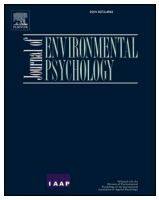
Journal of Environmental Psychology 98 (2024) 102369

Contents lists available at ScienceDirect

Journal of Environmental Psychology

journal homepage: www.elsevier.com/locate/jep



# Changing community climate change attitudes: Evidence from a community exhibit intervention

Stylianos Syropoulos [a,b,*], Sania Ashraf [c], Olivia Gomez [c], Frank Lowenstein [c], Anam Tariq [c], Travis Niles [c], Mary Fischer [d], Liane Young [a], Erez Yoeli [e]

[a] Department of Psychology and Neuroscience, Boston College, USA
[b] The Schiller Institute for Integrated Science and Society, Boston College, USA
[c] Rare, 1310 N. Courthouse Road, Suite 110, Arlington, VA, USA
[d] Brandeis University, Sustainability Programs, USA
[e] Massachusetts Institute of Technology, Applied Cooperation Initiative, USA

ARTICLE INFO

Handling Editor: W. Schultz

*Keywords:*
Climate change
Intervention
Exhibit
Norms
Behavior change

ABSTRACT

Engaging communities through exhibits displayed at community-oriented events is a longstanding practice in community activism that could prove valuable for shifting individual and collective behavior toward measures that can help reduce climate change. In this investigation we examined the effect of a climate change community exhibit that focused on four environmental issues: switching to electric vehicles, switching to community solar for residential electricity needs, reducing meat consumption, and supporting forest conservation and reforestation efforts. Participants from the greater Boston area (N = 125) were surveyed before and after attending the exhibit. Attending the exhibit increased participants' perceptions of how many members in their community engaged in action for each issue and how morally right community members thought addressing the issue was. Further, increases in how confident participants felt in engaging in the relevant actions, as well as in ease of engagement were also observed. Participants also expressed increased interest (albeit inconsistently so) in, and likelihood of, engaging in action for each issue. Across all issues, exposure to the exhibit also increased whether engaging in action was rated as an effective way to reduce climate change. Implications and future directions for interventions utilizing climate change exhibits are discussed.

## 1. Introduction

Our society is already experiencing the consequences of anthropogenic climate change (IPCC, 2023). Global warming and environmental destruction pose a huge risk to our planet. Even though people are starting to perceive climate change as a current phenomenon (Howe et al., 2015), they are often not aware of ways that they can effectively change their behavior to help reduce their contribution to climate change. In the present investigation we offer preliminary evidence from a community exhibit implemented in the greater Boston area that sought to increase awareness and decrease perceived friction for four key environmental issues relevant to the Boston community: switching to electric vehicles, switching to community solar for residential electricity needs, reducing meat consumption, and supporting forest conservation and reforestation efforts. We consider this investigation an important step for energizing local communities and a potential archetype that local non-profit organizations could employ with relative ease to catalyze (interest for) sustainable decisions for local community issues. From a theoretical perspective, this investigation offers preliminary test (and evidence) for the effectiveness of information campaigns presented through visually appealing format from entities that are relatively trusted (Clorely, 2023) by local communities.

### 1.1. Short review of climate change behavioral interventions

A recent meta-analysis of behavioral interventions targeting climate change-related outcomes found that, across interventions, small but statically robust effects are observed (van der Linden & Goldberg, 2020). A second-order meta-analysis (i.e., a meta-analysis of meta analyses) of field interventions also generated a similar finding, namely that small but statistically robust effects are observed (Berquist et al., 2023). Analyses on sub-groups of these interventions elucidated that social

* Corresponding author. Department of Psychology and Neuroscience, Boston College, USA.
*E-mail address:* syropoul@bc.edu (S. Syropoulos).

https://doi.org/10.1016/j.jenvp.2024.102369
Received 16 November 2023; Received in revised form 25 May 2024; Accepted 25 June 2024
Available online 26 June 2024

comparisons or reported financial incentives were particularly effective, while education through providing direct feedback was least effective (Berquist et al., 2023). Findings from specific interventions suggest that more lasting effects could be observed when the messenger of the intervention is a trusted ingroup member (Goldberg et al., 2021). This also appears to be the case for younger populations, for whom trust in and value alignment with the messenger appears to be important (Corner et al., 2015). Another review suggests that interventions appear to be more effective at shifting climate change beliefs than policy attitudes (Rode et al., 2021). Another knowledge-based intervention (Geiger et al., 2017) conducted both in the lab and in a field setting meaningfully shifted perceived self-efficacy (i.e., perceptions that one can meaningfully act to reduce climate change). Reviews of similar educational interventions more broadly suggest that by potentially focusing on information relevant to the participant and through the use of active teaching methods such interventions could prove more effective (Monroe et al., 2017). Finally, correcting misperceptions that people hold both about public opinion (e.g., Sparkman et al., 2022) and about their own practices (Marghetis et al., 2019) is possible, when people are presented with precise, concise and easy-to-follow information (e.g., Marghetis et al., 2019).

Thus, based on this short but comprehensive review of the state of field and behavioral interventions the following is clear: messages should come from trusted sources, focus on social comparison or economic incentives, seek to appeal to common values shared between the messenger and the receiver, and focus on efficacy and climate change beliefs rather than policy attitudes. These findings directly influenced our community interventions, which exposed participants to an exhibit, which both informed participants of the practices of their fellow community members, highlighted potential incentives opportunities, and focused on shifting beliefs and perceptions rather than policy attitudes. In addition, we sought to also provide information that could correct any misperceptions attendees had about relevant outcomes. Finally, we also highlighted ways in which attendees could take meaningful sustainable actions for each outcome, seeking to increase their confidence in being able to change their behavior, their belief that change is easy, as well as their likelihood of changing their behavior.

### 1.2. Predictors of behavior change

Although no theoretical model can truly account for the full complexity underlying proenvironmental behaviors, some are more widely used than others. Among them are the theory of planned behavior (Ajzen, 1991), and value-belief-norm theory (e.g., Stern, 2000). These theories share similarities in that they both highlight key individual differences and social influences that could underlie behavioral engagement and behavior change (for a review see Gifford et al., 2011). From these models we targeted the following, based on evidence suggesting that they are potential drivers of proenvironmental behaviors (e.g., Gifford et al., 2011). We argued that descriptive (i.e., perceived prevalence of a behavior) and injunctive (i.e., perceived approval/moral rightness of a behavior) norms (for a review see Cialdini & Jacobson, 2021; but also see Constantino et al., 2022), perceiving the target behavior as effective (Lee et al., 2020) and easy to do (Brick et al., 2017), and feeling confident (e.g., Miller et al., 2022), and interested (e.g., Miller et al., 2022), in doing the behavior are all key antecedents of proenvironmental behavior, that could be shifted through attending a community climate exhibit.

### 1.3. The current study

Following recommendations set by existing meta-analyses and reviews of the literature, we fielded a climate exhibit focusing on four issues that were of relevance to the greater Boston area. We recruited participants up until a few days prior to the exhibit, had them complete a pre-attendance survey of their attitudes and beliefs about the four behaviors targeted in the exhibits, and then instructed them to attend the exhibit during windows over a two-week period. Following their attendance (see Methods for more information on the content) participants completed a follow-up questionnaire. We hypothesized that attending the exhibit, which mainly focused on providing information about the prevalence of actions and behaviors relevant to each topic, highlighting ways that people can contribute to these efforts, and correcting misperceptions about the difficulty of taking action, would increase the aforementioned psychological drivers of behaviors as well as behavioral intentions.

## 2. Methods

All materials for the study (raw data, survey instruments, and code for analyses) can be found on the Open Science Framework (OSF) https://osf.io/ex97p/?view_only=f283e3639cfd4453a5dbfc8c56279263. This study was not pre-registered.

### 2.1. Participants

We recruited 217 Boston residents. Participants were recruited through various means: calls to participate posted on various Boston-area community groups on Facebook; through geographically targeted Facebook ads; through flyers posted in the towns of Waltham, Cambridge, Watertown and Newton; and through email blasts sent out to employees, students and community supporters by Brandeis University staff. Each participant completing the study received $50 as compensation for their involvement, which encompassed three steps: completing the pre-survey, attending the exhibit, and subsequently completing the post-survey. Payment eligibility was contingent upon successful completion of all three steps. Additionally, we conducted a raffle of $200 for the participants who completed all parts of the study. A total of 125 (58%) participants completed both the pre and post exhibit survey and attended the exhibits. The first survey was completed approximately 10–14 days prior to the exhibit (mid-May 2023), and the second survey was completed immediately, or a few days after the exhibit (late May-early June 2023). Answers to any questions were not supervised. Importantly, the participants who remained in the sample did not differ in any of the outcomes ($t(215) = 1.40$, $p = 0.162$),[1] age ($t(212) = 0.97$, $p = 0.333$), or worry about climate change ($t(212) = 1.24$, $p = 0.217$), but they were significantly more liberal ($t(212) = 2.08$, $p = 0.039$, $d = 0.28$; M = 3.28, SD = 1.90, Min = 1 Max = 10) compared to those who dropped out of the study at T1 (M = 3.85, SD = 2.11).

Detailed demographic information is presented in Table 1. The average age was around 45 years (SD = 17.88). The sample tended to be liberal on average (M = 3.28, SD = 1.90, 1–10 scale, 1 = very liberal, 10

**Table 1**
Demographic information.

| Parameter | N | Percentage |
|---|---|---|
| Sample size | 125 | 100% |
| Male | 39 | 31% |
| Female | 86 | 69% |
| White | 105 | 84% |
| Lives in an apartment | 56 | 45% |
| Lives in single family house | 50 | 40% |
| Homeowner | 51 | 41% |
| Some college education | 48 | 38% |
| Bachelor's | 60 | 48% |

[1] To avoid testing for every single outcome and thus increasing the chance for a false positive result, we standardized all continuous measures such that M = 0, SD = 1, and averaged them into a single construct ($\alpha = 0.84$).

= very conservative) and worried about climate change (M = 8.17, SD = 2.06, 1–10 scale, 1 = not at all worried, 10 = very worried). Importantly, this sample is in line with the demographic breakdown of the greater Boston area, which has a majority white population (50.1%; U.S. Census Bureau, 2023), tends to be fairly worried about climate change (81% of the population, Marlon et al., 2021). Further, in terms of education, approximately 50% of adults have at least a Bachelor's degree (U.S. Census Bureau, 2023). Finally, Massachusetts is a historically Democratic state (CNN, 2023), which is also reflected in our sample in terms of average political ideology leaning towards liberalism.

### 2.2. Measures

Four behavioral domains were selected. These domains were used because they concerned topics relevant to sustainability that are probably salient and impacting people living in the specific greater-Boston area, and because actively producing attitude (and behavior) change in these domains would be beneficial for promoting sustainability.[2] All measures utilized in the study are summarized in Table 2. The survey was fielded online through Alchemer. Measures were shown in a randomized order such that each topic was shown in a random order (i.e., electric vehicles, community solar, meat reduction, forest conservation). Measures were also randomized within each topic. Our goal was to examine key psychological mechanisms which extant literature has noted as capable of influencing proenvironmental behaviors. In detail these were: descriptive and injunctive norms, confidence in one's ability to change their behavior, friction reduction (i.e., how easy it is to change one's behavior), perceived effectiveness for reducing climate change, and behavioral intentions (i.e., interest in and likelihood of changing one's behavior).

### 2.3. Exhibit

The set of exhibits was developed in spring of 2022 for use at an event at the Peabody Essex Museum executed in April 2022. The exhibits consist of five large folding panels, ranging from 12 to 16 feet in length, all approximately 6.5 feet tall, and all approximately 2.5 feet deep. Each behavior is addressed on a single panel, and a fifth panel invites viewers to consider their own actions and commit to new climate-positive behaviors. All panels include physical interactive elements. For example, the electric vehicle exhibit includes a large map of the greater Boston area, with pegs, and viewers are invited to wind strings scaled to represent 25, 50, and 200 miles around the pegs to simulate electric vehicle trips. This is intended to convey that for urban trips, range anxiety is not a large challenge.

Exhibit content was developed based on polling data conducted by Rare in the Boston area in 2021 around attitudes toward these and other climate behaviors, which identified these four proenvironmental behaviors as ones with strong potential for support, and in many cases limited understandings or significant misperceptions. Based on perceived performance of the exhibits at this and other events in 2022, some of the content of the exhibits, and particularly the interactive component of the forest carbon offset panel was modified for 2023.

For this installation, fielded at Brandeis University, smaller supplementary panels were added to the displays; these were designed by Story Craft Labs based on input from Brandeis students and recent alumnae, and were intended to identify related behaviors that would be more easily executed by students. When displayed at public events, the exhibits are accompanied by docents who can answer questions and ensure both the safety of the exhibits and of the viewers (e.g., discourage young children from climbing the exhibits). These docents were present and

[2] Another practical consideration was that these domains fall directly under the umberall of sustainability domains that Rare, the nonprofit fielding the exhibit, works on.

**Table 2**
Item description, range and label for every outcome.

| *Electric Vehicles* | Range | Label | Psychological Construct |
|---|---|---|---|
| Imagine 10 people in your community, how many do you think drive a fully electric car? | 0–10 | Number of people | Descriptive Norm |
| Imagine 10 people you know. If you had to guess, how many think that people should drive an electric car? | 0–10 | Number of people | Injunctive Norm |
| I believe that switching to driving a fully electric vehicle is an effective strategy for reducing my contribution to climate change | 0–10 | Not at all effective - Extremely effective | Efficacy |
| How confident are you in your ability to purchase a fully electric car? | 0–10 | Not at all confident - Extremely confident | Confidence |
| How easy do you think it is for you to switch to driving a fully electric vehicle? | 0–10 | Not at all easy - Extremely easy | Friction Reduction |
| How interested would you be in participating in a program which helps you purchase a fully electric car? | 0–10 | Not at all interested - Extremely interested | Interest |
| How likely is it that the next car you purchase is a fully electric car? | 0–100% (increments of 10%) | Not at all likely - Extremely likely | Intention |
| Do you think that people should drive a fully electric car? | Yes (=1), No (=0) | | Attitude |
| ***Community Solar*** | **Range** | **Label** | |
| Imagine 10 households you know. If you had to guess, how many of them do you think get their electricity from community solar? | 0–10 | Number of people | Descriptive Norm |
| Imagine 10 people you know. If you had to guess, how many think that people should get their electricity from community solar? | 0–10 | Number of people | Injunctive Norm |
| How confident are you in your ability to sign up for community solar? | 0–10 | Not at all confident - Extremely confident | Confidence |
| How easy do you think it is for you to switch to community solar? | 0–10 | Not at all easy - Extremely easy | Friction Reduction |
| How interested would you be in participating in a program which helps you get your electricity from community solar? | 0–10 | Not at all interested - Extremely interested | Interest |
| Do you think community solar is available for renters? | Yes (=1), No (=0), Not sure (No and not sure were coded as 0) | | Knowledge |
| If people have the choice, should they get their electricity from community solar? | Yes (=1), No (=0) | | Attitude |
| Would you like to sign up for community solar? | Yes, No, I am already a member (excluded from analysis) | | Intention |
| ***Meat Reduction*** | **Range** | **Label** | |
| Imagine 10 people in your community. If you had to guess, how many of | 0–10 | Number of people | Descriptive Norm |

(*continued on next page*)

**Table 2** (*continued*)

| *Electric Vehicles* | Range | Label | Psychological Construct |
|---|---|---|---|
| them are trying to eat less meat than they used to? | | | |
| Imagine 10 people in your community. If you had to guess, how many of them think that people should eat less meat? | 0–10 | Number of people | Injunctive Norm |
| I believe that reducing my meat consumption is an effective strategy for reducing my contribution to climate change | 0–10 | Not at all effective - Extremely effective | Efficacy |
| How confident are you in your ability to eat less meat? | 0–10 | Not at all confident - Extremely confident | Confidence |
| How easy do you think it is for you to reduce your meat consumption? | 0–10 | Not at all easy - Extremely easy | Friction Reduction |
| How likely is it that you will reduce the amount of meat in your diet in the next 12 months? | 0–100% (increments of 10) | Not at all likely - Extremely likely | Intention |
| How interested would you be in participating in a program which helps you reduce your meat consumption? | 0–10 | Not at all interested - Extremely interested | Interest |
| Do you think that people should eat less meat? | Yes (=1), No (=0) | | Attitude |
| Would you like to learn more about how to reduce your meat consumption? | Yes (=1), No (=0), I am already a vegan/vegetarian (excluded) | | Intention |
| ***Forest Conservation*** | **Range** | **Label** | |
| Imagine 10 people in your community, how many do you think (practically or financially) support forest conservation or reforestation projects? | 0–10 | Number of people | Descriptive Norm |
| I believe that donating to (practically or financially)/supporting forest conservation or reforestation projects is an effective strategy for reducing my contribution to climate change | 0–10 | Not at all effective - Extremely effective | Efficacy |
| How confident are you in your ability to support forest conservation or reforestation projects? | 0–10 | Not at all confident - Extremely confident | Confidence |
| How easy do you think it is to support/donate to forest conservation or reforestation projects that want to protect nature? | 0–10 | Not at all easy - Extremely easy | Friction Reduction |
| Donating to forest conservation or reforestation projects is the right thing to do | 0–10 | Strongly disagree - Strongly agree | Attitude |
| Would you like to sign up for a tax-deductible donation to Rare to support forest conservation or reforestation projects? | Yes (=1), No (=0), I already donate (excluded) | | Intention |

active during the study as well and available to answer any questions from study participants. See Fig. 1 for a visual display of the exhibit.

## 3. Results

All analyses were conducted in SAS version 9.4. To examine the effect of the intervention we conducted paired sample t-tests comparing the pre and post exhibit score for all continuous outcomes (see Table 3). For all binary outcomes we conducted McNemar's test (see Table 4). Seeking to recruit as many participants as possible we did not conduct an a-priori power analysis. We estimated sensitivity analyses using G*power (Faul et al., 2007) for the paired-sample t-tests suggested that with power of 0.80 we would be able to meaningfully detect effect sizes as small as dz = 0.25. For the McNemar tests, our proportion of discordant pairs for significant results ranged from 0.08 to 0.74. Thus, for the smallest noted discordant proportion of pairs we could meaningfully detect Odds Ratios of 11.01, and for the largest noted discordant proportion of pairs we could detect Odds Ratios of 1.85. Replicating past research, perceived injunctive and descriptive norms, perceived friction reduction, perceived effectiveness for reducing climate change, perceived confidence for changing one's behavior, all for the most part positively and significantly related to increased likelihood of changing one's behaviors. For these correlations, as well as correlations within and between timepoints (i.e., pre and post exhibit exposure) see Tables S1–S4 in the Supplementary Materials.

### 3.1. Electric vehicles (EVs)

Attending the field exhibit significantly increased all perceived descriptive and injunctive norms, efficacy, confidence, intentions to buy an EV, and friction reduction, but interest in participating in a program which would help participants purchase an EV, or thinking that people should drive an EV, although for the latter the majority of participants were already supportive of this idea before the exhibit. Effect sizes ranged from 0.22 to 0.43 suggesting small to medium magnitude of change.

### 3.2. Community solar

Attending the field exhibit significantly increased perceived descriptive and injunctive norms, efficacy, confidence, and interest in community solar, knowledge about community solar, and for positive attitudes towards community solar (i.e., thinking everyone should get their energy from it if they can), but not for not for wanting to sign up for community solar (intentions). Effect sizes ranged from 0.28 to 0.79 suggesting small to large magnitude of change, with the largest changes noted for friction reduction and confidence.

### 3.3. Meat reduction

Attending the field exhibit significantly increased descriptive and injunctive norms, friction reduction, confidence, efficacy and intentions but not interest (both in the continuous and binary version) and for thinking that people should eat less meat, for which the majority of participants already agreed with the statement prior to the exhibit. Effect sizes ranged from 0.29 to 0.62, with the largest effect noted for efficacy.

### 3.4. Forest conservation

Attending the exhibit significantly increased confidence, friction reduction, efficacy, and positive attitudes (moral rightness) for forest conservation. However this was not the case for descriptive norms or for signing up for a tax-deductible donation supporting forest conservation and reforestation. It's possible that this effect could be the product of moral licensing such that since participants attended the exhibit, they


**Fig. 1.** Images of the exhibit.

already felt like they contributed to this effort. Effect sizes ranged from 0.27 to 0.40, suggesting small to moderate changes in magnitude.

## 4. Discussion

Field exhibits have the potential to attract people's attention and increase their concern for community-related issues. In this investigation we evaluated the impact of attending an exhibit on people's attitudes for four key environmental issues: switching to electric vehicles, adopting community solar, reducing meat consumption and supporting forest conservation and reforestation efforts. As the most severe consequences of climate change come into fruition, promoting awareness of what one can do to help reduce their contribution to climate change can prove crucial for adaptive and mitigating efforts.

Our results suggests that an exhibit that highlights community-specific information, in this case information relevant to the greater Boston area, can meaningfully shift people's descriptive and injunctive norms about how one's fellow community members engage in or support the aforementioned issues, reduce friction in adoption (i.e., increase perception of how easy it is to engage in an effort), increase confidence in one's ability to engage with the issue, increase the perceived effectiveness of a given method to address the issue, and shift behavioral intentions. The outcomes that were not consistently impacted were expressed interest in learning more about the issue. It's important to note that all the aforementioned outcomes (i.e., descriptive and injunctive norms, friction reduction, confidence and perceived effectiveness) are key psychological mechanisms explaining pro-environmental behaviors, suggesting that exhibits that meaningfully engage community members with relevant information about their own community could be a catalyst for behavior change.

Implementing such exhibits is not a costly endeavor and could very well be a very educational and meaningful experience for attendees. Our results suggest that for the most part such exhibits can increase pro-environmental attitudes and beliefs. Their relative low cost and ease of implementation make them an easy-to-produce method for increasing environmental awareness across multiple environmental issues relevant to a particular community.

### 4.1. Limitations and future directions

Considering these promising results, it's also important to consider the potential limitations of the current investigation. First, the specificity and demographics of the sample limit generalizability to other contexts. Although our sample was somewhat reflective of the greater Boston population, it is still the case that our participants were mostly female, educated, liberal and climate conscious. Thus, attending the exhibit itself could have been impacted by people's pre-existing elevated climate concern. Given this, it's possible that similar effects would not have been observed for more climate-skeptic and/or politically conservative individuals. We can only infer potentially positive effects for those who are already proenvironmentally inclined. Nevertheless we recommend that future work on this domains should build on this evidence by examining whether local community exhibits from organizations that are relatively trusted or perceived positively (e.g., a non-profit focusing on the environment) could increase community engagement, empower and motivate individuals to think and act sustainably, and correct misperceptions and educate community members about issues relevant to sustainability. Based on these results it appears that at the very least, this approach is promising for increasing engagement with local sustainability issues. Similar exhibits that are modified for other local contexts could thus also prove effective.

Second, our pre-post design limits our ability to draw causal inferences relative to a randomized experiment. One such threat is a possible demand effect, where respondents may have given higher values on the outcome survey based on their beliefs about the goals of the researchers. Given the field component of the exhibit itself, it was not feasible to construct a control condition which, for example, could have randomly assigned participants to view a control artistic exhibit on an unrelated topic. Future work can empirically test the effectiveness of such interventions and include a control condition to strengthen the validity of the observed effects. It's also important to acknowledge that there is an added strength of using a within-subject design, such as eliminating any potential a-priori individual differences between conditions and providing evidence for a shift in people's pre-existing attitudes prior to being exposed to the treatment (i.e., the exhibit). Nevertheless, a formal randomized control experiment would only strengthen the observed findings.

**Table 3**
Paired sample t-tests for all continuous outcomes.

| Continuous Outcomes | Psychological Construct | Pre Score | | Post Score | | Test | Adjusted *p* | Cohen's d |
|---|---|---|---|---|---|---|---|---|
| | | M | SD | M | SD | | | |
| ***Electric Vehicles*** | | | | | | | | |
| Imagine 10 people in your community, how many do you think drive a fully electric car? | Descriptive Norm | 1.79 | 1.66 | 2.62 | 1.71 | $t(124) = 4.50$, $p < 0.001$ | $p < 0.001$ | 0.40 |
| Imagine 10 people you know. If you had to guess, how many think that people should drive an electric car? | Injunctive Norm | 4.58 | 2.61 | 5.21 | 2.20 | $t(124) = 2.43$, $p = 0.017$ | 0.020 | 0.22 |
| I believe that switching to driving a fully electric vehicle is an effective strategy for reducing my contribution to climate change | Efficacy | 6.79 | 2.54 | 7.31 | 2.55 | $t(124) = 2.85$, $p = 0.005$ | 0.006 | 0.25 |
| How confident are you in your ability to purchase a fully electric car? | Confidence | 3.94 | 3.22 | 5.26 | 3.11 | $t(124) = 4.84$, $p < 0.001$ | $p < 0.001$ | 0.43 |
| How easy do you think it is for you to switch to driving a fully electric vehicle? | Friction Reduction | 4.63 | 3.06 | 5.50 | 2.99 | $t(124) = 3.62$, $p < 0.001$ | $p < 0.001$ | 0.32 |
| How interested would you be in participating in a program which helps you purchase a fully electric car? | Interest | 6.30 | 3.36 | 6.55 | 3.26 | $t(124) = 1.03$, $p = 0.304$ | 0.325 | 0.09 |
| How likely is it that the next car you purchase is a fully electric car? | Intention | 43.60 | 30.88 | 51.92 | 30.63 | $t(124) = 4.41$, $p < 0.001$ | $p < 0.001$ | 0.39 |
| ***Community Solar*** | | | | | | | | |
| Imagine 10 households you know. If you had to guess, how many of them do you think get their electricity from community solar? | Descriptive Norm | 1.98 | 1.88 | 2.62 | 1.89 | $t(124) = 3.12$, $p = 0.002$ | 0.003 | 0.28 |
| Imagine 10 people you know. If you had to guess, how many think that people should get their electricity from community solar? | Injunctive Norm | 4.82 | 2.71 | 6.19 | 2.44 | $t(124) = 4.64$, $p < 0.001$ | $p < 0.001$ | 0.41 |
| How confident are you in your ability to sign up for community solar? | Confidence | 4.00 | 2.82 | 6.73 | 3.07 | $t(124) = 8.83$, $p < 0.001$ | $p < 0.001$ | 0.79 |
| How easy do you think it is for you to switch to community solar? | Friction Reduction | 3.89 | 2.87 | 6.44 | 2.97 | $t(124) = 8.87$, $p < 0.001$ | $p < 0.001$ | 0.79 |
| How interested would you be in participating in a program which helps you get your electricity from community solar? | Interest | 6.30 | 3.11 | 7.18 | 3.03 | $t(124) = 3.15$, $p = 0.002$ | 0.003 | 0.28 |
| ***Meat Reduction*** | | | | | | | | |
| Imagine 10 people in your community. If you had to guess, how many of them are trying to eat less meat than they used to? | Descriptive Norm | 4.62 | 2.12 | 5.32 | 1.84 | $t(124) = 3.83$, $p < 0.001$ | $p < 0.001$ | 0.34 |
| Imagine 10 people in your community. If you had to guess, how many of them think that people should eat less meat? | Injunctive Norm | 5.22 | 2.34 | 6.21 | 1.92 | $t(124) = 4.34$, $p < 0.001$ | $p < 0.001$ | 0.39 |
| I believe that reducing my meat consumption is an effective strategy for reducing my contribution to climate change | Efficacy | 6.38 | 2.76 | 7.72 | 2.55 | $t(124) = 6.92$, $p < 0.001$ | $p < 0.001$ | 0.62 |
| How confident are you in your ability to eat less meat? | Confidence | 7.02 | 3.10 | 7.78 | 2.69 | $t(124) = 3.22$, $p = 0.002$ | 0.003 | 0.29 |
| How easy do you think it is for you to reduce your meat consumption? | Friction Reduction | 6.82 | 2.88 | 7.58 | 2.68 | $t(124) = 3.67$, $p < 0.001$ | $p < 0.001$ | 0.33 |
| How likely is it that you will reduce the amount of meat in your diet in the next 12 months? | Intention | 57.12 | 34.59 | 68.48 | 33.31 | $t(124) = 4.56$, $p < 0.001$ | $p < 0.001$ | 0.41 |
| How interested would you be in participating in a program which helps you reduce your meat consumption? | Interest | 4.85 | 3.84 | 5.15 | 3.83 | $t(124) = 1.20$, $p = 0.231$ | 0.256 | 0.11 |
| ***Forest Conservation*** | | | | | | | | |
| Imagine 10 people in your community, how many do you think (practically or financially) support forest conservation or reforestation projects? | Descriptive Norm | 3.43 | 2.74 | 3.60 | 2.36 | $t(124) = 0.80$, $p = 0.424$ | 0.438 | 0.07 |
| I believe that donating to (practically or financially)/supporting forest conservation or reforestation projects is an effective strategy for reducing my contribution to climate change | Efficacy | 5.50 | 2.93 | 6.70 | 2.84 | $t(124) = 4.53$, $p < 0.001$ | $p < 0.001$ | 0.40 |
| How confident are you in your ability to support forest conservation or reforestation projects? | Confidence | 5.28 | 2.88 | 6.46 | 2.72 | $t(124) = 4.43$, $p < 0.001$ | $p < 0.001$ | 0.40 |
| How easy do you think it is to support/donate to forest conservation or reforestation projects that want to protect nature? | Friction Reduction | 6.43 | 2.87 | 7.57 | 2.12 | $t(124) = 4.63$, $p < 0.001$ | $p < 0.001$ | 0.41 |

(*continued on next page*)

**Table 3** (*continued*)

| Continuous Outcomes | Psychological Construct | Pre Score | | Post Score | | Test | Adjusted *p* | Cohen's d |
|---|---|---|---|---|---|---|---|---|
| | | M | SD | M | SD | | | |
| Donating to forest conservation or reforestation projects is the right thing to do | Attitude (Moral Rightness) | 7.49 | 2.48 | 8.03 | 2.20 | $t(124) = 2.98$, $p = 0.003$ | 0.005 | 0.27 |

**Note.** To address the possibility of false discoveries due to multiple comparisons, we apply the Benjamini & Hochberg method (1995) to control the false discovery rate, and report adjusted p-values.

**Table 4**
McNemar's tests for all binary outcomes.

| Binary Outcomes | Yes $_{T1}$ to Yes $_{T2}$ | No $_{T1}$ to Yes $_{T2}$ | Yes $_{T1}$ to No $_{T2}$ | No $_{T1}$ to No $_{T2}$ | McNemar's Test | Adjusted p value |
|---|---|---|---|---|---|---|
| Do you think that people should drive a fully electric car? | 86 | 14 | 8 | 17 | $\chi2\ (1) = 1.63$, $p = 0.201$ | 0.230 |
| Do you think community solar is available for renters? | 21 | 91 | 1 | 12 | $\chi2\ (1) = 88.04$, $p < 0.001$ | <0.001 |
| If people have the choice, should they get their electricity from community solar? | 112 | 10 | 0 | 3 | $\chi2\ (1) = 10.00$, $p = 0.002$ | 0.003 |
| Would you like to sign up for community solar? | 43 | 17 | 8 | 37 | $\chi2\ (1) = 3.24$, $p = 0.072$ | 0.083 |
| Do you think that people should eat less meat? | 104 | 2 | 13 | 6 | $\chi2\ (1) = 8.07$, $p = 0.004$ | 0.005 |
| Would you like to learn more about how to reduce your meat consumption? | 37 | 12 | 15 | 29 | $\chi2\ (1) = 0.33$, $p = 0.564$ | 0.564 |
| Would you like to sign up for a tax-deductible donation to Rare to support forest conservation or reforestation projects? | 67 | 2 | 18 | 11 | $\chi2\ (1) = 12.80$, $p < 0.001$ | <0.001 |

**Note.** To address the possibility of false discoveries due to multiple comparisons, we apply the Benjamini & Hochberg method (1995) to control the false discovery rate, and report adjusted p-values.

A third limitation to consider is that although we assessed constructs that are central to theories like Value Beliefs Norm Theory and the Theory of Planned Behavior, we did not capture all possible psychological mechanisms. Our outcome selection was limited both by the content of the exhibit, which focused on the outcomes presented earlier, and by potential costs that would have required a larger per-participant payment. Finally, a fourth limitation and potential future direction is the inclusion of an additional timepoint after exposure to the exhibit. The results highlight a meaningful shift for participants who were exposed to the exhibit; however, it's not clear whether these findings are short lived or long-lasting. Participants were surveyed either immediately after or later in the day following the exhibit (depending on personal preference); thus, we cannot determine whether the observed effects persisted a few days, weeks or months later.

## 5. Conclusion

The present investigation highlights the effectiveness of an easy-to-implement community intervention that shifted several key psychological antecedents of proenvironmental behaviors across four key environmental issues of our time: switching to electric vehicles, adopting community solar, reducing meat consumption and supporting forest conservation and reforestation efforts. We hope that these findings serve as a reminder of the need to conduct more community-engaged research. Such research could not only advance our scientific understanding of behavior change, but it can also meaningfully change perceptions around key environmental issues, ultimately increasing concern for and willingness to meaningfully engage with environmental issues relevant to one's community.

## Declaration of interest

Ashraf, Gomez, Lowenstein, Tariq, and Niles are or were during the time the study was conducted, employed at the environmental nonprofit Rare. Rare's work includes conducting research on interventions to increase adoption of climate friendly behaviors and the design and implementation of interventions like the one studied here.

## CRediT authorship contribution statement

**Stylianos Syropoulos:** Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Sania Ashraf:** Conceptualization, Data curation, Funding acquisition. **Olivia Gomez:** Conceptualization, Data curation, Funding acquisition. **Frank Lowenstein:** Conceptualization, Data curation, Funding acquisition. **Anam Tariq:** Conceptualization, Data curation, Funding acquisition. **Travis Niles:** Conceptualization, Data curation, Funding acquisition. **Mary Fischer:** Conceptualization, Data curation. **Liane Young:** Supervision, Writing – review & editing. **Erez Yoeli:** Conceptualization, Supervision, Writing – review & editing.

## Acknowledgements

We are thankful to Erik Thulin and Dave Rand for their insight and feedback on previous versions of the manuscript. We thank Brandeis University for hosting the exhibits during the study.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2024.102369.

## References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B, 57*, 289–300. https://doi.org/10.1111/j.2517-6161.1995.tb02031.x

Bergquist, M., Thiel, M., Goldberg, M. J., & der Linden, Van (2023). Field interventions for climate change mitigation behaviors: A second-order meta-analysis. *Proceedings*

*of the National Academy of Sciences, 120*(13), Article e2214851120. https://doi.org/10.1073/pnas.2214851120

Brick, C., Sherman, D. K., & Kim, H. S. (2017). "Green to be seen" and "brown to keep down": Visibility moderates the effect of identity on pro-environmental behavior. *Journal of Environmental Psychology, 51*, 226–238. https://doi.org/10.1016/j.jenvp.2017.04.004

Cialdini, R. B., & Jacobson, R. P. (2021). Influences of social norms on climate change-related behaviors. *Current Opinion in Behavioral Sciences, 42*, 1–8. https://doi.org/10.1016/j.cobeha.2021.01.005

Clorery, P. (2023). Nonprofit vs. Philanthropy: Public is drawing A trust distinction. The NonProfit Times. Accessed via https://thenonprofittimes.com/npt_articles/nonprofit-vs-philanthropy-public-is-drawing-a-trust-distinction/#:~:text=Small20businesses20and20nonprofits20are,2425)20remains20considerably20lower.

CNN. (2023). Presidential results Accessed via https://www.cnn.com/election/2020/results/president.

Constantino, S. M., Sparkman, G., Kraft-Todd, G. T., Bicchieri, C., Centola, D., Shell-Duncan, B., Vogt, S., & Weber, E. U. (2022). Scaling up change: A critical review and practical guide to harnessing social norms for climate action. *Psychological Science in the Public Interest, 23*(2), 50–97. https://doi.org/10.1177/15291006221105279

Corner, A., Roberts, O., Chiari, S., Voller, S., Mayrhuber, E. S., Mandl, S., & Monson, K. (2015). How do young people engage with climate change? The role of knowledge, values, message framing, and trusted communicators. *WIREs Climate Change, 6*(5), 523–534. https://doi.org/10.1002/wcc.353

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175–191. https://doi.org/10.3758/BF03193146

Geiger, N., Swim, J. K., & Fraser, J. (2017). Creating a climate for change: Interventions, efficacy and public discussion about climate change. *Journal of Environmental Psychology, 51*, 104–116. https://doi.org/10.1016/j.jenvp.2017.03.010

Gifford, R., Kormos, C., & McIntyre, A. (2011). Behavioral dimensions of climate change: Drivers, responses, barriers, and interventions. *WIREs Climate change, 2*(6), 801–827. https://doi.org/10.1002/wcc.143

Goldberg, M. H., Gustafson, A., Rosenthal, S. A., & Leiserowitz, A. (2021). Shifting Republican views on climate change through targeted advertising. *Nature Climate Change, 11*, 573–577. https://doi.org/10.1038/s41558-021-01070-1

Howe, P., Mildenberger, M., Marlon, J., & Leiserowitz, A. (2015). Geographic variation in opinions on climate change at state and local scales in the USA. *Nature Climate Change, 5*, 596–603. https://doi.org/10.1038/nclimate2583

Intergovernmental Panel on Climate Change. (2023). Climate change 2023, synthesis report Accessed via https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

Lee, K., Gjersoe, N., O'Neill, S., & Barnett, J. (2020). Youth perceptions of climate change: A narrative synthesis. *WIREs Climate Change, 11*(3), e641. https://doi.org/10.1002/wcc.641

Marghetis, T., Attari, S. Z., & Landy, D. (2019). Simple interventions can correct misperceptions of home energy use. *Nature Energy, 4*, 874–881. https://doi.org/10.1038/s41560-019-0467-2

Marlon, J., Neyens, L., Jefferson, M., Howe, P., Mildenberger, M., & Leiserowitz, A. (2021). Yale climate opinion maps 2021 Accessed via https://climatecommunication.yale.edu/visualizations-data/ycom-us/.

Miller, L. B., Rice, R. E., Gustafson, A., & Goldberg, M. H. (2022). Relationships among environmental attitudes, environmental efficacy, and pro-environmental behaviors across and within 11 countries. *Environment and Behavior, 54*(7–8), 1063–1096. https://doi.org/10.1177/00139165221131002

Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2017). Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research, 25*(6), 791–812. https://doi.org/10.1080/13504622.2017.1360842

Rode, J. B., Dent, A. L., Benedict, C. N., Brosnahan, D. B., Martinez, R. L., & Ditto, P. H. (2021). Influencing climate change attitudes in the United States: A systematic review and meta-analysis. *Journal of Environmental Psychology, 76*, Article 101623. https://doi.org/10.1016/j.jenvp.2021.101623

Sparkman, G., Geiger, N., & Weber, E. U. (2022). Americans experience a false social reality by underestimating popular climate policy support by nearly half. *Nature Communications, 13*, 4779. https://doi.org/10.1038/s41467-022-32412-y

Stern, P. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*, 407–424. https://doi.org/10.1111/0022-4537.00175

U.S. Census Bureau. (2023). QuickFacts Boston city, Massachusetts Accessed via https://www.census.gov/quickfacts/fact/table/bostoncitymassachusetts/PST045222.

van der Linden, S., & Goldberg, M. H. (2020). Alternative meta-analysis of behavioral interventions to promote action on climate change yields different conclusions. *Nature Communications, 11*, 3915. https://doi.org/10.1038/s41467-020-17613-7