity and affect may also be relevant if respondents' main reactions to the images is of the beauty of their representation of nature. There is no doubt that respondents have to think more in order to figure out how the Wind Map Project images relate to the danger of climate change. So the different impacts of the Canary Project and Wind Map Project images may be due to the different avenues via which they are likely to affect behavior.

This hypothesis, as well as other aspects of the relationship between art and environmental behavior, could be investigated with additional survey-based research, whether based on choice experiments or on simpler surveys about past or planned future behavior. All of the images used in this study are quite explicitly about climate change and all can be viewed as warnings about the impacts of climate change whereas much art work that historically has been said to influence environmental attitudes or behavior has been more in Goldberg's (1991) pastoral eulogy category. Contrasting the effects of exposure to these different kinds of art would help identify whether emotional affinity or emotional indignation had a larger effect on behavior. It would also be interesting to explore the effects of different kinds of art works, including not just visual images but other formats. Other interesting extensions would be to investigate whether abstract art has similar effects to more documentary art and whether prolonged or repeated exposure leads to greater behavioral change.

The *Sensing Change* exhibit and accompanying conference explored the connection between art and scientific communication. This study reported on in this chapter investigated whether that combination of art and communication leads to behavioral change. Results suggest that exposure to artistic images does affect behavior, but different images have different effects. A likely cause of these differences is that different images engage different causal pathways that lead to behavioral change.

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Figure 1
Climate Change Information

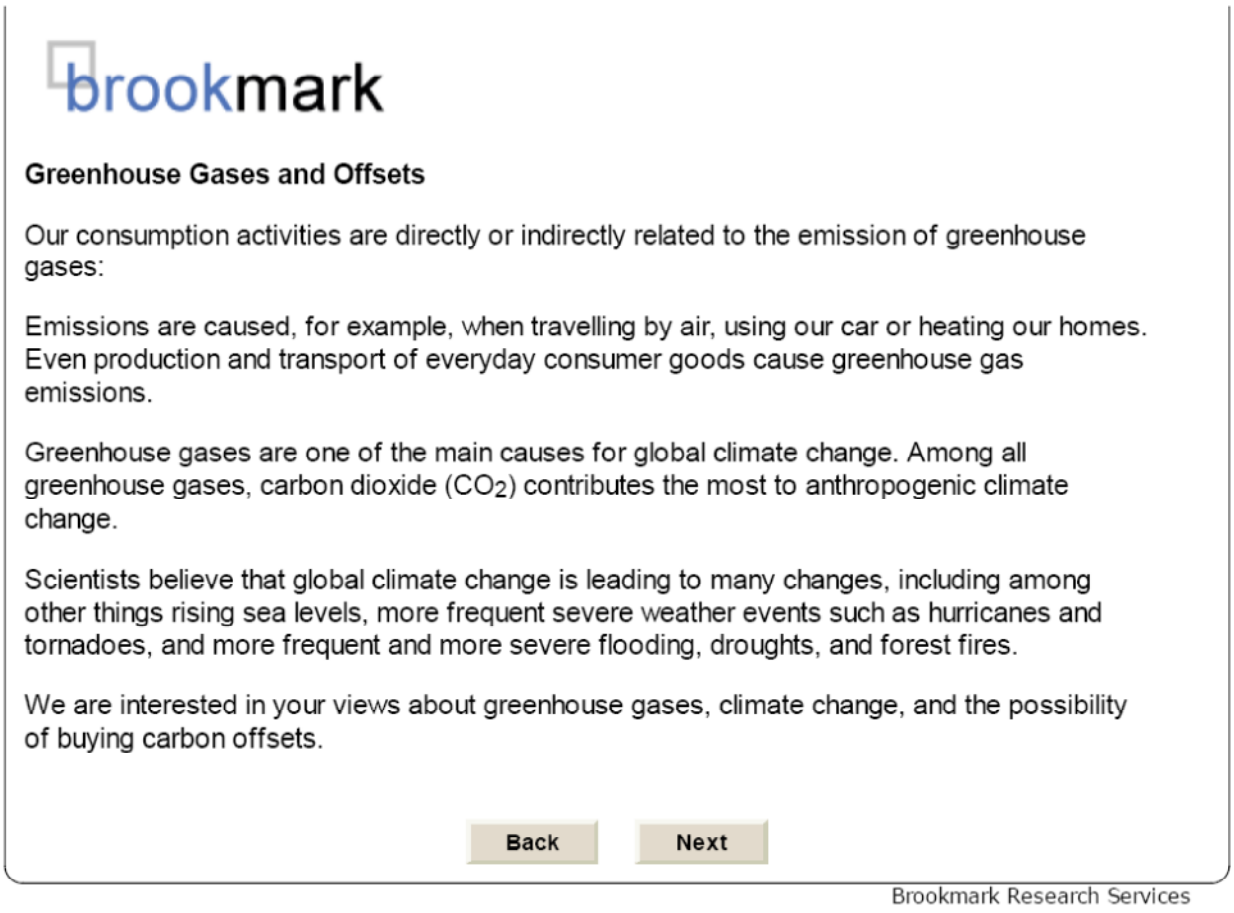

Figure 2
Representative Choice Set

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Imagine you have booked a long-distance flight, e.g. from New York to Cairo (Egypt) or Buenos Aires (Argentina). The ticket costs you $1,200 (economy class/round-trip). While booking your flight you get the information that your flight causes some 3.6 tons of CO_2 emissions per passenger. You are given a choice to offset the CO_2 emissions from your trip.

Which option would you choose among the four listed below:

Screen: 1 out of 8

	Option A full offset	Option B full offset	Option C full offset	Option D no offset
Type of project	Energy efficiency	Renewable energy	(Re-)/Afforestation	
Project host country	Newly industrializing country (e.g. China, India, Brazil)	Developing country (e.g. Bangladesh, Burkina Faso, Haiti)	Developing country (e.g. Bangladesh, Burkina Faso, Haiti)	I would choose not to offset emissions in this situation under the given circumstances.
Type of offset provider	Non-profit provider	Non-profit provider	For-profit provider	
Third-party certification	by the U.S. Environmental Protection Agency (EPA)	by the United Nations (UN)	by a non-governmental organization (NGO)	
Amount payable	$18.00 ($5/tCO_2)	$126.00 ($35/tCO_2)	$82.80 ($23/tCO_2)	
Which option would you choose in this situation?	☐	☐	☐	☐

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Table 1
Descriptive Statistics for Individual Characteristics: Mean (std.dev.)

Variable	Entire Sample	Control Group	Canary Project Group	Wind Project Group
Age (interval data) Median = 4	3.91 (1.59)	3.86 (1.54)	3.96 (1.64)	3.90 (1.60)
Income (interval data) Median = 3	6.95 (18.13)	7.48 (19.54)	6.35 (16.19)	7.05 (18.55)
Adherence to social norms Median = 0.118	0.207 (0.857)	0.213 (0.77))	0.265 (0.870)	0.144 (0.819)
Ascribed responsibility Median = 0.148	0.213 (0.714)	0.147 (0.741)	0.273 (0.698)	0.215 (0.699)
Expected cooperation Median = 4	4.14 (2.21)	4.17 (2.32)	4.13 (2.22)	4.11 (2.09)
Knowledgeable about climate change	0.380	0.366	0.411	0.360
Number of respondents with nonmissing data	1515	486	513	516

Table 2
Conditional logit estimates: control group

Attribute	Coefficient	Std error	P-value
ASC-status quo (reverse coding)	-.090	.075	.2280
CO_2 emissions offset	-.020	.037	.5874
Cost in air travel context	-.007*	.004	.0660
Cost in automobile travel context	-.003	.003	.4008
Cost in hotel stays context	-.009***	.003	.0026
Cost in home heating context	-.012***	.003	.0000
Type: afforestation	.037	.035	.2907
Type: renewable energy	.060*	.035	.0836
Type: methane	-.008	.035	.8209
Developing Country	.006	.039	.8852
Nonprofit provider	.074***	.021	.0004
Certifier: EPA	.091***	.033	.0061
Certifier: NGO	-.073**	.034	.0309
Note: ***, **, * → Significance at 1%, 5%, 10% level			
Omitted categories (base case) Type: energy efficiency; Context: home heating; For-profit provider; Certifier: United Nations			
Average (partial) effect of ASC-status quo on Pr(buying offset) = -.019			

Table 3
Comparison of Control and Treatment Groups

	Control	Canary Project	Wind Map Project
ASC-status quo coefficient (reverse coding)	-.090	.129*	-.167**
Average partial effect on Pr(buying offset)	-.019	.026	-.036
Note: each column presents selected results from a conditional logit model like that shown in Table 2.			

Table 4
Average Partial Effects of ASC-status quo
Comparisons for Knowledgeable and Not Knowledgeable Respondents

	All respondents	Knowledgeable respondents	Not Knowledgeable respondents
Control group	-.019	.073	-.080
Canary Project group	.026	.112	-.053
Wind Map Project group	-.036	.056	-.096
Note: each cell shows the average partial effect for a separate conditional logit model, each similar to that shown in Table 2.			

Table 5
Latent Class Models

Subset	Number of latent classes	ASC-status quo coefficients (reverse coded)	Average expected partial effect of ASC-status quo
Knowledgeable, Control group	2	3.273*** -1.061***	-.031
Knowledgeable, Canary Project group	3	10.759 0.679** -1.350***	.001
Knowledgeable, Wind Map Project group	3	2.339*** -5.903 -0.425	-.029
Not knowledgeable, Control group	2	-1.285*** 1.134***	-.093
Not knowledgeable, Canary Project group	3	-2.947*** 2.510*** -0.329**	-.057
Not knowledgeable, Wind Map Project group	3	-1.737*** 3.420*** 0.195	-.124
Note: each row represents a separate estimation of a latent class model.			