

# A megastudy of behavioral interventions to catalyze public, political, and financial climate advocacy

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## Abstract

Addressing climate change depends on large-scale system changes, which require public advocacy. Here, we identified and tested 17 expert-crowdsourced theory-informed behavioral interventions designed to promote public, political, and financial advocacy in a large quota-matched sample of US residents ( $n = 31,324$ ). The most consistently effective intervention emphasized both the collective efficacy and emotional benefits of climate action, increasing advocacy by up to 10 percentage points. This was also the top intervention among participants identifying as Democrats. Appealing to binding moral foundations, such as purity and sanctity, was also among the most effective interventions, showing positive effects even among participants identifying as Republicans. These findings provide critical insights to policymakers and practitioners aiming to galvanize the public behind collective action and advocacy on climate change with affordable and scalable interventions.

**Keywords:** climate change, collective action, advocacy, interventions, megastudy

## Significance Statement

Climate change is a collective problem that can only be addressed with collective solutions. To identify scalable strategies for mobilizing public, political, and financial climate advocacy in the United States, we conducted a behavioral megastudy with over 30,000 participants in an approximately representative sample of the US public. The most successful of 17 behavioral interventions tested emphasized people's ability to create large-scale change (collective efficacy) and the positive emotions they can gain from doing so; highlighting moral values like purity and sanctity was also highly effective. These results suggest that simple, low-cost messages can help mobilize public support for climate action at scale and can inform how policymakers, advocates, and civil society design public outreach.

## Introduction

Climate change is among the most threatening and complex problems facing modern society (1). Beyond the increase in and rising cost of natural disasters, such as hurricanes, wildfires, floods, and droughts (2, 3), increasing temperatures are projected to decrease crop yields (4), increase fresh water insecurity (5), and leave 1 to 3 billion people outside the range of optimal human habitation (i.e. human climate niche) within the next few decades (6). Current policies are insufficient to maintain safe planetary boundaries for human civilization (7), and countries around the world are failing to meet their climate commitments and sustainable development goals (1). Given the critical role of the public in demanding climate mitigation at all levels (8–13), here, we identify and evaluate behavioral interventions aimed at stimulating collective climate action.

We define “collective climate action” as people’s engagement in climate advocacy behavior, either as organized groups or as unorganized collectives, to trigger beneficial structural change (14–16). Prior research on collective climate action suggests that participation in collective action is primarily influenced by social norms and group identification (17–20). Other research has found that collective climate action is instead more strongly influenced by psychological distress (16), collective hope (21), or collective efficacy (22–24). However, these different theories of how to most effectively catalyze collective action in the climate change domain have only been tested independently of each other and on different facets of collective action, limiting the ability to make direct comparisons among various strategies and optimize their implementation (25, 26). To address this concern, here, we adopted a megastudy design, a large-scale experiment that tests many interventions concurrently on a shared outcome in a common sample

(25, 27, 28). This type of design enables direct comparisons of multiple mechanisms, overcomes the comparability limitations of single-study research, and accelerates research by testing multiple hypotheses simultaneously. This approach is particularly valuable in addressing urgent policy challenges where decision-makers need clear evidence of which theoretical framework works best, for whom, and under what conditions (27).

While recent work has demonstrated the promise of large-scale megastudies in identifying behavioral interventions for climate mitigation (26, 29), such studies suffer from their narrow focus on individual-level behaviors such as tree planting (26), or from their exclusive reliance on behavioral intentions (29). To address these critical limitations, we conducted one of the largest behavioral science megastudies to date, testing 17 expert-developed, theory-informed interventions aimed at catalyzing collective action on climate (Table 1). Each intervention was submitted through an open call to behavioral scientists and practitioners (50), an approach that promotes diversity in perspectives and intervention design (51) and has been proven effective in identifying promising behavioral interventions (26).

We evaluated each intervention’s effect on three distinct categories of climate advocacy, focused on mobilizing action among different key actors and outcomes: public awareness advocacy, political/policy advocacy, and financial advocacy, as preregistered. First, we focused on advocacy aimed at raising public awareness about climate change by joining climate advocacy groups, committing to share information about climate change, and committing to attend climate events and demonstrations. This type of advocacy could, under certain conditions, be effective at triggering structural change, provided it engages a large enough proportion of the population (52, 53). For instance, over a quarter

**Table 1.** Intervention names (ordered alphabetically), theoretical frameworks, brief descriptions, and example quotes.

Intervention	Description	Examples
Binding moral foundations (30)	Uses moral reframing to appeal to purity and create a sense of loss caused by climate change. Prompts participants to write about whether America's natural world should be kept pure and sacred.	"America's pristine nature, our sacred natural monuments and symbols must be preserved. We must fight against what is tainting our lands before it is too late. We must stop polluting the air. We must stop emitting unsustainable amounts of carbon into the air. We are causing the earth to warm and the warming is spoiling the purity of our national parks. If we don't fight climate change's effects on our nation's greatest wonders, it will be a blemish on our history." "How much do you believe America's treasures should be kept pure, pristine, and sacred?"
Bipartisan elite cues (31)	Emphasizes how non-partisan experts as well as bipartisan coalitions support climate action.	"In the White House ceremony for the Bipartisan Bill, speakers from both the Republican and Democratic parties, including President Joe Biden (D), Vice-President Kamala Harris (D), Senator Mitch McConnell (R), and Senator Rob Portman (R) celebrated the bipartisan nature of the bill and highlighted some of its initiatives."
Climate activist perspective taking (32)	Conveys the emotional journeys of climate activists and prompts participants to write about their own negative experiences with environmental pollution.	From video: "I'm not an expert, I'm a local person. I've been fighting against this. I've been trying to protect the land 300 meters above my garden." "Take the next 3 minutes to reflect and write about a time when you had a negative experience due to environmental pollution and degradation, or due to a climate disaster (hurricane, wildfire, flood, drought), or simply due to the realization that your future and your children's future is in danger because of climate change."
Climate policy literacy (33)	Details three climate policies: a ban on new combustion-engine cars by 2030, a carbon tax, and a green infrastructure program.	From video: "A green infrastructure program would bring about the transition in energy infrastructure needed to halt climate change. In the U.S., 1.5 million people could find a job in green sectors."
Co-benefits (34, 35)	Emphasizes the co-benefits of climate action, such as economic growth and improved health. Prompts participants to write about the co-benefits of climate action they experienced.	From image: "Investments in innovative technology can improve our industrial and agricultural systems and lead to decreased costs for energy and materials. This in turn strengthens productivity (...) creating more jobs and economic growth. Or think about wind farms and rooftop PV. We'll be more independent from fossil fuels and increase energy security. This can improve the air we breathe, water we drink, and the food we eat. And would provide us with affordable energy and prevent conflicts over oil and gas."
Collective efficacy and emotional benefits (36)	Highlights successful examples of collective actions (attending demonstrations, donating) and emphasizes emotional benefits of engaging in collective action. Prompts participants to write about such experiences.	"Have you heard about successful climate campaigns like the Sunrise Movement? These climate campaigns rely on many tactics, such as encouraging people to contact their public officials to demand climate action. These campaigns can be very successful! For example, a climate activist group called the Sunrise Movement managed to advance climate policies through the IRA (Inflation Reduction Act).!" "By taking action today, you can boost your happiness and build deep connections with others!"
Connecting to ecological disruptions (37)	Creates a universal pro-environmental narrative highlighting the interconnectedness of human and environmental health.	"Migratory birds are arriving too early or too late, further thinning the margins of survival on an already arduous journey. The warming ocean, the changing of climate, the dissolution of century old cycles—all of it is throwing the ecosystems of South Florida into disarray."
Dynamic anger norm (38)	Highlights the growing bipartisan anger about climate inaction.	"Research has found that more and more Americans report feeling angry about climate change. Now, around 57% of Americans are angry about U.S. inaction on climate change."
Global health threat (39)	Reframes climate change as a health issue, emphasizing its impacts on human health and the need for preventive action.	"Experts on global health warn that climate change is the biggest global health threat of the 21st century. Climate change affects our health. We suffer more from UV (ultraviolet) radiation, heat stress, allergies and air pollution. Climate change also affects our drinking and bathing water, our food and the prevalence of infectious diseases."
Guilt-based collective responsibility (23, 40)	Emphasizes Americans' shared collective responsibility for historical CO <sub>2</sub> emissions.	"The United States ranks among the highest in terms of CO <sub>2</sub> emissions per capita. And right because we are a large emitter, cutting our emissions not only fulfills our obligation to address climate change but also can have a great impact on climate mitigation worldwide!"
Hope and anger narratives (41)	Exposes participants to emotional real-life stories of environmental degradation and successful citizen actions, drawing attention to emotional reactions to these narratives.	"Christian and Harper are protesting outside the Town Hall, demanding that the burning of low-quality fuel in stoves be banned. Thanks to their protest, the authorities impose the ban and decide to allocate additional subsidies for the replacement of stoves in the homes of residents who cannot afford it on their own. Notice your emotions." "August is a senator and his wife works at a state-owned company responsible for heavy environmental pollution. August blocks financial support for climate action to protect his wife's financial interests. Notice your emotions."

(continued)

Table 1. Continued

Intervention	Description	Examples
Linking individual and structural change (42)	Conveys the importance of individual actions at promoting climate advocacy and increasing perceived collective efficacy. Prompts participants to write about ways in which they believe they can make social change.	“Experts have shown that individual actions can reduce carbon emissions, which increase climate change, by up to 70% through lifestyle changes, political actions and social influence. Specific actions include: political actions like voting, protesting, signing petitions, and making calls; pressuring businesses through purchasing choices or by boycotting certain products; speaking with family, friends, peers and strangers about climate change; public and private lifestyle choices like eating less meat, taking public transit or driving an electric vehicle, purchasing energy efficient appliances or rooftop solar; social influence by taking public actions like the ones above, thereby influencing others to do the same. We would like to know whether you think that you, as an individual, can create broad social change, even for issues that seem at first very large.”
Misperception correction: risks (43, 44)	Corrects misperceptions about the costs of climate change at the household level and highlights the importance of climate action. Prompts participants to write about personal climate disruptions, and personal climate engagement.	“Is climate change increasing or decreasing prices of energy; consumer goods, including food; healthcare; dependent care? “Everyday personal choices like eating less meat make a difference! However, larger wins against climate change can only be achieved through when people act together.” “Please take a moment to write about the issue you indicated would be the most disruptive to your everyday life. How has this issue previously affected you or your loved ones, or how might it affect you in the future?” “Please take a moment to write about some ways in which you would consider getting involved to combat climate change.” “Being pro-environmental allows us to protect and preserve the American way of life. It is patriotic to conserve the country’s natural resources. It is important to protect and preserve our environment so that the United States remains the United States.” “Think about why it is patriotic to conserve the country’s natural resources. Reflect on the importance of protecting and preserving our environment so that the United States remains the United States.”
System justification (45)	Frames climate change as a threat to the American lifestyle, emphasizing pro-environmental behavior as a patriotic act. Prompts participants to write about the importance of protecting the environment for patriotic reasons.	From video: “It is the fossil fuel company BP that really popularized the idea of a carbon footprint, because it took away the focus off of big polluters and put it onto everyday people as if we are all to blame for the energy system around us. So the paradigm shift is toward organizing, if you want to change the system.”
Shifting focus from individual to collective action (46)	Challenges individual responsibility for climate change and emphasizes the need for collective action, in a talk delivered by a scientist.	“The sea levels will rise, hurricanes will become stronger, droughts will wreak havoc on food supplies, and there will be incredible heat waves. Although these will affect us all, our most vulnerable people—children, the elderly, and the poor—are likely to suffer the most since they are the least able to avoid all the harmful effects of climate change. This is unfair and unjust. They contributed the least to the problem, yet will suffer the most.”
Threat, injustice, and efficacy (47)	Pairs fear-based appeals about climate change with potential solutions. Prompts participants to write about whether taking climate action will increase justice and fairness.	“What do you think? Will taking action against climate change help lead to a more fair and just place?”
Letter to future generations (benchmark condition, based on effectiveness in prior work) (26, 48, 49)	Emphasizes how current actions affect the future generation by prompting participants to write a letter to a child they know, explaining current actions to keep the Planet habitable for them.	“This letter is a message from you. In it, you tell this family about all of the things you have done and want to do in the future to ensure that they will inherit a healthy, inhabitable planet. You tell them about your own personal efforts—however small or large—to confront the complex environmental problems of your time, from habitat loss to water pollution to climate change.” “On the next page, please write this letter. Describe the personal legacy you want to build and the efforts you are taking to ensure a more stable planet for them.”

of fossil fuel projects encountering social resistance have been canceled, suspended, or delayed, highlighting the power of social resistance (54).

Second, we focused on political advocacy, geared toward influencing policy through writing to representatives, self-reported petition signing, or committing to supporting climate focused representatives. Recent work has shown that policy makers and government officials underestimate their constituents’ support for clean energy policies (55), in part because of closer and

more frequent contact between conservatives and interest groups and congressional representatives (56, 57). By encouraging a quota-matched sample of American residents to contact their representatives, these interventions could help to correct representatives’ misperceptions of voters’ policy preferences. Moreover, including the costly behavior of writing an actual letter to one’s representative, which we delivered on behalf of participants, overcomes the exclusive reliance on intentions or self-reported behaviors, which are subject to social desirability



and inaccurate self-assessment, a major limitation of prior work in the field (58).

Third, we focused on financial advocacy, measured through an incentivized decision task to donate to climate organizations, and a commitment to divest from institutions investing in expanding fossil infrastructure. Climate organizations are critical to advancing national climate policy adoption (59), thus financially supporting such nongovernmental organizations directly impacts systemic mitigation efforts. Moreover, measuring real donation behavior to climate organizations, similarly to the letter writing outcome, aims to overcome the intention-action gap reported in prior work, thus increasing the external validity of this investigation (60). Finally, we also tested the effects of these interventions on commitments to making personal lifestyle changes (e.g. flying less and eating less beef, as individual-level actions with relatively high potential for emissions reduction compared with other lifestyle behavioral changes (61, 62)), to examine whether they are specifically effective at stimulating collective climate action or climate action more broadly. We expected different interventions to influence individual-level versus collective-level action, given recent work suggesting that the effects of climate interventions differ according to the outcome measured (26); for example, in a global intervention tournament, while writing a letter to a future generation member describing current climate actions was the most effective intervention at increasing climate policy support, negative emotion induction was the most effective at increasing social media sharing of climate information; and no intervention was successful at increasing an effortful tree planting behavior (26). Despite its comprehensiveness, this global study emphasized individual-level mitigation attitudes and behaviors (i.e. tree planting). But framing climate solutions in terms of individual-level actions has been found to induce feelings of helplessness and concerns about free riding (63) and has been hypothesized to distract from systems-level climate action (40, 62). In light of these considerations, our primary focus here remains on collective climate actions, while also measuring individual behavior change commitments for comparison. In addition to identifying promising interventions aimed at increasing climate advocacy, we also conducted exploratory analyses to probe the potential psychological mechanisms (e.g. positive and negative emotions, efficacy beliefs (36, 64, 65)) underlying their effects.

Finally, we examined potential heterogeneity in the effectiveness of the interventions depending on participants' political preferences, given recent findings showing differential impacts of climate interventions as a function of political ideology (66). Thus, we investigated whether political affiliation moderates the effects of the interventions on advocacy.

A large, quota-matched sample of US residents (Table S3) was recruited through Connect by Cloud Research, an online data collection platform. They were randomly assigned to one of 16 experimental interventions (Table 1), a no intervention control condition, or a benchmark condition (i.e. "letter to future generation," an intervention that was found to be the most effective pathway for increasing climate policy support and social media sharing in the United States in a prior megastudy (26)). Participants were then given opportunities to participate in public awareness advocacy (i.e. newsletter sign-ups, video sharing, and climate conversation/march attending commitments), political advocacy (i.e. petition signing, letter writing to representatives, and supporting climate-friendly representatives), financial advocacy (i.e. donation behavior and commitment to divest from fossil-funding banks), and personal lifestyle changes (i.e. intentions to reduce beef consumption and air travel) (see [Materials and methods](#)).

## Results

A total of 31,666 participants completed the study, of which 31,324 were included in the analyses according to the preregistered criteria (see [Materials and methods](#)). The sample size for each condition is provided in Table S4. At baseline (i.e. in the control condition;  $n = 1,739$ ), a majority of participants were likely to commit to lifestyle changes such as flying less (79%) or eating less beef (71%); also a large proportion of participants committed to engaging in financial advocacy, such as switching financial assets from banks investing in fossil developments (73%), in political advocacy such as supporting political campaigns of climate-friendly representatives (68%), and in public advocacy such as attending climate marches (65%) or having climate conversations (65%). Fewer participants, however, engaged in the behavioral outcomes, such as making real donations to environmental organizations (49%), or writing to their representative (41%). Even fewer participants reported joining climate organizations by subscribing to their newsletter (22%), signing petitions (19%), or sharing video information online (16%; Fig. 1; [Section S2](#)).

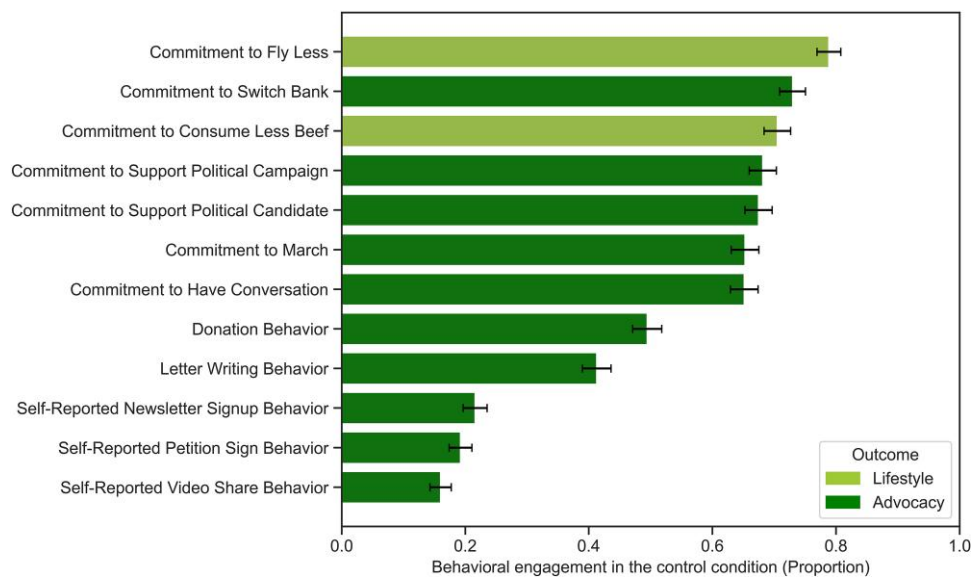
To compare intervention effects across different advocacy domains, we normalized all variables to be on the same 0.00–1.00 scale. This allowed us to compute composite scores for each category of advocacy by averaging the normalized values across items. Figure 1 shows the untransformed raw baseline proportions of behavior in the control group to give a sense of real-world prevalence; subsequent analyses use the normalized composite scores for consistency across mixed measurement types.

We conducted linear mixed effects models to investigate the effect of the interventions on the three preregistered categories of advocacy: (i) public advocacy (i.e. signing up for a newsletter, sharing a video on social media, committing to initiate a conversation about climate change, and committing to attend a climate march; Cronbach's  $\alpha = 0.75$ ); (ii) political advocacy (i.e. signing a petition, writing a letter to government representatives, and supporting climate-friendly politicians; Cronbach's  $\alpha = 0.76$ ); and (iii) financial advocacy (i.e. choosing to donate to environmental campaigns and committing to switch investments; Cronbach's  $\alpha = 0.64$ ) (Fig. 2). For comparison, we also investigated the interventions' effects on personal lifestyle changes (i.e. committing to eat less beef and take fewer flights; Cronbach's  $\alpha = 0.85$ ). In each of these four mixed models we included advocacy as the outcome variable, condition as the fixed effect, and by-participant random intercepts (although we preregistered also including by-item random intercepts, the models did not converge with the additional complexity introduced by the crossed random effects; we thus report models only including by-participant random effects).

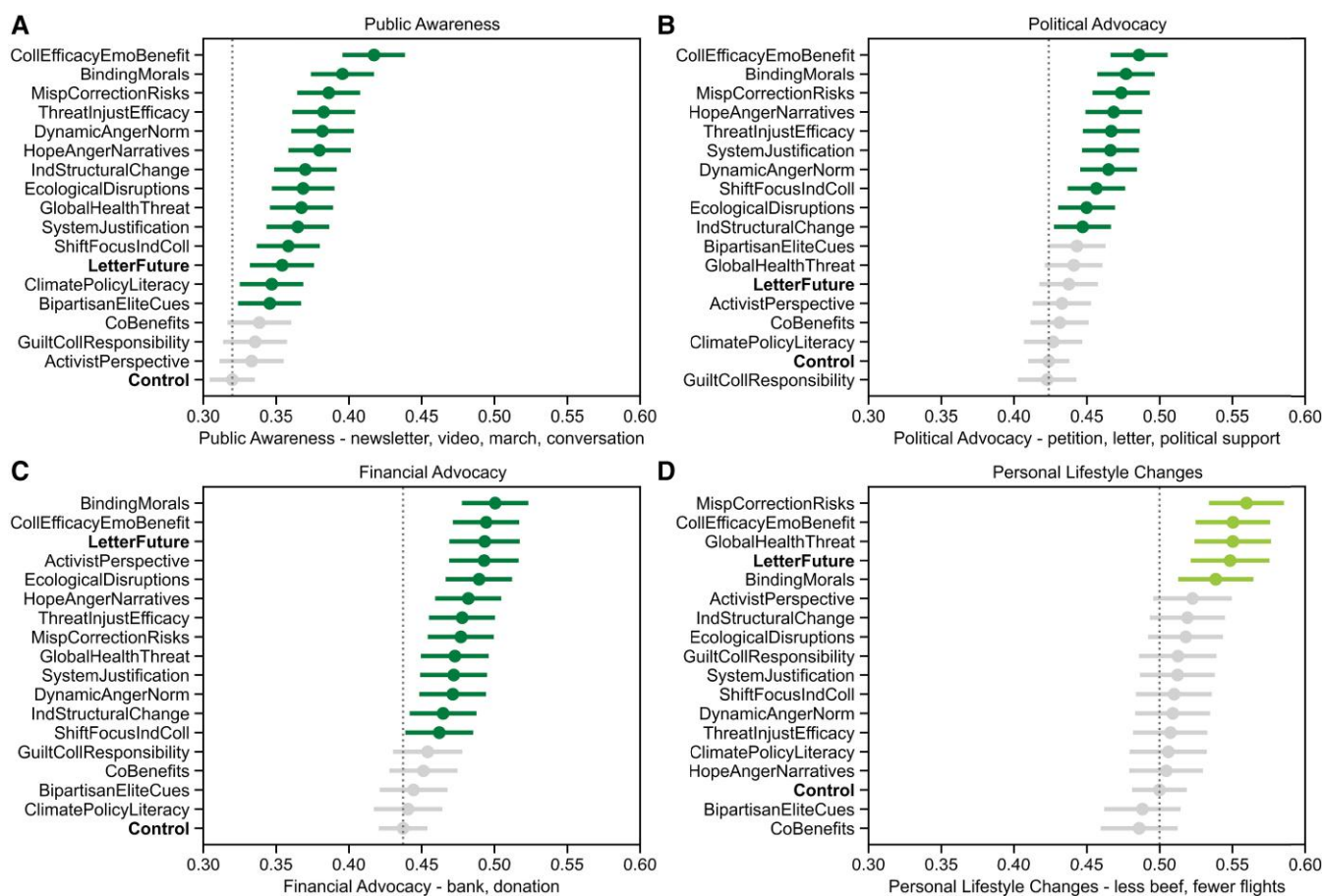
Following prior megastudies (25), we report unadjusted standard errors, two-sided  $P$ -values, and CIs, then apply the Benjamini-Hochberg (BH) procedure (67, 68) to control for multiple testing across 68 contrasts (17 conditions  $\times$  4 outcomes; [Section S13](#)). Additionally, we apply the James-Stein shrinkage procedure (69) to correct for the winner's curse (70, 71) ([Section S14](#)).

We found that the "collective efficacy and emotional benefit" intervention increased public awareness advocacy by 10 percentage points ( $b = 0.10$ , 95% CI [0.08–0.12],  $P < 0.001$ ,  $d = 0.30$ ; Fig. 2A; Table S16) and political advocacy by 6 percentage points ( $b = 0.06$ , 95% CI [0.04–0.08],  $P < 0.001$ ,  $d = 0.16$ ; Fig. 2B; Table S17), the highest increases compared with the control condition (although not significantly different from the second highest increases observed in the "binding moral foundations" intervention; see [Section S7](#) for pairwise comparisons between the top interventions).

The "binding moral foundations" intervention increased financial advocacy by 6 percentage points [ $b = 0.06$ , 95% CI [0.04–0.09],  $P$



**Fig. 1.** Baseline behaviors. Bars represent the proportion of participants who engaged in each behavior, grouped by lifestyle and advocacy actions in the control condition ( $n = 1,739$ ). Error bars represent 95% CIs.



**Fig. 2.** Average treatment effects on climate advocacy outcomes: public awareness advocacy (A), political advocacy (B), financial advocacy (C), as well as on personal lifestyle commitments (D) in a quota-matched sample of US residents ( $n = 31,324$ ). The points represent average treatment effects, and the error bars represent 95% CIs. The vertical dashed lines represent the mean for the control group. Bolded interventions represent the control conditions (i.e. pure control as “Control”) and the benchmark condition (i.e. as letter future).

$< 0.001$ ,  $d = 0.21$ ; Fig. 2C; Table S18), and the “misperception correction: risks” intervention increased personal lifestyle change commitments by six percentage points ( $b = 0.06$ , 95% CI [0.03–0.09],

$P < 0.001$ ,  $d = 0.26$ ; Fig. 2D; Table S19), the largest increases compared with control for those two outcome variables, respectively (although not significantly different from the second highest increases

triggered by the “collective efficacy and emotional benefit” intervention; [Section S7](#)).

Of the interventions initially significant at  $P < 0.05$  based on unadjusted tests, most remained significant after applying the BH correction, except for: “letter to future generations” on awareness advocacy (raw  $P = 0.029$ , BH-adjusted  $P = 0.062$ ), “global health threat, dynamic anger norm,” and “system justification” on financial advocacy (raw  $P \approx 0.03$ – $0.04$ , BH-adjusted  $P \approx 0.07$ – $0.08$ ), and “binding moral foundations” on lifestyle ( $P = 0.04$  vs.  $0.08$ ; [Section S13](#)). Additional validation checks (e.g. controlling for duration or stimuli type) are available in [Sections S3](#) and [S5](#), and results for individual outcome measures appear in [Section S8](#). Controlling for intervention duration did not meaningfully alter the pattern of results: the top-performing interventions in each outcome domain remained the same ([Section S3](#)). Finally, we observed a near-linear, monotonic decrease in engagement associated with outcomes that appeared later in the randomized outcome sequence, but controlling for this order effect did not meaningfully alter the relative effects of individual interventions; instead, it uniformly raised baseline engagement with the outcomes by roughly five percentage points across conditions ([Section S4](#)). This pattern likely reflects declining attention or survey fatigue over time, particularly for more effortful behaviors. In real-world campaigns, presenting high-effort actions (e.g. donations or letter writing) earlier in an engagement sequence, or including fewer tasks, may increase their uptake. Inverse-probability weighted-adjusted models closely mirrored the unweighted results, both in direction and relative ranking of interventions. Lee bounds, as expected, narrowed effects. Interventions such as “binding morals”, “collective efficacy with emotional benefit”, and “misperception correction” remained robust, while others attenuated and no longer reached significance. Complete inverse-probability weighting (IPW) and bounding results are reported in the [Section S15](#).

In exploratory analyses, we also investigated the effects of the interventions on two actual behaviors (as opposed to commitments or self-reported behavioral measures): writing a letter to a representative that was actually delivered ([Fig. 3A](#)) and donating to an environmental organization ([Fig. 3B](#)). The “system justification” intervention was most effective at promoting letter writing compared with control (OR = 1.27,  $b = 0.24$ , 95% CI [0.11–0.38],  $P < 0.001$ ). This result remained true in validation analyses restricting the sample to only participants who wrote in favor of

climate action (OR = 1.26,  $b = 0.23$ , 95% CI [0.09–0.37],  $P = 0.001$ ; see [Section S3.3](#)). For donation behavior, “binding moral foundations” was the most effective intervention compared with control ( $b = 0.07$ , 95% CI [0.04–0.10],  $P < 0.001$ ,  $d = 0.18$ ).

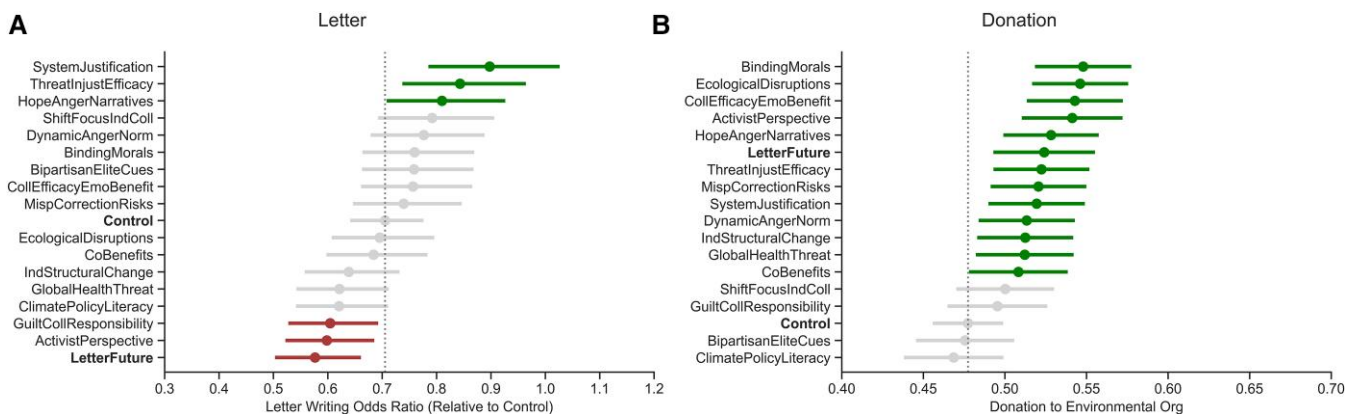
Given that one of the most effective interventions, the “collective efficacy and emotional-benefit”, combined two distinct psychological processes (efficacy beliefs and positive emotions), we conducted exploratory follow-up studies and mediation analyses to disentangle the mechanisms at play. These analyses, detailed in [Sections S9](#) and [S16](#), suggest that the intervention’s effectiveness was primarily driven by increased efficacy beliefs, though both the efficacy and emotional engagement components were crucial to its success.

We also explored whether intervention effects varied by political affiliation. Among participants identifying as Democrats, “collective efficacy and emotional benefit” was the most effective intervention at increasing public awareness advocacy ( $b = 0.09$ , 95% CI [0.06–0.13],  $P < 0.001$ ,  $d = 0.26$ ; [Table S60](#)) and political advocacy ( $b = 0.04$ , 95% CI [0.02–0.07],  $P = 0.002$ ,  $d = 0.11$ ; [Table S61](#)), while the “letter future” produced the largest increase in financial advocacy ( $b = 0.07$ , 95% CI [0.03–0.10],  $P < 0.001$ ,  $d = 0.21$ ; [Table S62](#); [Fig. 4](#)). Among participants identifying as Republicans, the “binding moral foundations” intervention led to the largest increase in financial advocacy ( $b = 0.07$ , 95% CI [0.02–0.11],  $P = 0.005$ ,  $d = 0.23$ ; [Table S70](#)), while most other interventions had limited effects. These effects held when weighting the model with Gallup poll data on national party affiliation ([Appendices S10.7–S10.9](#)) (72). Validation models can be found in [Section S10](#). Additional moderation analyses by demographic variables (e.g. age, gender, income, education, socioeconomic status, and ideology) can be found in [Section S11](#).

Finally, to assess the durability of effects, we recontacted participants 2 weeks after the initial survey. However, due to a low response rate (25%), the follow-up sample lacked sufficient power to detect longitudinal effects. These exploratory results are reported in [Section S12](#).

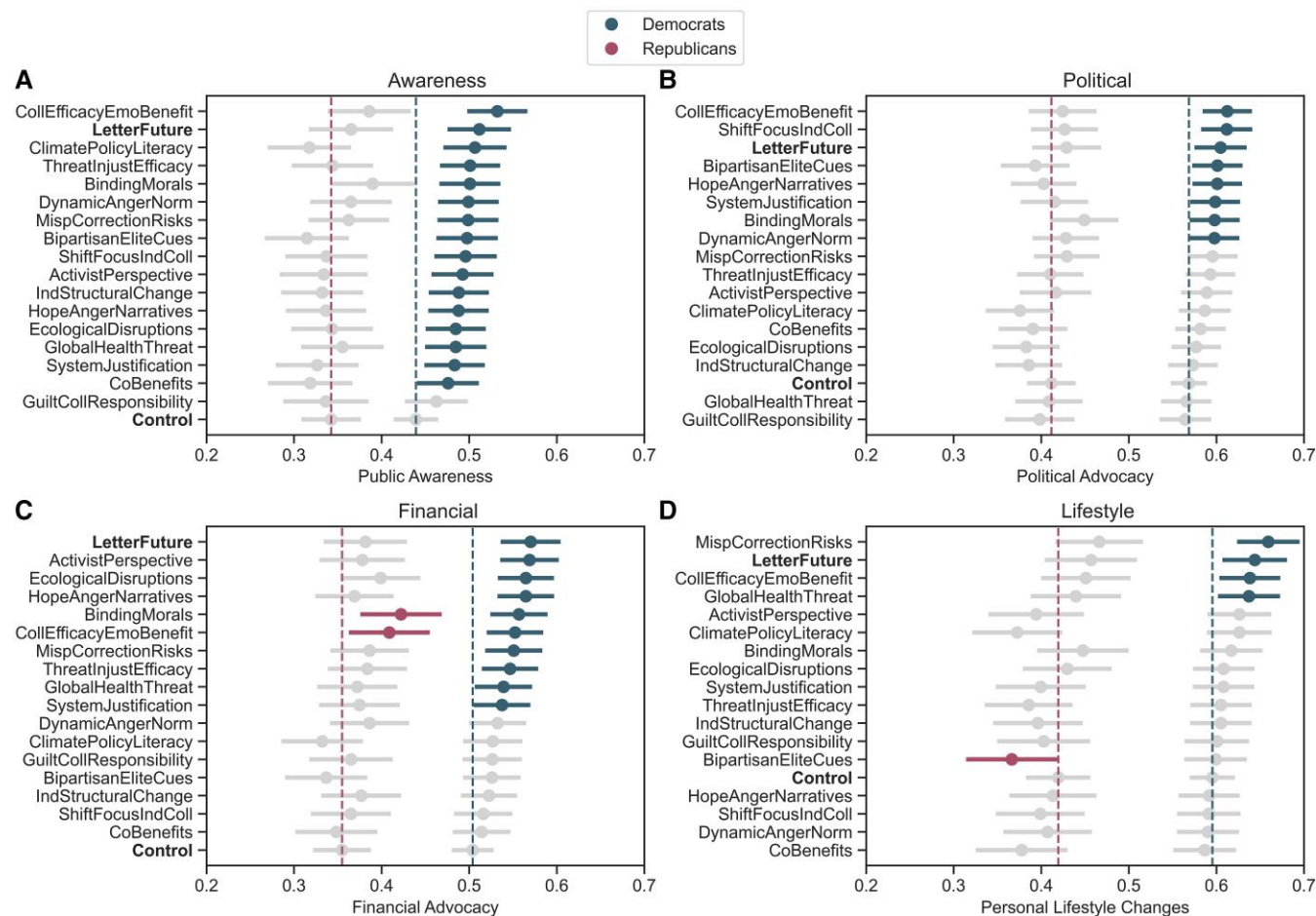
## Discussion

In a megastudy conducted on a large, quota-matched sample ( $n = 31,324$ ) that approximated the US population on age, race, gender, and ethnicity, we tested the effectiveness of 17 theoretically



**Fig. 3.** A) Relative odds ratios (adjusted by intercept) of a generalized linear model with decision to write a letter to government representative (binary variable) as the dependent variable and intervention condition (relative to control) as the fixed effect. B) Coefficients of a linear model with donations to environmental organizations (continuous variable from 0–10; normalized to 0–1) as the dependent variable and intervention condition (relative to control) as the fixed effect. The points represent the average treatment effects, and the error bars represent 95% CIs. The vertical dashed lines represent the mean for the control group. Bolded interventions represent the control conditions (i.e. pure control as “Control”) and the benchmark condition (i.e. as letter future).





**Fig. 4.** Political party affiliation ( $N_{\text{Democrat}} = 10,152$ ,  $N_{\text{Republican}} = 6,496$ ) differences in intervention effects (without controlling for other demographic covariates). The points represent the estimated effects of each intervention, and the error bars represent 95% CIs. The vertical dashed lines represent mean levels in the control group for Democrats (blue dashed line) and Republicans (red dashed line). Bolded interventions represent the control conditions (i.e. pure control as “Control” and benchmark condition as letter future).

derived, expert-crowdsourced behavioral interventions at promoting collective climate action through public, political, and financial advocacy.

One of the most effective interventions tested was “collective efficacy and emotional benefit”, which was designed to enhance personal efficacy beliefs and highlight the positive emotional benefits of climate action. While exploratory analyses suggest that this intervention’s effectiveness was largely driven by increases in efficacy beliefs, follow-up experiments suggest that both efficacy beliefs and positive emotions were critical processes additively contributing to the strength of the effect, neither process in isolation eliciting effects as high as their combination. Moreover, interventions that paired efficacy with negative emotional appeals (e.g. “threat injustice and efficacy”) or that omitted emotional content altogether (e.g. “linking individual and structural change”) were comparatively less effective. This pattern aligns with prior work suggesting that combining efficacy beliefs with positive emotions fosters climate engagement more effectively than efficacy or emotion alone (64, 73).

The “binding moral foundations” intervention, which appealed to purity and sanctity motives to stimulate advocacy, was also among the top interventions. This finding advances previous research suggesting that appealing to moral obligations can influence climate beliefs (30). This intervention was also the most effective at increasing real donations to an environmental

organization, pointing to its practical potential of triggering meaningful action that comes at an actual expense. Moreover, this intervention was effective even among participants identifying as Republicans. This finding aligns with prior work pointing to purity and sanctity as moral values endorsed by conservatives more than liberals in the United States (74), and it is particularly noteworthy given the stark difficulty of engaging people with a conservative ideology in climate action (66), a critical step in addressing the deeply polarized nature of climate change in the United States.

Although not among the most effective interventions at increasing the collective advocacy indices, the “system justification” intervention, which framed climate change as threatening to the American way of life and climate action as the patriotic response, was one of the most effective strategies to encourage participants to write a letter to their representatives. This finding advances previous work on the effectiveness of system-sanctioned change mechanisms in the United States (45, 75), critical to catalyzing social change.

Personal lifestyle change commitments were primarily influenced by the “misperception correction: risks” intervention, which corrected participants’ misperceptions about the consequences of climate change on employment prospects, prices, healthcare, and benefits of climate action. In addition to being the top strategy to encourage commitments to lifestyle changes, this intervention



was also effective at increasing climate advocacy, suggesting shared psychological pathways for individual- and collective-level climate action.

On the other hand, not all interventions produced uniform effects across outcomes. For example, the “letter future” benchmark intervention, in which participants were asked to write a letter to a socially close child describing their current climate actions (26), increased awareness and financial advocacy, as well as personal lifestyle commitments, but not political advocacy. However, among participants identifying as Democrats, “letter future” was the top intervention at increasing financial advocacy. These findings underline the variability and heterogeneity of effects, pointing to the importance of tailoring interventions to the outcome and audience of interest.

To assess the effects of the interventions tested across the various outcomes and demographic groups, including political ideology, gender, age, socioeconomic status, income, and education, we developed an interactive web tool in which the data can be queried as needed (<https://goto.stanford.edu/climate-advocacy>). We hope this data exploration web tool, along with the open-source raw data, will facilitate additional scientific investigations as well as practical applications. Moreover, many of the most effective interventions explicitly foregrounded collective action by referencing real-world organizing, highlighting collective efficacy, or prompting personal reflection on joining broader efforts. Interventions like “collective efficacy and emotional benefit”, “misperception correction: risks”, “shifting from individual to collective action”, and “linking individual and structural change” consistently ranked among the top performers. This pattern aligns with theories emphasizing that collective action salience boosts efficacy, emotional engagement, and readiness to act (17, 38). Future work could further isolate the specific role of outcome salience in intervention effectiveness by experimentally manipulating salience while holding content constant.

Despite widespread popularity, some interventions tested did not increase climate advocacy. For example, interventions such as “co-benefits,” emphasizing the additional benefits of climate solutions such as economic growth and improved health, or “guilt-based collective responsibility,” emphasizing Americans’ shared collective responsibility for historical emissions, were no different from the control condition at increasing any facet of climate action tested here. These results call into question the usage of such interventions to stimulate collective action on climate.

Additionally, we found partisan asymmetries in the effects of many of the interventions, offering insights into how identity shapes responsiveness to climate advocacy appeals. Among Democrats, many interventions increased advocacy, potentially by activating preexisting values, successfully nudging action. For Republicans, however, a majority of the interventions tested had limited impact, reflecting potentially reflecting resistance to perceived ideological messaging.

Notably, the randomized order of outcomes created a conservative testing environment, with outcomes that appeared later in the randomized sequence monotonically declining in engagement. Despite this feature of the design, several interventions still produced effect sizes as high as  $d = 0.30$ , suggesting they may be even more impactful in settings with fewer competing demands. These findings also highlight the practical importance of message sequencing: actions placed later in a communication stream may suffer from reduced engagement, particularly if they are costly or effortful. Strategically ordering opportunities to act (i.e. placing key behaviors earlier) could help maximize real-world impact.

A limitation of this study is the slightly uneven attrition across conditions, which may bias comparisons. To address this concern, we conducted robustness checks using IPW (76, 77), which supported our main findings. Moreover, despite our sample approximating the United States population on age, race, gender, and ethnicity, it is not a truly representative sample, and might embed biases associated with online panel samples. Nonetheless, given that the interventions were randomly assigned, between-condition comparisons remain valid for identifying relative treatment effects. Indeed, representative samples are not required to obtain generalizable estimates of effect sizes (78), convenience samples being adequate for estimating treatment effects (79, 80). However, we encourage future work to examine the effects reported here using even more representative samples.

Due to substantial attrition in our sample size at follow-up, which reduced our statistical power to detect effects, we did not detect any differences in the collective advocacy measures between the control and any of the treatment groups 2 weeks post treatment. Future work could provide additional incentives for recurrent participation, or use panel providers with higher recontact success to understand the durability of these interventions. Future research could also test additional theoretical interventions, as well as different modes of delivering interventions, such as using interactive games or immersive videos, and assess the longitudinal effects of repeated exposure to the intervention content on sustained collective climate action.

Indeed, it is critical to contextualize this investigation within the broader scope of behavior change interventions. Here, we only tested brief, online, and easy-to-implement information interventions to detect scalable, low-cost avenues for catalyzing collective action on climate. However, there is a broad array of behavior change interventions that were not examined, such as choice architecture or material incentives (81, 82), that may also prove effective at stimulating climate advocacy. Future work could compare the relative efficacy and cost of such interventions.

Another limitation of our study is the reliance on commitments or self-report measures for some of our outcomes, which can be subject to biases such as social desirability and inaccurate self-assessment, as well as to the well-documented intention-behavior gap (58). To address this concern, we measured two behaviors (donating money to environmental organizations and writing a letter to government representatives), and uncovered treatments that significantly increased these behavioral outcomes. Future research could incorporate additional behavioral measures and policy-relevant outcomes, and test them in field experiments deployed in target communities, to empirically validate and extend the present findings.

Extending the present investigation to additional countries with varying political, cultural, or environmental factors, would also help ensure the generalizability of the effects and uncover potential cultural moderators (83). Such follow-up work would also have the potential to unveil additional influential factors, such as infrastructure, laws, or entrenched power structures (84), that might play an important role in decisions to engage in collective climate action.

Overall, we tested the effects of 17 expert-crowdsourced theoretically derived behavioral interventions at increasing public, political, and financial climate advocacy in the United States. Our findings provide an empirical assessment of these theories’ impact on climate advocacy, with “collective efficacy and emotional benefit”, as well as “binding moral values”, emerging as the most effective theoretically informed approaches for catalyzing collective action on climate. These findings provide critical insights to

policymakers and practitioners aiming to galvanize the public behind collective action and structural solutions to climate change with relatively affordable and scalable strategies.

## Materials and methods

Preregistration: <https://aspredicted.org/hwmf-hvbn.pdf>.

### Participants

#### *A priori power analysis*

In an *a priori* power analysis (using the R package “webpower” (85)), we determined that for a one-way ANOVA with 18 conditions (16 interventions, a benchmark condition, and a control), in order to achieve 95% power to detect a small effect size  $f$  of at least  $f = 0.05$ , at an alpha level of 0.05, a sample of 11,632 participants is necessary. We also calculated that this sample would allow for 95% power to detect a small effect size Cohen’s  $d$  of at least  $d = 0.2$ , at an alpha level of 0.05 in two-tailed paired comparisons. Given we wanted to detect these effects at the 2-week follow-up and given expected attrition by the data collection provider, we aimed to recruit a sample of 20,000 participants at time 1.

#### *Sample*

We collected the data using the survey panel provider Connect by Cloud Research. During data collection, Cloud Research recruited 20,000 participants who completed 99% of the survey, as contracted. However, a sample of 31,666 participants completed the interventions and outcome variables. This larger-than-anticipated sample reflects an unexpectedly high number of participants who began and completed the intervention and outcome variable phases of the experiment before the system closed the study. The difference (7,784 participants), did not completely finish the survey and their demographic information is missing. Thus, while all the preregistered main analyses are based off of the full sample, the exploratory analyses (i.e. including covariates, mediators, or moderators) are based off of the restricted sample.

A total of 31,666 participants (approximately matched to US Census quotas by age, race, gender, and ethnicity) participated in the study. Seventy-nine participants were removed due to missing a unique identifier, and for 126 participants whose unique identifier appeared twice in the dataset, only the first occurrence of their data was retained. Then, as preregistered, participants who failed to answer the attention check question correctly (i.e. “Please select the color ‘purple’ from the list below”;  $n = 137$ ) were excluded from the analysis. Overall, 31,324 participants ( $M_{\text{age}} 48.01$ ,  $SD_{\text{age}} 17.32$ ; 60% women, 40% men, and 0% who identified as “other”) who passed the pretreatment attention check were included in data analyses.

Although this sample was approximately matched to US Census benchmarks on age, race, and ethnicity, it overrepresents women (see Discussion for implications).

At time 2, a total of 8,161 participants from the original sample completed the follow-up survey ( $M_{\text{age}} 38.85$ ,  $SD_{\text{age}} 12.79$ ). The sample consisted of 61% women, 39% men, and 0% who identified as other.

Participants were recruited by Cloud Research primarily through their Connect platform. All participants were US residents, verified by the panel provider based on panel registration information and demographic quotas. To minimize self-selection bias, the study was advertised under a neutral description (“new research study”), and climate change was not mentioned in the recruitment materials. Upon completion of the study, participants

received compensation in the amount they had agreed to with the platform through which they entered the survey.

A summary table reporting the number of participants who began the survey, completed the intervention, completed the outcomes, and completed the full survey, broken down by condition, is included in Table S5 to provide transparency on attrition patterns across groups.

To assess robustness to differential attrition, we conducted two supplementary analyses. First, we applied IPW (76, 77); using demographic and socioeconomic covariates to adjust for dropout. Second, we estimated Lee bounds (86) for each outcome domain, which provide conservative estimates under the assumption of monotonic attrition. Full details are reported in the Section S15.

Ethics approval was obtained from the New York University Institutional Review Board and all research was conducted in accordance with regulations.

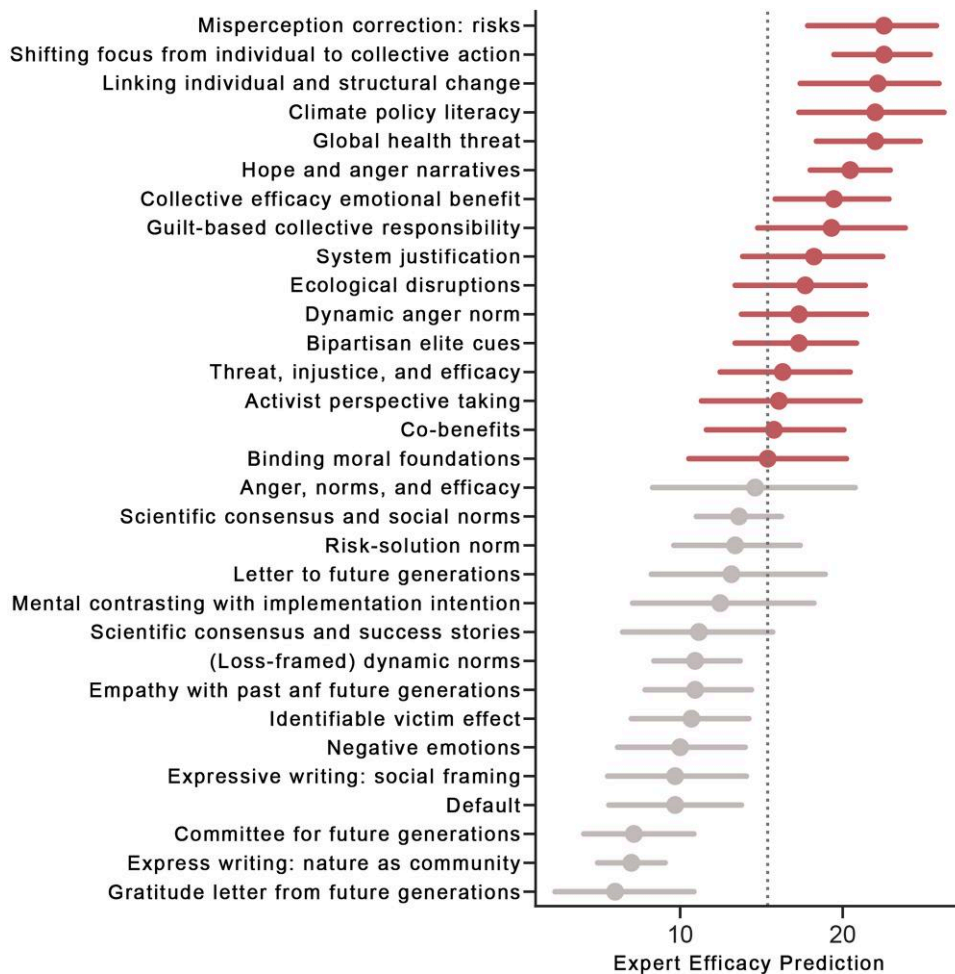
### Collaboration procedure

Following the methods from previous megastudies (26, 87), we launched a call for collaboration in January 2024 to crowdsource interventions from experts. The leadership team disseminated the open call for intervention submissions through multiple academic channels and social media platforms, aiming to reach a broad cross-section of researchers in environmental psychology, behavioral economics, and related fields, inviting experts to submit theoretically informed interventions aimed at promoting climate advocacy behaviors. Submitters were asked to adhere to our procedural guidelines (e.g. ethical, executable online, scalable, <5 min in duration) and target specific outcome variables (e.g. increasing public awareness through joining climate groups or attending demonstrations, political advocacy like writing to government representatives or signing petitions, and financial advocacy such as donating money or divesting from institutions supporting fossil fuels).

We received a total of 60 submissions, from which the leadership team (i.e. Danielle Goldwert, Sara Constantino, and Madalina Vlasceanu) identified 31 unique interventions suited for the preestablished dependent variables (Fig. 1). These 31 interventions along with their descriptions were then ranked by an expert advisory board (members: Anandita Sabherwal, Cameron Brick, Anna Castiglione, Ramit Debnath, Kimberly C. Doell, Rachit Dubey, Matthew Goldberg, Wei Ji Ma, Kristian S. Nielsen, Steve Rathje, Claudia R. Schneider, Michael Sheldrick, Ganga Shreedhar, Sander van der Linden). The board members were selected based on their breadth of expertise in climate communication, psychology, policy, and data science. We asked the advisory board members to score the interventions on theoretical merit and practical effectiveness in the context of our dependent variables (Fig. 5). Critically, the board was blinded to the specific authors of each submission during the ranking process, helping to mitigate potential bias.

Collaborators whose interventions were selected for the main study were contacted to coordinate the intervention implementation and programming on the Qualtrics survey platform (88). Feedback from the advisory board was provided for each submission to allow for necessary adjustments. Researchers whose interventions were conceptually or theoretically similar were invited to collaborate on a joint intervention.

The interventions were piloted by research assistants to ensure they met the target duration range of 4–5 min, and adjustments were made to reach this time range for consistency across treatments. The advisory board members were surveyed again



**Fig. 5.** Mean ranking of the 31 interventions by the advisory board. The advisory board was instructed to use their best judgment in scoring the interventions on both theoretical merit and practical potential. The dark red indicates the 16 interventions included in the study. The light pink indicates the interventions not tested here (except for the letter to future generations, which we included as a benchmark condition given its efficacy at increasing climate policy support in a prior megastudy (26)).

following the selection and implementation of the interventions, to ensure the label of each intervention accurately depicted their final implementation, and used a majority rule to select the final intervention labels.

## Experimental design

Participants signed up to complete the study, which was expected to take 15 min. They first read and signed the informed consent. An initial attention check (“Please select the color ‘purple’ from the list below.”) was used to screen out inattentive participants. Participants were then randomly assigned to one of 18 conditions: 16 experimental interventions (Table 1), a benchmark condition, or a control condition, in a between-subjects design. Participants in the control condition watched a 5-min, thematically unrelated video on how to tie knots, while those in the benchmark condition wrote a letter to a future generation member—an intervention that was found to most strongly increase policy support and social media sharing in the United States, in a previous megastudy (26). Participants in the experimental conditions were exposed to one of the 16 experimental interventions (Table 1).

Subsequently, all participants were directed to the outcome variable phase, where they were told they would “have the opportunity to take climate impactful actions, such as signing petitions, sharing information, registering to receive information, writing to

representatives, donating funds made available by our team, or committing to taking additional actions.” In randomized order, they were exposed to these outcome variables, which assessed their public awareness advocacy (e.g. registering for climate newsletters and committing to attending climate marches), political advocacy (e.g. signing a petition, writing to their local representative, and committing to support climate-friendly representatives), and financial advocacy (e.g. donating to environmental organizations and committing to moving money away from financial institutions investing in fossil fuels), as well as their commitment to various pro-environmental actions (e.g. reducing meat consumption, reducing flights). Participants were then asked to share a short informational video about climate change by the United Nations, on social media. Finally, participants were asked to rate their climate efficacy beliefs and climate emotions, after which they provided their demographic information, were debriefed, and compensated.

## Follow-up

Two weeks after their initial participation in the survey, all participants who passed the attention checks were invited to participate in a follow-up study. After providing consent, participants were asked whether they had engaged in a conversation about climate change in the past 2 weeks. They were then informed that they would have

“another opportunity to take climate impactful actions.” after which they were exposed to outcome variables resembling those at time 1. Finally, participants were debriefed, and compensated.

## Outcome variables

Time 1 outcome variables (as well as demographic variables, mediators, and moderators) are available for review at [https://nyu.qualtrics.com/jfe/form/SV\\_9X2uFiuZTGGMnFc](https://nyu.qualtrics.com/jfe/form/SV_9X2uFiuZTGGMnFc).

We assessed four primary outcomes:

1. Public awareness advocacy, including newsletter sign-ups, video sharing, and climate conversation/march commitments.
2. Political advocacy, including petition signing, letter writing, and supporting climate-friendly representatives.
3. Financial advocacy, including real donation behavior and commitment to divest from fossil-funding banks.
4. Personal lifestyle change, including self-reported intentions to reduce beef consumption and air travel.

Outcomes were measured using a mix of binary (e.g. signed or did not sign) or discrete (e.g. 0–100 commitment ratings or 0–10 donation amount) responses. To facilitate comparability across outcomes, all variables were normalized to a 0–1 scale and then averaged within each category to form composite scores. Cronbach’s alpha values for each composite ranged from 0.64 to 0.85, indicating acceptable internal consistency.

### Public awareness advocacy

#### Newsletter signup

At time 1, participants were given the option to sign up to the newsletters of two climate groups (i.e. 350.org and Citizens’ Climate Lobby). These newsletters were described as an opportunity to “learn about online campaigns, grassroots organizing, and mass public actions,” and featured an embedded panel allowing participants to directly subscribe (<https://350.org/?r=US&c=NA>). They were then asked whether they signed up through a binary choice task (e.g. “Did you sign up for the 350.com newsletter?” with options “yes” or “no”). At follow-up, participants were given the option to sign up to the Carbon Brief newsletter.

#### Commitment to march

At both times, we assessed participants’ commitment to attending climate marches with the following question: “Do you commit to participating in climate demonstrations,” which they rated on a scale from 0 = “definitely not” to 100 = “definitely yes.”

#### Conversation

At time 1, participants were asked “Do you commit to initiating a conversation about climate change with close others?” on a scale from 0 = “definitely not” to 100 = “definitely yes.” At time 2, participants were asked this same question, as well as an additional question: “In the past 2 weeks, did you have a conversation about climate change with someone?” with response options “yes” or “no.”

#### Video sharing

At time 1, participants were shown a video titled “Broken Record: UNEP’s #EmissionsGap Report 2023,” published by the UN Environment Programme (<https://www.youtube.com/watch?v=NvNjz1dnwqQ>). This video highlights the discrepancy between current global emission trajectories, based on national commitments, and the required reductions to limit global warming to 1.5 °C. In particular, it focuses on energy transitions in low- and middle-income

countries and explores the role of carbon dioxide removal in bridging the emissions gap. After watching the video, participants were asked, “Are you willing to share this information on your social media?”. Their response options were “yes,” “no,” and “I do not have social media.” At follow-up participants were shown another video by the UN Environment Programme, titled “We have #OnlyOneEarth (World Environment Day 2022).” This video addresses climate change and the urgent “code red” status of our planet, calling for collective, transformative action on a global scale to celebrate, protect, and restore our planet. After watching it, participants were again asked if they were willing to share the video on social media.

### Political advocacy

#### Petition

At time 1, participants were shown an Environmental Defense Fund petition titled “Don’t pour more fuel on the fire. Reduce methane emissions!” and were given the option to sign it. Participants were then asked whether they signed the petition in a binary choice task (i.e. “yes” or “no”). At time 2, participants were given the option of signing a different petition by the Environmental Defense Fund, titled “Strengthen U.S. air quality monitoring. Protect public health.”

#### Letter to representatives

Participants were given the opportunity to write a letter to their representative. They were asked “What would you say to your representative about climate change? Here you have the opportunity to express your thoughts about climate change, which we will forward to your local government representative based on your zip code. By responding to the question below, you agree to have your response shared with an actual government representative.” These letters were then shared without participant’s personally identifiable information, unless they chose to include that information in the letter content. To score responses for completion, we first excluded any responses that were fewer than 10 characters or consisted only of numerical digits. We then used GPT 3.5, a large-language model (LLM; (89)) to detect whether participants “expressed any opinion or clear thoughts about climate change, regardless of whether those thoughts are supportive, dismissive, or neutral.” The rating was not influenced by the participant’s stance on climate change or the detail of their response—only by whether they communicated a clear message about the topic, even if it was dismissive or brief. The LLM returned a numeric score: 0 to indicate the participant did not sufficiently answer the question, 1 to indicate the participant did sufficiently answer the question, or –1 to indicate that the LLM was unsure and that a human should check. These responses marked –1 ( $n = 150$ ) were then manually coded by the research team. We also conducted manual validity checks on a random selection of entries scored as 1 or 0. As an alternative analysis, we then used the LLM to detect whether participants expressed “supportive” opinions about climate action. The LLM returned a numeric score: 0 to indicate the participant expressed dismissive opinions or did not sufficiently answer the question, 1 to indicate the participant expressed supportive opinions, and –1 to indicate that the LLM was unsure and that a human should check. These responses marked –1 ( $n = 756$ ) were then manually coded by the research team. We also conducted manual validity checks on a random selection of entries scored as 1 or 0.

#### Supporting climate-friendly representatives

Participants were asked: “Do you commit to supporting political candidates that plan to take action to reduce climate change?”



on a scale from 0 = “definitely not” to 100 = “definitely yes,” with an option to select “Not Applicable/Not Eligible to Vote.” In total, there were 8,963 responses coded as “NA,” indicating that participants selected the “Not Applicable” option or skipped the question altogether. They were also asked, “How willing or unwilling would you be to join a campaign to convince elected officials to take action to reduce global warming?” on a scale from 0 = “extremely unwilling” to 100 = “extremely willing.”

### Financial advocacy

#### Donations

Participants had the option to donate a monetary bonus to an environmental organization or keep it for themselves. They were informed: “For the next question, we would like you to allocate \$10 between yourself and an environmental organization. We will randomly select 100 participants and actually implement their choices. You can give all of the money to the organization and keep none for yourself, or you can keep all the money for yourself and give none to the organization, or you can pick any split in between. If at least half of survey participants choose to allocate \$5 or more to the environmental organization, we will double the total donation pool. Remember, 100 participants will have their choices realized as a cash bonus or as a real monetary donation.” Participants were then asked to choose how to allocate the \$10 bonus.

#### Divest from bank

Participants were first presented with the following text: “Banks live and die on their reputations. Mass movements of money to fossil-free competitors puts those reputations at grave risk. By moving your money to a sustainable financial institution, you will: Send a message to your bank that it must defund fossil fuels; Join a fast-growing movement of consumers standing up for their future; Take a critical climate action with profound effects.” They were then instructed to check the embedded panel (<https://bank.green/>) to see if their bank funds fossil fuels and to learn more about their bank’s practices. Afterward, they were asked to report their bank’s rating with options including: “Your bank is great,” “Your bank is good,” “Your bank is okay,” “Your money is funding the climate crisis,” “Your money is being used to fund the climate crisis at an alarming rate,” or “Sorry, we don’t know enough about your bank yet.” Participants were then asked, “Do you commit to moving your money away from a bank that funds fossil fuels?” on a scale from 0 = “definitely not” to 100 = “definitely yes.” When cleaning the data, we recoded the responses of anyone whose bank scored “great” or “good” as NA ( $n = 4,109$ ). For time 2, an additional response option was included: “I already moved my money after checking the first time.”

### Additional outcome variables

#### Personal lifestyle changes

We assessed commitment to two behaviors which would have high impacts on mitigating individual contributions to climate change: flying less and eating less red meat. Participants were asked “Do you commit to flying less (e.g. 1 less flight) this year?” on a scale from 0 = “definitely not” to 100 = “definitely yes,” with an option to select “Not Applicable (e.g. ‘I already don’t fly’).” They were also asked “Do you commit to eating less red meat (e.g. swapping a meat-based meal for a vegetarian meal multiple times per week) this year?” on a scale from 0 = “definitely not” to 100 = “definitely yes,” with an option to select “Not Applicable (e.g. ‘I already don’t eat red meat’).”

### Efficacy

To assess participants’ efficacy beliefs, we asked “To what degree do you believe that your climate actions can help alleviate the threat posed by climate change?” and “To what degree do you believe that our collective climate actions can help alleviate the threat posed by climate change?” on a scale from 0 = “not at all” to 100 = “very much.”

### Emotions

Participants were asked to rate how strongly they experienced various emotions related to climate change. The question was, “When it comes to climate change and everything you associate with it, how strongly do you experience the following emotions?” They rated their emotions—anger, sadness, fear, guilt, hope, pride, disappointment, anxiety, joy, and disgust—on a scale from 0 = “not at all” to 100 = “extremely.”

### Demographics

Participants were asked to indicate their gender, age, education level, political orientation for economic and social issues, political party, household income, and perceived socioeconomic status.

### Interventions

See [Section S1](#) for full experimental condition (intervention) descriptions.

## Supplementary Material

Supplementary material is available at [PNAS Nexus](#) online.

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## Data Availability

All data and code are publicly available through the Open Science Framework (90). A web tool for rapidly assessing which intervention is most likely to be effective at increasing each outcome for any subsample target of interest—varying along demographics such as political ideology, age, gender, education, or income level—is available at <https://goto.stanford.edu/climate-advocacy>.

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