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Abstract

This paper reports the results of two experiments exploring the impact of exposure to environmental art on environmental beliefs, using images of plastic bag pollution in oceans. Even though the experimental design investigates only the immediate impact of a brief exposure to artistic images, the design controls well for other factors that might influence changes in environmental beliefs. This study is one of the few to directly estimate the effect of environmental art and it is the first to use elements of the New Ecological Paradigm in that context. Beyond the main research question of whether environmental art has effects on beliefs, the study also investigates whether expected behavior is affected, whether it is art or the information conveyed along with the art that matters, whether other factors influence the effect of exposure to the artwork, and what personal characteristics are associated with pro-environmental behaviors with respect to plastic bags as well as pro-environmental beliefs.

Keywords: environmental art, environmental beliefs, plastic pollution, New Ecological Paradigm

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This paper reports the results of two experiments exploring the impact of exposure to environmental art on environmental beliefs, using images of plastic bag pollution in oceans. Even though the experimental design investigates only the immediate impact of a brief exposure to artistic images, the design controls well for other factors that might influence changes in environmental beliefs. This study is one of the few to directly estimate the effect of environmental art and it is the first to use elements of the New Ecological Paradigm in that context. Beyond the main research question of whether environmental art has effects on beliefs, the study also investigates whether expected behavior is affected, whether it is art or the information conveyed along with the art that matters, whether other factors influence the effect of exposure to the artwork, and what personal characteristics are associated with pro-environmental behaviors with respect to plastic bags as well as pro-environmental beliefs.

In the first experiment, some internet survey respondents were shown a digital version of Chris Jordan's artwork *Whale*, an image of a whale made up of 50,000 plastic bag images, along with an explanation that there are an estimated 50,000 pieces of floating plastic in every square mile in the world's oceans. Another group of subjects responded to the same survey except they were given only the information about floating plastic, not the artistic image. Both groups of respondents were asked before-and-after questions about behavior and beliefs regarding plastic bag pollution. Results indicated that many subjects expected behavior to change and that some beliefs were changed as well, but that the changes were essentially the same for the two groups of respondents.

While the first experiment compared subjects who saw art plus text with those who saw only text, the second experiment compared subjects who saw art plus text with those who saw only an image. This experiment used an underwater photograph by Rich Carey of plastic bags and other detritus floating in the ocean, supplemented (for the relevant group of respondents) with the same text as used in the first experiment. Results indicate that respondents who saw art and text were affected more than those who saw just art. The latter group often showed no treatment effect at all.

The next section of the paper discusses relevant theoretical and conceptual frameworks, including the New Ecological Paradigm (NEP). Then the experimental design for the two experiments is described, including the elements of the NEP used in the study. After results are presented and discussed, the paper concludes with implications and suggestions for further study.

Theoretical and conceptual frameworks

The experiments reported on in this paper were informed by theoretical and conceptual frameworks from environmental sociology and psychology. Psychological theories of

environmental behavior, including the value-belief-norm theory (Stern et al. 1999) and the theory of planned behavior (Ajzen 1985) in addition to other theories, are based on affect, reasoned choice, and social norms, thus including both internal and external factors. David Curtis and various co-authors (Reid, Reeve, and Curtis 2005; Curtis, Reeve, and Reid 2007; Curtis 2009; Curtis 2011; Curtis, Reid, and Ballard 2012) developed theoretical arguments that stress mostly internal factors. For example, in the model of Curtis (2009) the arts can shape environmental behavior by creating an emotional affinity with nature, developing a cognitive interest in nature, and/or provoking emotional indignation about environmental harm. As stated by Blasch and Turner (2015), the only previous study that used experiments to investigate the impact of environmental art, "[t]he arts can seemingly create both internal and external influences on behavior, by informing people about the consequences of their choices and actions, developing empathy for the natural environment, creating or enhancing moral imperatives, indicating social norms and expectations, and affecting policies and regulations." Recent work in neuroscience is consistent with Curtis' emotional indignation argument. Sawe and Knutson (2015) found that contributions to a fund aimed at promoting conservation at national parks were affected by seeing images of national parks and threats to those parks. Images of threats invoked negative emotional responses and were particularly influential in spurring donations.

The experiments reported on here focus on two potential pathways for art to affect environmental beliefs and behaviors: providing information (Curtis' cognitive interest development) and provoking emotional indignation about threats to the environment (in particular, plastic bag pollution in oceans). The experiments were designed to isolate the separate effects of art (digital images) and purely textual information as well as to measure their combined impact.

Environmental beliefs in general are measured by several survey questions. Among them is a subset of the questions developed by the creators of the revised New Ecological Paradigm (NEP) concept (Dunlap et al. 2000). Although not without controversy (see the reviews of literature in Dunlap 2008 and Hawcroft and Milfont 2010), the NEP scale or index, created from 15 survey questions that ask respondents the extent to which they agree or disagree with statements about the relationship between humans and the environment, is a widely used measure of a pro-environmental world view (the NEP). Some researchers use all 15 questions to create a scale while others use a subset of questions; some use the overall scale and some use subscales or individual questions separately.

Experimental designs

The first experiment, conducted in 2015, was an internet survey, designed and implemented using Qualtrics, a company that provides survey tools, using a sample of 666 respondents that Qualtrics provided. The sample was created to be approximately 50% female and to be representative of the US population with respect to age and income distributions. The respondents knew that the survey was about plastic bag use and pollution but didn't know that it

was about the effect of art. The survey was revised in light of two pretests before the final version was sent.[1]

Partway through the survey, about half (330) of the respondents were given a link to a website[2] showing a digital version of *Whale*, by Chris Jordan. The original 44"x82" artwork, created in 2011, is based on a photograph of a whale by Bryant Austin. Jordan recreated the image using 50,000 images of plastic bags and added the following explanatory text: "Depicts 50,000 plastic bags, equal to the estimated number of pieces of floating plastic in every square mile in the world's oceans." On the website, viewers can click on the image to zoom in to see the plastic bags in detail or zoom out to focus on the whale as a whole, similar to what viewers in a gallery would do by moving closer to or further away from the displayed artwork. The remaining 336 survey respondents were shown just the explanatory information "It is estimated that there are 50,000 pieces of floating plastic in every square mile of the world's oceans."

Before being shown the image or being given textual information, all respondents answered demographic questions and background questions, including some about plastic bag use. They were asked for a self-appraisal of environmental sustainability knowledge ($1 - 7$ scale; 7 is "very well informed") and they were asked several questions about environmental beliefs. Among these questions were 7 of the 15 NEP questions, chosen to be the most salient for the plastic bag pollution issue. The 7 questions are shown in Figure 1.[3] Respondents were also asked, using a four-item Likert scale question, "Do you think your individual actions can have an effect on the environment?" Then they were asked to rate, on a continuous scale from 1 (strongly disagree) to 5 (strongly agree), their agreement with the statement, "I feel personally responsible for the condition of the environment." Respondents were also asked continuous-scale questions about the extent of their agreement with three statements about plastic bags and pollution: "Plastic bags are a significant source of roadside litter," "Plastic bags are a significant source of pollution in landfills," and "Plastic bags are a significant source of pollution in oceans."

Respondents then saw the artwork and/or textual information and were asked follow-up questions: whether they felt more knowledgeable after receiving the information; whether they thought they were more likely to use reusable plastic bags; and whether they thought others, if they saw the same artwork or received the same information, would be more likely to use reusable bags. The belief questions described in the previous paragraph were repeated at the end of the survey to see if the treatment (either the artwork plus text or the text alone) changed respondents' answers; but due to concerns about respondents being annoyed at too much repetition, only four of the NEP-based questions were repeated.

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[1] Colgate's Institutional Review Board authorized the survey design.

[2] The image is used by permission. The website is http://www.chrisjordan.com/gallery/rtn2/#whale (accessed on August 1, 2016). Respondents had to click on the link before continuing with the survey.

[3] The image also shows one of the recommended quality-control questions that were placed in several places in the survey.

The second experiment, carried out in 2016, used an identical survey instrument except for the treatment images used. About half of the respondents (148) were shown an underwater photograph by Rich Carey[4] of plastic bags and other detritus floating in the ocean, supplemented with the same text as used in the first experiment. The remaining 164 respondents were shown just the photograph, with no explanatory text.

Combining the two experiments, there are four treatment groups, each of which uses pre-treatment responses as a control. Thus the statistics of main interest are difference-in-difference estimates: the extent to which before-and-after differences are different across treatment groups. The four treatment groups are those who saw text only, those who saw text plus the *Whale* image, those who saw text plus the underwater photograph, and those who saw the photograph only. This allows for explorations of the relative impacts of two different images, the relative impact of image versus text, and the combined impact of image plus text.

Results

Respondent characteristics

The Qualtrics sampling procedure used to obtain data ensured that the overall samples were representative of the US adult population with respect to age and income and that there was a close to 50-50 gender split. This does not mean that each of the four treatment groups is necessarily representative, though there is no reason to suspect that they would not be. The sample means shown in Table 1 indicate that they are all representative and that, consequently, all four subsamples are very similar in terms of demographics. The four subsamples are also very similar in terms of the environmental knowledge, beliefs, and behaviors reported: the sample means of the relevant variables, shown in Table 1, are very close to each other, and histograms showing the distributions of the relevant variables are similar, too.

Personal characteristics for the most part are unrelated to environmental beliefs and behaviors. The only variables that mattered consistently were prior knowledge, gender, and age. As shown in Tables 2[5] and 3, being older made respondents less likely to believe that they had a personal responsibility for the environment or that individual actions matter (though the latter is not statistically significant) but otherwise is positively related to pro-environmental beliefs. Women were more likely to have pro-environmental beliefs, though the effect on the personal responsibility variable is not statistically significant. Those with higher (self-rated) prior knowledge about sustainability had significantly more pro-environmental belief variables except for the NEP indexes. With regard to behaviors, Table 4 indicates that greater prior knowledge about sustainability had statistically significant and positive effects on reusable bag use and recycling frequency, while the other variables had mixed effects: women were more likely to use

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[4] The photograph is licensed through Shutterstock.
[5] In this and all later tables, belief variables were reverse-coded when necessary so that larger values always indicate more pro-environmental beliefs.

reusable bags, and older people used recycling facilities more often. Table 5 shows that prior belief variables generally have little or no impact on these behaviors.

Changes in knowledge and expected behavior

After respondents were given information, in the form of images and/or text, they were asked whether they had become more informed by it. As shown in Table 6, a little over half of each group that saw text, whether alone or in combination with either image, said yes. There are no statistically significant differences among these proportions.[6] Of the group that saw just the underwater photograph, however, only about a third said they had become more informed, which is statistically significantly lower than for the other groups.[7] Controlling for respondents' self-reported prior knowledge of sustainability does not change this much, though for the group that saw text plus the whale image there was a statistically significantly (p-value: 0.014) positive effect of prior knowledge; the effect of prior knowledge was statistically insignificant at the 5% level for the other groups.

About half of each subsample from the first experiment thought that the information provided (regardless of whether it was in the form of the whale image plus text or just text) would change their behavior, while about two-thirds of each subsample from the second experiment thought so. The difference across experiments is statistically significant, suggesting that the underwater photograph had a larger influence than did the text alone or the text combined with the whale image. Within each experiment, though, there were no statistically significant differences across treatment groups:[8] the percentage who thought their behavior would change was slightly lower for the group that saw only the photograph than for the group that saw the same photograph with accompanying text, but this is not statistically significantly different than the percentage for the group that saw the photograph plus text.

Respondents were more pessimistic about whether others' behaviors would change: around 40% in the first experiment thought so while the corresponding percentage in the second experiment is around 50%. Once again, the underwater photograph had a statistically significantly larger impact,[9] but in neither experiment was there a statistically significant difference across treatment groups.[10]

Table 7 indicates that the effects on expected behavior varied depending on prior knowledge and whether respondents said that the experimental treatment was informative. Except for the photo-only treatment group, those who said they were more informed by the treatment were statistically significantly more likely to think that their own and others' behaviors would change. The more knowledgeable respondents said they were before treatment, the more

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[6] The p-value for a test of equal proportions is 0.116.
[7] The p-value for the test that all four proportions are equal is 0.000.
[8] The relevant p-value is 0.698.
[9] The p-value for a test of equal proportions is 0.019.
[10] The relevant p-value is 0.606.

likely they were to think that others' behaviors would change. In fact, for those with relatively little prior knowledge[11] and who said the treatment was not informative, there was no statistically significant effect of the treatment at all. Only for the text-only and photo-only groups did more knowledge lead to statistically significantly more belief that respondents' own behaviors would change. But all treatments had statistically significant effects on the belief that others' behaviors would change, even for those who said the treatment was uninformative and who said they had the least prior knowledge of sustainability.

Changes in beliefs

Tables 8, 9, and 10 provide the central results of the experiments. They show changes in the mean values[12] of the variables involved in before-and-after questions for each treatment group. Almost always there was an increase in pro-environmental beliefs after treatment. For the most part there is little difference depending on whether information (treatment) comes in the form of text, artistic image, or both; that is, the difference-in-difference estimates are small. When there is an indentifiable difference, the group that saw the underwater photograph without text typically showed smaller changes than did the other three groups. When the NEP-based index is broken into its components, only components 2 ("Humans are severely abusing the environment") and 6 ("The balance of nature is very delicate and easily upset") were affected by any of the experiments. For component 2, the combination of text and image (regardless of image) seemed to have a positive effect on pro-environmental beliefs. For component 4, only the underwater photograph plus text had a statistically significant effect. All of the changes shown in Tables 8-10 are quite small, compared to both the relevant sample means and the relevant sample standard deviations.[13] So none of the experimental treatments had large effects, but some were statistically significant. Generally speaking, the photograph by itself had little effect; textual information by itself had mostly statistically significant positive effects; text plus image had slightly larger effects than text alone, but not by statistically significant amounts; the photograph and the digital image of *Whale* had mostly similar effects when combined with text.

As was true for prior belief variables, most personal characteristics were unrelated to treatment effects. [14] Including personal characteristics as additional explanatory variables made all of the difference-in-difference effects smaller and generally less significant. The patterns across different kinds of treatments were similar, however.

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[11] For most treatment groups, this corresponds to self-rated knowledge of less than 3; for the text-and-photo group, it corresponds to self-rated knowledge of less than 2.

[12] Analyses based on the whole distributions of the relevant variables come to similar conclusions.

[13] Sample means are shown in Table 1. The standard deviations for the three variables shown in Table 8 are approximately 0.7, 1.0, and 0.8, respectively. The standard deviations for the three variables shown in Table 9 are all approximately 0.85. The standard deviations for the four variables shown in Table 10 are all slightly larger than 1.

[14] Details of these results are available upon request.

Discussion

The experimental treatments led a majority of respondents to think that their own behavior would change and many respondents thought others' behaviors would change. The four different treatments all had statistically significant effects on beliefs and attitudes, leading to more pro-environmental beliefs. The estimated magnitudes of these effects, though, were small. The different results for beliefs versus behaviors are not totally surprising: Dunlap (2008, p.12) notes that attitude-behavior links have been difficult to identify. It is interesting, though, that most social-psychological theories of environmental behavior, including those referenced earlier, have attitudes or beliefs as one important causal factor for explaining behavior, whereas in this study many respondents expected behavior to change while underlying beliefs and attitudes were not affected much.

There were few statistically significant differences across treatments. In particular, providing just text without art had approximately the same impact as providing the same text along with an artistic image. Showing just the underwater photograph had a smaller impact that did other treatments. The similarity between the treatment effects of showing *Whale* plus text and showing the underwater photograph plus text suggests that the results are not driven solely by the particular art works used in the study.

Personal characteristics had few effects. Of the characteristics investigated, only age, gender, and prior knowledge about environmental sustainability had noticeable effects on pre-treatment beliefs or behavior (with regard to plastic bags). Personal characteristics also had little effect on treatment effects in general and almost no effect on the difference-in-difference estimates of the relative impacts of different treatments.

Implications and suggestions

One way of interpreting the results of this study is that art by itself doesn't have much impact on environmental beliefs and attitudes. Respondents who saw only the underwater photograph, with no explanatory text, were less likely to see an increase in pro-environmental beliefs; moreover, the impact of seeing art and text together was approximately the same as the impact of seeing just the explanatory text. But this interpretation is surely too simplistic. The study investigates the <u>immediate effects</u> of <u>particular</u> pieces of environmental art, viewed <u>very briefly</u>, on beliefs about a <u>particular</u> environmental problem. (Even though the NEP index is general, respondents knew they were in responding to a survey about plastic bags and so that could have influenced their responses even to the general NEP questions.) The estimated impacts from this study should be viewed as extremely conservative estimates of the impacts of exposure to environmental art.

Another interpretation is that the main impact of environmental art is achieved by its conveyance of information, whereas the emotional impact of the art is small in terms of changes in beliefs and attitudes. All treatment groups had statistically significant increases in at least

some pro-environmental beliefs, and while the photograph-only treatment had smaller effects than the others, the effects weren't much smaller.

Additional studies would help determine the external validity of this study's findings. It is possible that different art works about plastics pollution in oceans would have different impacts. This study used digital images of art works meant to be viewed in different settings and in different contexts. Ongoing work will use images designed to be viewed on the internet to see if that leads to any important differences. It is also possible that beliefs, attitudes, and behaviors about other environmental issues might be more susceptible to artistic influence, so studies about issues other than plastic bag pollution in oceans would be helpful.

Probably the biggest drawback of the current study is that by design it can measure only the immediate impacts of brief exposure to environmental art. Different kinds of studies are required to measure the long-run impact of exposure or the impact of repeated or prolonged exposure. There would likely be many possible factors influencing changes in environmental attitudes, beliefs, and behaviors, so it will be important to account for them in order to isolate the impact of art. It will also be important to control for pre-existing beliefs in order to accurately measure whose beliefs have changed and related those changes to art exposure. The experimental design used in this study controls for these confounding factors well, but at the expense of being able to measure only the immediate impacts of brief exposure to art.

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Figure 1
Subset of New Ecological Paradigm Questions

Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you STRONGLY AGREE, MILDLY AGREE, are UNSURE, MILDLY DISAGREE or STRONGLY DISAGREE with it.

	Strongly agree	Mildly agree	Unsure	Mildly disagree	Strongly Disagree
Humans have the right to modify the natural environment to suit their needs	○	○	○	○	○
Humans are severely abusing the environment	○	○	○	○	○
The balance of nature is strong enough to cope with the impacts of modern industrial nations	○	○	○	○	○
The earth is like a spaceship with very limited room and resources	○	○	○	○	○
For quality control purposes, please move click on "Mildly disagree"	○	○	○	○	○
The earth has plenty of natural resources if we just learn how to develop them	○	○	○	○	○
The balance of nature is very delicate and easily upset	○	○	○	○	○
The so-called "ecological crisis" facing humankind has been greatly exaggerated	○	○	○	○	○

Table 1: Sample means by treatment group

	Saw text only	Saw text + *Whale*	Saw text + photo	Saw photo only	Total
Age					
>=18 <30	0.289	0.279	0.297	0.305	0.289
>=30 <50	0.217	0.258	0.230	0.189	0.228
>=50 <65	0.301	0.282	0.284	0.311	0.293
>=65	0.193	0.182	0.189	0.195	0.189
Female	0.484	0.459	0.551	0.470	0.483
Marital status					
married, civil union, partner	0.561	0.543	0.466	0.521	0.534
divorced or separated	0.099	0.125	0.123	0.092	0.110
never married	0.281	0.293	0.329	0.331	0.300
widowed	0.060	0.040	0.082	0.055	0.056
Annual household income					
<20K	0.154	0.135	0.178	0.147	0.150
>=20K <35K	0.233	0.239	0.226	0.276	0.241
>=35K <75K	0.296	0.343	0.377	0.340	0.331
>=75K <100K	0.199	0.190	0.103	0.135	0.171
>=100K <150K	0.088	0.067	0.062	0.083	0.076
>=150K	0.030	0.028	0.055	0.019	0.031
Race					
white	0.821	0.839	0.821	0.809	0.825
black or African American	0.116	0.111	0.131	0.134	0.119
American Indian or Alaskan	0.021	0.006	0.007	0.013	0.013
Asian	0.036	0.037	0.034	0.038	0.037
Native Hawaiian or Pacific Islander	0.006	0.006	0.007	0.006	0.006
Hispanic	0.080	0.106	0.108	0.091	0.095
Employment status					
employed	0.560	0.530	0.473	0.494	0.526
student	0.054	0.052	0.074	0.091	0.062
Residential location					
urban	0.318	0.270	0.270	0.280	0.288
suburban	0.426	0.482	0.466	0.433	0.452
rural	0.256	0.248	0.264	0.287	0.260
Type of housing					
house	0.711	0.724	0.649	0.677	0.700
group living	0.009	0.009	0.007	0.000	0.007
apartment	0.214	0.224	0.304	0.262	0.239
mobile home	0.065	0.042	0.041	0.061	0.053

Table 1 (continued)

Living situation					
live alone	0.190	0.215	0.297	0.226	0.221
with family	0.649	0.652	0.601	0.646	0.642
with roommate	0.042	0.018	0.027	0.037	0.031
with partner	0.119	0.115	0.074	0.091	0.106
Environmental sustainability knowledge self-rating	4.881	4.900	4.824	4.921	4.885
Pre-treatment general belief variables					
individual actions affect environment (definitely yes = 1; definitely no = 4)	1.708	1.730	1.716	1.805	1.733
I feel personally responsible for environment	3.228	3.295	3.303	3.234	3.263
NEP-based index	0.780	0.829	0.795	0.748	0.794
index of subset of 4 NEP questions	-0.758	-0.760	-0.730	-0.747	-0.753
humans are severely abusing the environment	1.810	1.933	1.919	1.799	1.866
the earth is like a spaceship	2.298	2.285	2.209	2.311	2.282
the earth has plenty of natural resources	2.244	2.133	2.081	2.165	2.169
the balance of nature is delicate	3.318	3.312	3.291	3.287	3.307
Pre-treatment plastics belief variables					
roadside pollution	4.032	4.001	4.005	4.058	4.022
landfill pollution	4.120	4.083	4.161	4.155	4.120
ocean pollution	4.073	4.038	4.134	4.146	4.083
Behavior variables					
use reusable bags? (never = 1; always = 5)	3.104	3.127	2.959	3.104	3.090
use recycling? (never = 1; daily = 7)	4.986	4.849	4.919	4.782	4.898
Observations	336	330	148	164	978

Table 2: Factors influencing general belief variables

	Individual actions matter^	Personal Responsibility	NEP-based index	index based on subset of NEP
Age >= 50	-0.08	-0.17*	0.18***	0.13*
Female	0.21***	0.10	0.19***	0.16**
Prior knowledge	0.13***	0.22***	0.01	0.03
Constant	-2.44***	2.20***	0.56***	-1.02***

^reverse-coded
$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3: Factors influencing beliefs about plastic pollution

	Litter	Landfill pollution	Ocean pollution
Age >= 50	0.18***	0.27***	0.19***
Female	0.14*	0.11*	0.18**
Prior knowledge	0.15***	0.13***	0.16***
Constant	3.15***	3.30***	3.13***

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 4: Factors influencing baseline behaviors

	Reusable bag use frequency	Recycling frequency
Age >= 50	0.06	0.31*
Female	0.28**	-0.17
Prior knowledge	0.25***	0.29***
Constant	1.71***	3.38***

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 5: Effects of prior beliefs on behaviors

	Reusable bag use frequency	Recycling frequency
Age >= 50	0.02	0.30*
Female	0.19*	-0.23
Prior knowledge	0.19***	0.22***
Pre-treatment belief variables		
individual actions matter (reverse coded)	0.11	0.20
personal responsibility	0.07	0.10
NEP-based index	0.13*	-0.02
roadside pollution	0.14*	-0.05
landfill pollution	0.04	0.07
ocean pollution	0.03	0.11
Constant	1.10***	3.24***

$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Table 6: Changes in reported knowledge and expected changes in behavior

Treatment group	Survey provided new information	Own behavior expected to change	Others' behavior expected to change
Saw text only	0.62***	0.51***	0.38***
Saw text + *Whale*	0.56***	0.52***	0.41***
Saw text + photo	0.53***	0.66***	0.51***
Saw photo only	0.32***	0.61***	0.48***
p-value for test of equal means	0.00	0.01	0.02

$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$ for tests of zero means

Table 7: Effects of knowledge and new information

	Own behavior expected to change	Others' behaviors expected to change
Constant	0.188	-0.007
Main treatment effects		
Saw text + *Whale*	-0.022	-0.034
Saw text + photo	0.222	0.118
Saw photo only	0.063	-0.006
Interacted with new information dummy		
Saw text only	0.233***	0.110*
Saw text + *Whale*	0.317*	0.313*
Saw text + photo	0.429*	0.368*
Saw photo only	0.216	0.287
Interacted with prior knowledge		
Saw text only	0.037*	0.065***
Saw text + *Whale*	0.034	0.051**
Saw text + photo	0.028	0.056*
Saw photo only	0.063*	0.080**

$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Table 8: Changes in general attitude and belief variables

	Individual actions matter^	Personal responsibility	NEP-based index
Saw text only	0.07*	0.19***	0.01
Saw text + Whale	0.11***	0.23***	0.07*
Saw text + photo	0.12*	0.23***	0.13**
Saw photo only	0.17***	0.10	0.03
p_value for test of equal means	0.35	0.30	0.09

^reverse coded
$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$ for test of zero means

Table 9: Changes in beliefs about plastic pollution

	Litter	Landfill pollution	Ocean pollution
Saw text only	0.06	0.07*	0.27***
Saw text + Whale	0.13***	0.14***	0.23***
Saw text + photo	0.24***	0.08	0.20***
Saw photo only	0.01	0.07	0.09
p_value for test of equal means	0.00	0.48	0.03

$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$ for test of zero means

Table 10: Changes in components of NEP-based index

	Abuse^	Spaceship^	Balance of nature^	Crisis exaggerated
Saw text only	0.00	-0.00	0.07	-0.02
Saw text + Whale	0.19***	0.01	0.06	0.02
Saw text + photo	0.16*	0.12	0.21**	0.03
Saw photo only	0.13	0.02	0.11	-0.15
p_value for test of equal means	0.05	0.61	0.41	0.35

^reverse coded

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ for test of zero means