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Misperceived Social Norms and Willingness to Act Against Climate Change

Peter Andre Teodora Boneva Felix Chopra Armin Falk

April 2, 2024

Abstract: We document the individual willingness to act against climate change and study the role of social norms in a large sample of US adults. Individual beliefs about social norms positively predict pro-climate donations, comparable in strength to universal moral values and economic preferences. However, we document systematic misperceptions of social norms. Respondents vastly underestimate the prevalence of climate-friendly behaviors and norms. Correcting these misperceptions in an experiment causally raises individual willingness to act against climate change and individual support for climate policies. The effects are strongest for individuals who are skeptical about the existence and threat of global warming.

JEL codes: D64, D83, D91, Q51, Q54, Z13.

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1 Introduction

Climate change poses substantial threats to humankind and the environment at large (IPCC, 2022). Successful climate action critically depends on people's willingness to act and their support for political measures. To foster climate-friendly behaviors and further increase public support for climate policies, it is essential to understand the factors influencing individual decisions. In this context, practitioners and researchers alike have turned to examining the importance of social norms, which represent behavioral rules that express which behavior is considered common and normatively acceptable (e.g., Allcott, 2011; Nyborg et al., 2016; Fehr and Schurtenberger, 2018; Constantino et al., 2022). Social norms can exert a strong influence on individuals' attitudes and behaviors, potentially creating substantial momentum either in favor of or against climate action. Whether or not social norms can unleash a positive momentum crucially depends on how social norms are perceived (Geiger and Swim, 2016; Mildenberger and Tingley, 2019; Bursztyn et al., 2020).

In this paper, we present novel evidence on how climate norms are perceived in the United States, and we investigate the extent to which perceived norms and behaviors predict individual willingness to act against climate change. Using a survey experiment, we further provide causal evidence on the effect of two information treatments that provide people with truthful information about prevalent climate norms and behaviors in the United States. Our central contribution is to show that people in the US systematically misperceive prevalent norms and behaviors, but that correcting these misperceptions is possible, encourages climate-friendly behavior, leads to increased policy support, and is particularly effective among those who are more skeptical about the existence and threat of global warming.

To study individual willingness to fight climate change and the role of perceived social norms, we administer a survey to a large sample of 8,000 US adults who represent the general US population in terms of key sociodemographic variables. We elicit individual willingness to fight climate change using an incentivized donation decision. Respondents are asked to divide $450 between themselves and a charitable organization that fights global warming. This decision captures the central trade-off that individuals face when deciding whether to take climate action, namely the notion that protecting the climate comes at a

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cost. The more money the respondents are willing to forgo and donate, the higher their willingness to act against climate change. We incentivize the decision by implementing the choices of a random subset of participants.

We obtain detailed information on perceived social norms by asking respondents to estimate (i) the share of the US population that tries to fight global warming ('perceived behavior') and (ii) the share of the US population that thinks people in the US *should* try to fight global warming ('perceived norms'). We also elicit the perceived behavior and norms for a set of six concrete climate-friendly actions such as restricting meat consumption, avoiding flights, or using environmentally-friendly alternatives to fossil-fueled cars. In each case, we can compare participants' beliefs with the actual share of respondents who report that they engage in these actions or think this should be done. As we will discuss, the beliefs are incentivized, and we also study beliefs about the actual donation decision to address potential social desirability concerns for self-reported behavior. To put our analysis of social norms into context, we also measure economic preferences, using an experimentally validated module for patience, willingness to take risks, altruism, trust, positive reciprocity, and negative reciprocity (Falk et al. 2018, 2023), and moral universalism, drawing on the Moral Foundations Questionnaire (Haidt and Joseph 2004; Haidt 2012; Graham et al. 2013; Enke 2020).

We conduct our survey in two waves. Wave 1 establishes the basic descriptive facts, including the widespread misperception of climate norms. Wave 2 additionally includes a survey experiment, which allows us to study whether these misperceptions can be corrected and whether this, in turn, raises individual willingness to fight climate change. Respondents are randomized into a control condition or one of two treatments. The 'behavior treatment' provides respondents with truthful information about the proportion of the US population who try to fight global warming (62%), while the 'norms treatment' informs respondents about the true share of the US population who think that people in the US should try to fight global warming (79%). As we will discuss in greater detail, we mitigate the scope for experimenter demand effects through steps such as obfuscating the purpose of the information provision and incentivizing the donation outcome.

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Several findings emerge from our study. In a first step, we document large heterogeneity in individual willingness to fight climate change. Conditional on a large set of covariates, perceived social norms strongly predict individual willingness to fight global warming. A one-standard-deviation increase in the perceived share of Americans trying to fight global warming is associated with a $12 higher donation amount, while a corresponding increase in the perceived share of Americans who think that people in the US should try to fight global warming is associated with a $14 higher donation. To put those results into context, we compare the estimated effect sizes to the estimated effects of economic preferences and moral universalism. Among the economic preferences that we measure, patience, altruism, and positive reciprocity positively predict individual willingness to fight global warming. Similarly, individuals with universal moral values are more willing to fight climate change compared to individuals who endorse communal, in-group-oriented values. The descriptive analysis suggests that the estimated effects of a one-standard-deviation increase in perceived behaviors and norms ($12 and $14), are similar in order of magnitude to the estimated effect of a one-standard-deviation increase in patience ($15), positive reciprocity ($8), or universal moral values ($23), whereas the estimated effect of altruism is larger in magnitude ($52). Different factors are likely to influence individual decision-making. However, social norms hold high potential from the perspective of behavioral change. While it is hard to change economic preferences or moral values, at least in the short run, beliefs about social norms are likely to be considerably more malleable, and even large shifts in beliefs can be possible (Tankard and Paluck, 2016, 2017; Bicchieri, 2017), especially if beliefs are miscalibrated.

Indeed, in a second step, we document a large heterogeneity in beliefs about prevalent behaviors and norms in the US and find that respondents on average misperceive the prevalent social norms. 67% of respondents in our sample underestimate the true share of Americans who try to fight global warming, and 76% underestimate the true share of Americans who think that people in the US should try to fight global warming. The average perception gaps are sizable. For example, while 79% of Americans say that one should try to fight global warming, this fraction is perceived to be just 61%. We document similar patterns for several specific climate-friendly actions and for the incentivized donation decision.

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In light of our earlier results, this systematic underestimation of climate norms is concerning because it could hamper individual willingness to act against climate change. However, it also provides us with an opportunity to explore whether correcting these misperceptions can boost individual willingness to act.

Hence, in a third step, we report the results of our survey experiment. We find that correcting participants' beliefs about prevalent pro-climate behaviors and norms strengthens individual willingness to fight climate change. Being informed about the true share of Americans who try to fight global warming raises donations by $12 (or 4.7%), while being informed about the true share of Americans who think that people in the US should try to fight global warming increases donations by $16 (or 6.3%). A heterogeneity analysis reveals that the positive treatment effects on the donation amount are primarily driven by the subgroup of respondents whose prior beliefs lie below the actual shares. Reassuringly, we do not observe a back-firing effect among respondents with prior beliefs above the actual shares. For them, the estimated treatment effects are also positive, albeit insignificant.

We further explore whether the information treatments differentially affect individuals who are more or less skeptical about the existence and threat of human-caused climate change. We find that the information treatments are more effective for 'climate change skeptics', who may have been surprised to learn that they hold minority views. Additional analyses reveal that the larger effects among climate change skeptics are not solely driven by baseline differences in beliefs about the prevalence of social norms or differential belief updating. Instead, a more speculative account of why we observe larger effects among climate change skeptics relates to differences in moral values. Climate change skeptics exhibit much lower moral universalism, and we provide suggestive evidence that individuals who score low on the moral universalism index, i.e., endorse communal values, respond more strongly to our information treatments. Overall, the results are promising as they suggest that low-cost informational interventions may be well-suited to reach skeptical subgroups of the population who are otherwise difficult to reach and convince. As a result, social norm interventions could also reduce polarization. For example, informing Americans that most other Americans try to act against climate change, reduces the sizable baseline difference

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in climate donations ($142) between those who believe in human-caused climate change and those who do not by 27%.

Finally, we study whether the treatments causally affect individual support for climate policies (e.g. a carbon tax, subsidies for green energy, pollution regulation) and find that both treatments significantly raise support for climate policies. Again, the estimated treatment effects are stronger for the subgroup of the population who we classify as 'climate change skeptics'.

Our findings have important implications for climate politics. Misperceptions of climate norms prevail in the US and can form a dangerous obstacle to climate action. This phenomenon that has been dubbed pluralistic ignorance (Allport, 1924; Miller and McFarland, 1987; Bursztyn et al., 2020) could trap Americans in an equilibrium with low climate engagement. The majority may privately endorse climate action but incorrectly assume that it is not endorsed by others. This incorrect belief may discourage people from acting against climate change, thereby confirming other people's pessimistic beliefs. However, at the same time, this situation provides a unique opportunity to promote and accelerate climate-friendly behavior. Correcting prevalent misperceptions can encourage climate-friendly behavior and is a relatively simple, scalable, and cost-effective intervention. Our results suggest that social norms should play a pivotal role in the policy response to climate change. Policies that foster social norms should complement formal regulations. For example, while carbon taxation is an effective tool to curb CO_2 emissions, muted public support for such environmental policies has so far been a significant political constraint. Fostering social norms might alleviate these political constraints by increasing support for environmental policies.

Related literature Our central contribution is documenting that climate norms are misperceived in the US and providing causal evidence that correcting these prevalent misperceptions can promote climate-friendly behavior and increase policy support for climate policies. The estimated effects are strongest for those most skeptical of climate change. Our study thereby adds to a rich literature on social norms, sustainable behavior, and political polarization.

Misperceptions of social norms have been documented in different settings where social

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norms are in a phase of transition, giving rise to the phenomenon of pluralistic ignorance (Allport, 1924; Miller and McFarland, 1987; Kuran, 1991; Bursztyn et al., 2020). This general observation is echoed in an ongoing research effort to study misperceptions in the context of the climate or environment. Research in psychology and political science has found that many people underestimate how many others believe that climate change is real or dangerous, and has demonstrated that this underestimation can curb people's own engagement (Geiger and Swim, 2016; Leviston et al., 2013; Pearson et al., 2018; Mildenberger and Tingley, 2019; Ballew et al., 2020). Concurrent work documents that many Americans underestimate how many of their fellow Americans support transformative climate policies (Sparkman et al., 2022) and that many Chinese underestimate others' pro-environmental engagement (Chen et al., 2022). Our study also inspired a global survey that measures people's willingness to contribute a part of their income to act against climate change across the globe (Andre et al., 2024). This follow-up project does not only replicate a similar underestimation of others' willingness to contribute money in the US but also finds that such misperceptions are almost universally present across the globe. Together, these studies provide a clear diagnosis: pessimism about others' climate views and actions is prevalent, which renders our finding that these misperceptions can be corrected even more important.

More generally, we contribute to the literature studying the role of social norms in human behavior (e.g., Cialdini et al., 1990; Bicchieri, 2006; Fehr and Schurtenberger, 2018; Krupka and Weber, 2013; Young, 2015; Nyborg et al., 2016; Nyborg, 2018; Constantino et al., 2022). We show that norms can be misperceived and that these norm perceptions predict and causally affect individual willingness to fight climate change. Our study thus corroborates earlier correlative analyses that find a positive association between norm perception and environmental behavior (e.g., Farrow et al., 2017; van Valkengoed and Steg, 2019), field experiments which show that informational interventions that raise people's awareness about their neighbors' energy consumption or water use causally affect energy or water demand (see, e.g., Allcott 2011; Costa and Kahn 2013; Ferraro and Price 2013; Bergquist et al. 2019), and survey experiments that illustrate that social norm messaging influences behavior (e.g., Jachimowicz et al., 2018; Sabherwal et al., 2021). For example,

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Jachimowicz et al. (2018) show that information about others' normative beliefs is critical for intentions to save energy.

Our finding that correcting misperceptions about climate norms is particularly effective among people who are more skeptical about climate change suggests that social norm interventions that correct strong initial misperceptions of social norms could be a successful tool in reducing polarization. This relates our study to a large body of work on political polarization, particularly in the US context (Iyengar et al., 2019; Alesina et al., 2020). Views on climate change and climate policy strongly differ across political groups in the US (Dunlap et al., 2016; Hornsey et al., 2018; Doell et al., 2021). While decreasing political polarization is recognized as a crucial step to foster a broad support for climate policies, it often proves difficult in practice as liberals and conservatives tend to react most favorably to factual information that is in line with their existing beliefs or allegiances (Bénabou and Tirole, 2016; Alesina et al., 2018; Druckman and McGrath, 2019; Ditto et al., 2019). Our results suggest that instead of providing information in an abstract manner, it may be more productive to inform individuals about opinions, values and behaviors of their fellow citizens and peers. This type of "social information" seems to be particularly effective for those individuals who are skeptical of climate change or even science in general.

2 Study Design

To study individual willingness to fight climate change, it is important to obtain a reliable and inter-personally comparable measure of individual willingness to fight climate change as well as detailed information on its potential determinants, in particular perceived social norms. To make inferences about the US population, a large, broadly representative sample is required. Establishing a causal relationship between perceived social norms and climate behavior further requires exogenous variation in the perception of norms. This section explains how we design the sampling approach and survey to meet these requirements. All appendices are available online.[1]

[1]We pre-registered the experiment, the sampling approach, and the main analyses of our wave 2 survey at the AEA RCT Registry (#AEARCTR-0007542). See Online Appendix D for

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2.1 Sample and survey procedures

We collect survey data from a large sample of 8,000 US adults who represent the general US population in terms of key sociodemographic variables. To be eligible to participate in the study, respondents had to reside in the US and be at least 18 years old. The data collection was carried out in two waves. The first wave of data ($N = 2,000$) was collected in March 2021. This wave of data forms the basis for the descriptive analysis presented in this paper, and informs the treatments embedded into wave 2. The second wave of data ($N = 6,000$) was collected in April 2021 and it contains the information experiment that allows us to study the causal relationship between perceived social norms and individual willingness to fight climate change. To collect the data, we collaborated with the professional survey company *Pureprofile*, which is frequently used in social science research. All survey participants were part of the company's large online panel where people opt in to receiving invitations to participate in online surveys such as ours. The online surveys were scripted in the survey software Qualtrics. In both waves, the median time to complete the survey was 18 minutes. Respondents could only participate in one of the two waves. We screen out participants who do not pass an attention check (see Appendix B.1) or speed through the survey with a duration of less than three minutes. Both exclusion criteria are pre-registered.

We used a stratified sampling approach to ensure that the samples represent the adult US population in terms of gender, age, education, and region, allowing us to mitigate concerns about selection. Comparing our samples to data from the American Community Survey 2019, we note that the distribution of demographic characteristics in our samples closely matches the distribution of characteristics in a nationally representative sample (see Appendix Table A.1).

The survey contains several modules. In the following, we explain how we measure individual willingness to fight climate change (Section 2.2) and proceed with describing our measures of perceived social norms, preferences, and universal moral values (Section 2.3). We then present the information intervention embedded into wave 2 (Section 2.4).

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further information and a description of how we deviate from the pre-registration.

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We also measure individual support for climate policies, political activism, climate change skepticism, and a range of background characteristics (Section 2.5). The exact wording of the main survey blocks is provided in Appendix B.

Throughout the survey, we use the term "global warming" instead of the preferred scientific term "climate change" as the former is less likely to be confused with short-term or seasonal weather changes or ozone depletion, a misunderstanding that still occasionally arises (Lorenzoni et al., 2006). To avoid confusion, we define global warming as follows at the beginning of the survey: "*Global warming means that the world's average temperature has considerably increased over the past 150 years and may increase more in the future.*" Throughout this article, we use the terms global warming and climate change interchangeably.

2.2 Measuring individual willingness to fight climate change

To measure individual willingness to fight climate change, we use an incentivized donation paradigm. Respondents are asked to divide \$450 between themselves and *atmosfair*, a charitable organization that fights global warming and offsets CO_2 emissions.[2] The more money that a respondent is willing to donate, the higher their willingness to fight climate change. The measure is quantitative and inter-personally comparable, and it captures the central trade-off underlying most individual-level decisions to fight climate change: mitigating climate change comes at a cost, whether in terms of money, time, or convenience. The amount of \$450 was chosen because, by donating the full amount, respondents could offset the annual CO_2 emissions of an average US citizen.[3] We explain this to respondents in order

[2]A potential concern is that respondents perceive the endowment as "house money" that they are more willing to donate. While the evidence on the house money effect is mixed (Benz and Meier, 2008; Clark, 2002; Bailey et al., 2023; Engel, 2011), it might affect the level of donations in our experiment. While we acknowledge that this may be the case, we are primarily interested in understanding *differences* in willingness to act against climate change across groups.

[3]At the time of the survey, it cost about \$28 to offset 1 ton of CO_2 emissions. The World Bank estimates that a typical US resident causes about 16 tons of CO_2 emissions per year.

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to put their contribution decision into context and render it meaningful and tangible.[4]

Before respondents make their decision, the instructions provide further information on *atmosfair*. Participants are informed that the charity actively contributes to CO_2 mitigation by promoting, developing, and financing renewable energies worldwide. Further information is provided on the charity's annual expenditure dedicated to the fight against global warming ($12 million) as well as its low overhead costs (5%). To minimize rounding, respondents can indicate their responses using a slider ranging from $0 to $450. The incentive scheme is probabilistic: 25 participants are chosen at random and their decisions are implemented accordingly.

2.3 Measuring perceived social norms and other determinants

Perceived social norms Social norms are behavioral rules that express the collectively shared understanding of what is typical and morally acceptable behavior. They set the standards of conduct, shape individual behavior, are decentrally enforced, and could thus create a potent momentum either in favor of or against climate action (Bicchieri, 2006; Krupka and Weber, 2013; Nyborg et al., 2016; Bursztyn and Jensen, 2017). We thus hypothesize that individual willingness to fight global warming is determined by individual perceptions of other people's behavior (*'perceived behavior'*) as well as individual perceptions of what other people believe should be done (*'perceived norms'*).[5] Beliefs about the choices that other people make reflect the perceived behavioral standard or norm in a community, which is particularly relevant when people condition their cooperation on the action of others ('con-

[4]We are primarily interested in understanding *differences* in willingness to act against climate change across groups. This is why design parameters that could potentially affect the *level* of our measure are secondary for almost all of our later analyses. Instead, we prioritize the simplicity and tangibility of the decision situation. See the related literature on estimating the willingness to pay for climate action for a different approach (e.g., Johnson and Nemet, 2010).

[5]The former are sometimes referred to as descriptive norms or empirical beliefs, while the latter are also sometimes referred to as second-order normative beliefs, injunctive norms, or prescriptive norms (Cialdini et al., 1990; Bicchieri, 2006).

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ditional cooperation', Fischbacher et al., 2001). Beliefs about what other people consider appropriate reflect the perceived moral rules or principles in a community. People might have a preference to adhere to the prevalent rules to protect their reputation or self-image (Bursztyn and Jensen, 2017; Falk, 2021).

Before eliciting respondents' perceptions about prevalent social norms, we first ask respondents about their own behavior and normative views which allow us to establish prevalent behaviors and endorsement of norms in a sample of US adults. Specifically, we ask all respondents whether they "try to fight global warming" (yes/no) and whether they believe that "people in the US should try to fight global warming" (yes/no).

To measure *perceived* social norms, we then ask all respondents to estimate what proportion of the US population "try to fight global warming" ('perceived behavior') and what proportion think that "people in the US should try to fight global warming" ('perceived norms'). Before making their guesses, respondents are informed that we have gathered survey evidence on whether people try to fight global warming and whether they think that people in the US should try to fight global warming. More specifically, it is explained that we have surveyed a large sample of the US population and that the survey results "represent the views and attitudes of people in the United States". For ease of comprehension, respondents are not asked to estimate proportions but rather estimate the number of people to whom the statement applies out of 100 people we asked:

- *Out of 100 people we asked, how many stated that they try to fight global warming?*
- *Out of 100 people we asked, how many stated that they think that people in the United States should try to fight global warming?*

To determine whether individual perceptions are correct, we can compare participants' guesses with the actual shares of wave 1 respondents answering affirmatively to the questions whether they "try to fight global warming" and whether they think that "people in the US should try to fight global warming". We incentivize the guesses that respondents make to induce and reward careful and accurate responses. In particular, every respondent can earn a $1 bonus if their guess in a randomly-selected belief question differs at most by three

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from the true value.[6] The resulting measures of perceived behaviors and perceived norms are simple, yet quantitative, incentivized, and inter-personally comparable. Together, they capture the two key facets of social norms that have been identified as important drivers of human behavior in many contexts.

The abstract wording of our central perceived social norm measures ("fight global warming") is likely to capture a broad range of climate-relevant behaviors. To shed light on more specific and context-dependent norms, we use an analogous procedure to ask respondents to estimate what proportion of the US population reports engaging in a set of concrete climate-friendly behaviors ('perceived behaviors') and what proportion of the US population says that one should engage in those behaviors ('perceived norms'). The set of concrete behaviors includes restricting meat consumption, avoiding flights, using environmentally-friendly alternatives to fossil-fueled cars, using green electricity, adapting shopping behavior to the carbon footprint of products, and politically supporting the fight against global warming. Guesses are incentivized using the same reward scheme.[7]

One potential concern when comparing participants' beliefs with self-reported behaviors or norms is that participants might report an inflated tendency to behave sustainably, e.g. due to a desire to appear good, which may result in an artificial gap between beliefs and behaviors/norms. We take four steps to address this concern. First, participants know that the survey is anonymous and no conclusion about their person can be drawn. Second, we explicitly elicit beliefs about the *stated* behavior and norms of others, and, third, we incentivize these guesses. Put differently, participants are incentivized to anticipate potential social desirability effects and to take them into account. Finally, we conduct an additional

[6]The perceived behavior and the perceived norms question are the central but not the only belief questions in the survey. In total, we ask fifteen different belief questions, all of which are incentivized by the reward scheme, see below.

[7]To determine whether individual perceptions are correct, we compare participants' guesses with the actual shares of wave 1 respondents answering affirmatively to the questions whether they engage in those concrete behaviors and whether they think people should engage in those behaviors.

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robustness study in which we measure (incentivized) beliefs about other participants' donation decisions. As real money is at stake in those decisions they are arguably less prone to desirability effects.

Economic preferences To put our analysis of social norms into context, we consider two other frequently studied economic and behavioral factors. The first is economic preferences. Economic preferences have been shown to predict a range of important decisions and they are likely to be important determinants of individual willingness to fight climate change. To explore the relationship between economic preferences and the propensity to fight global warming, we obtain detailed individual-level measures of economic preferences following the methodology used in the Global Preferences Survey (Falk et al. 2018, 2023). This experimentally validated survey relies on a range of qualitative and quantitative survey items and allows us to construct preference measures for six preferences: *patience*, *willingness to take risks*, *altruism*, *trust*, *positive reciprocity*, and *negative reciprocity*. The latter two capture the willingness to reward kind or punish unkind actions, respectively. More information on the survey items and how the composite measures are computed can be found in Appendix C. For ease of interpretation, each preference measure is standardized to have a mean of zero and a standard deviation of one.

Universal moral values The second factor is moral universalism which captures the tendency to extend altruistic and moral concerns to individuals who are socially distant (Singer, 2011; Crimston et al., 2016). This factor has only recently gained attention among economists (Enke et al., 2023; Cappelen et al., 2023; Enke et al., 2024). Given the global nature of climate change, there are strong reasons to hypothesize that individual willingness to fight global warming is determined by the relative importance of universal versus communal moral values. To connect to this recent debate, we measure universal moral values with the help of Moral Foundations Theory (MFT), following the approach proposed by Enke (2020). MFT posits that people's moral concerns can be partitioned into five distinct foundations: care/harm, fairness/reciprocity, in-group/loyalty, authority/respect, and purity/sanctity. "Universal" values – captured by the care/harm and fairness/reciprocity foundations – apply irrespective of the people involved. "Communal" values – captured by

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the in-group/loyalty and authority/respect foundations – are tied to certain groups or relationships (Haidt and Joseph, 2004; Haidt, 2012; Graham et al., 2013; Enke, 2020). We administer the Moral Foundations Questionnaire (MFQ) to measure the distinct foundations and calculate the relative importance of universal moral values following Enke (2020). More information on how the standardized measure is constructed can be found in Appendix C.

Our list of behavioral measures is not exhaustive. Psychologists have studied many other behavioral factors that are relevant for pro-climate behavior, including domain-specific concepts such as biospheric values. In this study, our main intention is to provide context to our analysis of norms which is why we opt for a few general measures that are commonly used in economics and have a wide range of applicability.

2.4 Shifting perceived social norms

Given the threat posed by global warming, it is important to understand which interventions could increase individual willingness to fight climate change. While it is difficult to alter economic preferences or moral values in the short term, beliefs about social norms are likely to be more malleable. As we will show in Section 3.2, respondents on average misperceive the prevalence of social norms in the US. Based on this finding, we embed an information experiment into wave 2. The exogenous variation induced by this experiment allows us to study whether the perceived prevalence of social norms causally affects individual willingness to fight global warming.

The experiment starts by eliciting respondents' beliefs about prevalent behaviors and norms, using the abstract belief measures introduced in Section 2.3. Then, we provide randomly-selected participants with truthful information about the actual proportions of the US population who (i) "try to fight global warming" ('*behavior treatment*') or (ii) think that "people in the US should try to fight global warming" ('*norms treatment*'). Estimates of both shares are derived from wave 1. More specifically, we randomize respondents in wave 2 into one of three treatments. Appendix Figure A.1 summarizes the structure of the experiment.

1. Behavior treatment In this treatment, respondents are informed about the share of the US population who "try to fight global warming". Respondents are first informed

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about the fact that "we recently surveyed 2,000 people in the United States and asked them whether they try to fight global warming. Respondents come from all parts of the population and their responses represent the views and attitudes of people in the United States." On the following page, respondents learn that 62% of Americans try to fight global warming. To ensure that participants pay attention, the information is revealed piece by piece, and respondents need to spend a minimum of 5 seconds on the final screen before being able to proceed. A graph on the final screen expresses the information visually, making it salient and tangible (see Figure 1a).

2. Norms treatment In an analogous manner, respondents in the norms treatment learn that 79% of Americans think that people in the US should try to fight global warming (see Figure 1b).

3. Control No information is provided to participants in the control condition.

Subsequently, we elicit individual willingness to fight climate change with the incentivized donation decision (see Section 2.2), which constitutes our main outcome measure.

This study design allows us to assess whether providing respondents with accurate information about prevalent behaviors or norms can shift individual climate behavior. Respondents randomized into the behavior or norms treatment are likely to revise their beliefs about prevalent behaviors or norms in the US. Such a shift in beliefs may lead to a change in individual willingness to fight climate change. Since – as we will show – individuals systematically underestimate the share of Americans trying to fight global warming as well as the share who think that Americans should try to fight global warming, we posit that the information interventions are likely to increase individual willingness to fight climate change.

To study belief revisions, we assess participants' posterior norm perceptions by including the belief measures for the six concrete climate-friendly behaviors (e.g., restricting meat consumption, avoiding flights or fossil-fueled cars; see Section 2.3) as a post-treatment module. For the purpose of the analysis, we compute a perceived behavior index and a perceived norms index by calculating the average across the six climate-friendly behaviors/norms items. We then standardize each index to have a mean of zero and a standard deviation

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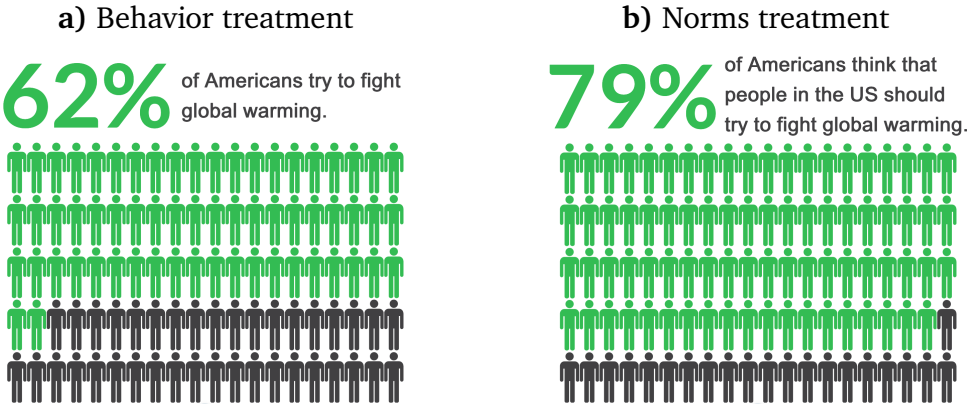
Figure 1: Information treatments in wave 2



Notes: Panels a and b provide a visual summary of the information provided to participants in the behavior and the norms treatments, respectively. The exact wording of the survey instructions is provided in Online Appendix B.

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of one among control group respondents. Conceptually, individual perceptions about the prevalence of concrete behaviors/norms are strongly related to the more general behavior/norm of "trying to fight global warming". We can thus use those questions to test for and detect belief revisions without repeating our main questions, thereby mitigating experimenter demand effects and consistency bias in survey responses (Haaland et al., 2023).

We opt for the dual approach of shifting perceived behavior and perceived norms, respectively, as both are regarded as central drivers of human behavior (see Section 2.3). Nonetheless, the experiment is not designed to speak to their relative importance. Technically, a direct comparison is difficult because participants in the two treatment arms learn about statistical figures of varying magnitudes (62% vs. 79%) and – as we will see – also hold different prior beliefs about other American's behavior versus norms. The two conditions thus differ in more than one dimension. Conceptually, a direct comparison is difficult because beliefs about others' behavior and beliefs about others' norms are so closely related that a change in perceived behavior may also lead to a change in perceived norms and vice versa. For these reasons, we view the two conditions as statistically independent but conceptually tightly related manipulations. They use two different "levers" but activate a similar mechanism. Both conditions allow us to test whether perceived social norms causally affect behavior.

The controlled environment of our information experiment has several advantages. We can precisely control which information participants receive and ensure that they pay attention to it. We can measure prior and posterior beliefs as well as a large set of additional background variables. Moreover, we can establish a common knowledge base by providing brief descriptions of important concepts such as global warming and carbon offsetting. The information experiment is thus ideally suited to provide a "proof of concept" – evidence that social norm perceptions can be shifted and that they matter for behavior. However, it is important to keep those design features in mind when interpreting the results of our study. Our survey design does not allow us to test whether social norms interventions alone would have produced similar effects if no additional information was provided on the context. We return to this issue in the concluding discussion. Second, experimenter demand effects could

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occur, an issue to which we turn next.

Mitigating experimenter demand effects A key challenge in information experiments is to disentangle the effects driven by genuine changes in beliefs from effects driven by priming or a desire to please the experimenter. While existing empirical evidence suggests that experimenter demand effects hold limited quantitative importance in anonymous online surveys (de Quidt et al., 2018), we nevertheless took great care to mitigate these concerns. As noted by Haaland et al. (2023), demand effects could vary across settings, which is why it is considered best practice to include measures to mitigate it. First, we inform all participants that the survey is anonymous and that no conclusions can be drawn about their identity. Second, we elicit prior beliefs in the full sample of respondents – irrespective of the respondents' treatment status – which ensures that all respondents are primed to think about the issue of interest. Third, the elicitation of prior beliefs is incentivized, i.e. we tell respondents that they can earn an additional bonus of $1 if their guess differs at most by three from the correct answer. This design feature has the advantage that when we provide the information to the treated participants, the provided information can be understood as feedback on whether the respondent's answer qualified for extra payment. Obfuscating the information treatments by framing the information as feedback on whether the respondent's answer is correct and qualifies for a bonus payment is viewed as one of the best practices to mitigate experimenter demand effects (Haaland et al., 2023). Fourth, we use an incentivized donation decision as our main outcome measure, as demand effects are likely to be lower in tasks in which real money is at stake. Finally, the elicitation of incentivized posterior beliefs allows us to document that respondents in the treatment groups are more likely to revise their beliefs, while the elicitation of incentivized prior beliefs allows us to document treatment effect heterogeneity by prior beliefs (see Section 3.4). Both results are often interpreted as evidence that treatment effects are driven by genuine belief changes (Haaland et al., 2023).

2.5 Additional measures

Climate change skepticism The public and political debate on climate change has been shaped by skepticism about its existence, dangers, or human origin. This phenomenon is par-

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ticularly relevant in the US where climate change skepticism is still common and has often formed a key obstacle to effective responses against climate change (Dunlap and McCright, 2011; Leiserowitz et al., 2013). The survey includes a diverse set of items that allow us to measure respondents' skepticism. We ask respondents to indicate how much trust they have in climate science, whether they think scientists agree that global warming is happening, how worried they are about global warming, whether they think it will harm people in the US, and whether they think that climate change is human-caused (see Appendix B). These questions are asked at the beginning of the survey to ensure that the responses are not affected by the information treatments. We use this information to explore the heterogeneity of treatment effects.

Policy support and political activism In addition to eliciting individual willingness to fight climate change, we collect detailed information on the extent to which individuals support different climate polices (e.g., a carbon tax, subsidies for green energy, pollution regulation) and are willing to engage in political activism (e.g., volunteer time, attend protest, contact government officials). We pose a total of 18 questions adapted from a detailed politics module developed as part of the Climate Change in the American Mind Project (Howe et al., 2015). Respondents can express their policy support and individual political activism on a four-point Likert scale (see Appendix B), which we recode in our analysis to ensure that larger values indicate more policy support and political activism. For ease of interpretation, we aggregate individual items into a policy support index (7 items), a political activism index (11 items), and a joint index comprising all 18 items. Each index is standardized to have a mean of zero and a standard deviation of one among control group respondents. The questions are posed after the information treatments in wave 2, which allows us to study whether shifting beliefs about prevalent behaviors and norms causally affects policy support and political activism.

Background characteristics We collect detailed information on individual background characteristics. Those include age, gender, education, employment status, household income, the number of children, and whether the respondent thinks of themselves as being closer to the Republican or Democratic party. We use those variables as additional control

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variables in the analysis.

3 Results

3.1 Willingness to fight climate change and its determinants

To measure willingness to fight climate change, we use an incentivized donation decision in which respondents divide $450 between themselves and a charitable organization that fights global warming. We use this measure to study which factors predict individual willingness to fight climate change. For the purpose of this descriptive analysis, we focus on survey data collected in wave 1 ($N = 2,000$), which did not contain any treatment manipulation. Appendix Figure A.2 displays the distribution of individual willingness to fight global warming, as measured through the incentivized donation decision. On average, respondents are willing to donate $225 of the $450. There is a considerable degree of heterogeneity across respondents (SD=$147), with 6% donating $0, 12% donating $450, and the remaining 82% donating some value in between.[8]

We explore which factors predict individual willingness to fight climate change. For this purpose, we regress the donation amount (in $) on (i) individual beliefs about prevalent behaviors or norms, (ii) our measures of economic preferences (i.e., patience, risk-taking, altruism, positive reciprocity, negative reciprocity, and trust), (iii) universal moral values, and (iv) a range of background characteristics. Given that beliefs about prevalent behav-

[8]The incentivized pro-climate donation strongly predicts other climate-related choices. Table A.2 shows that the donation measure is strongly correlated with respondents' self-reported climate-friendly behaviors. For example, respondents who avoid taking flights contribute on average $75 more to the climate charity than those who do not, which corresponds to 33% of the baseline mean. Likewise, Table A.3 shows that the measure strongly correlates with respondents' self-reported willingness to contribute 1% of their income every month to fight global warming – another measure of willingness to act against climate change that we included in the wave 1 survey. This hypothetical question might be useful in survey contexts where it is logistically more difficult to provide financial incentives to elicit individual willingness to pay for climate action.

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iors and norms are conceptually related and highly correlated in our data ($\rho = 0.67$), we estimate two separate regression models, including one belief measure at a time. For the purpose of this analysis, the belief measures are standardized to have a mean of zero and a standard deviation of one. The results are reported in columns 1 and 2 of Table 1, respectively.

First, perceived behaviors and norms are strong predictors of individual willingness to fight climate change. Controlling for the large set of covariates, a one-standard-deviation increase in perceived behavior is associated with a $12 higher donation amount ($p < 0.001$), while a corresponding increase in perceived norms is associated with a $14 higher donation ($p < 0.001$). Both belief measures have a standard deviation of 22 percentage points, and the coefficients can therefore also be interpreted as follows: A 10 percentage point increase in the behavior belief is associated with a $5.50 higher donation amount, while a corresponding increase in the norms belief is associated with a $6.50 higher donation amount. These results are consistent with norm perceptions playing an important role in determining individual willingness to fight global warming. This could, for example, be the case if individuals are 'conditional cooperators' or if they have a preference for complying with existing social norms. Whether or not this relationship can be interpreted as causal is a question we turn to in Section 3.3.

Second, the results presented in Table 1 further reveal that climate donations are related to economic preferences and moral values. Altruism and positive reciprocity – both of which are facets of prosociality – positively predict the donation amount. The magnitudes of the estimated coefficients are sizable. For example, a one-standard-deviation increase in altruism is associated with a $52 higher donation amount. Similarly, patience positively predicts donation decisions. These patterns are plausible given that climate action benefits other people around the world as well as future generations. We find no statistically significant associations between climate donations and risk preferences, negative reciprocity, or trust. Universal moral values, by contrast, are strongly related to climate donations. A one-standard-deviation increase in relative universalism – namely the extent to which individuals endorse universal moral values that apply equally to all humans rather than commu-

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Table 1: Determinants of climate change behavior

	Donation ($)	
	(1)	(2)
Perceived social norms		
Behavior belief	12.067***	
	(3.146)	
Norms belief		14.372***
		(3.058)
Economic preferences		
Altruism	51.361***	51.819***
	(3.476)	(3.447)
Patience	15.139***	15.132***
	(3.095)	(3.086)
Risk	-1.527	-0.925
	(3.374)	(3.357)
Positive reciprocity	9.504***	7.819**
	(3.243)	(3.260)
Negative reciprocity	-3.469	-2.690
	(3.212)	(3.183)
Trust	1.061	0.816
	(3.231)	(3.201)
Moral foundations		
Relative universalism	23.496***	23.137***
	(3.295)	(3.283)
Sociodemographics		
Democrat	45.254***	44.279***
	(6.247)	(6.255)
Age	0.801	0.823
	(1.039)	(1.038)
Age (squared)	-0.008	-0.008
	(0.011)	(0.011)
Female	16.474***	16.044**
	(6.341)	(6.306)
Log income	10.315***	10.257***
	(3.770)	(3.755)
College degree	-15.188**	-15.798***
	(5.955)	(5.937)
Employed	8.341	8.746
	(6.623)	(6.601)
Parent	4.634	4.667
	(6.500)	(6.481)
R^2	0.281	0.284
N	1,975	1,975
Mean of dep. var.	225.21	225.21

Notes: This table shows OLS regression estimates using respondents from wave 1, where the dependent variable is the amount donated to the charitable organization that fights

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nal or ingroup-restricted values – is associated with a $23 higher donation amount. Climate change is a global problem and individuals whose moral values apply irrespective of the people involved are more likely to make larger donations, presumably because they are more likely to take the welfare of other people outside of their community into account.

Third, demographic characteristics also significantly predict individual willingness to fight climate change. Democrats on average contribute about $45 more than Republicans, female respondents about $16 more, and household income is also positively associated with the donation amount. However, higher education negatively predicts climate donations. Further analyses reveal that this effect is entirely driven by Republicans among whom a college education is associated with a $23 lower donation amount (see Appendix Table A.4).[9]

Taken together, the results suggest that beliefs about prevalent behaviors or norms strongly predict individual willingness to fight climate change, over and above what can be explained by other factors such as economic preferences and moral values. The estimated effect size of a one-standard-deviation increase in perceived behaviors or norms on individual donations is comparable in magnitude to the estimated effect sizes of factors such as positive reciprocity, patience, or universal moral values, and it is smaller than the estimated effect of altruism. From the standpoint of encouraging behavioral change, social norms present a particularly promising avenue. Unlike economic preferences or moral values, which are difficult to alter in the short term, perceptions of social norms are more malleable.

3.2 Misperceived social norms

We now explore the distribution of beliefs about behaviors and norms in more detail, relying on the survey data collected in wave 1. Figure 2 depicts the distribution of perceived social norms. Panel A.1 displays perceived behavior, i.e., the distribution of individual beliefs about the share of the US population that tries to fight global warming. Panel A.2 displays

[9]We are not the first to document a negative education gradient among Republicans (Newport and Dugan, 2015). It has been hypothesized that highly-educated individuals are cognitively better equipped to rationalize and internalize the views of their cultural community, which for Republicans might correspond to climate change skepticism (Kahan et al., 2012; but see Van Der Linden et al., 2017).

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perceived norms, i.e., the distribution of beliefs about the share of Americans who think that people in the US should try to fight global warming. The average belief is indicated by a vertical red line, whereas the actual share is marked by a dotted blue line.

Figure 2 reveals a considerable degree of heterogeneity in individual beliefs. Both panels further reveal that respondents vastly misperceive the prevalence of climate-friendly behaviors and norms among their fellow citizens. On average, respondents believe that 51% of Americans try to fight global warming, while the actual share is 62% (p-value < 0.001). The majority of participants – namely 67% – underestimate the level of climate-friendly behavior in the US. Similarly, respondents on average believe that 61% of Americans think that people in the US should try to fight global warming, while the actual share is 79% (p-value < 0.001). Again, most participants (76%) underestimate this share. We find larger misperceptions among respondents who are older, have a lower income, have a lower education, or are Republicans (see Appendix Table A.5).

Overall, we document the same systematic underestimation of climate norms for the set of concrete climate change behaviors for which we elicited perceived social norms. For example, these behaviors include restricting meat consumption, avoiding flights and cars, or adapting a sustainable shopping style.[10] Panel B.1 of Figure 2 contrasts the actual share of respondents who report engaging in a specific behavior with the average perceived share. Analogously, Panel B.2 contrasts the actual share of respondents who report that they think people in the US *should* engage in a specific behavior with the average perceived share. For most behaviors, we find that Americans underestimate how many other Americans engage in climate-friendly behavior or think this should be done. For example, 51% of Americans report regularly using environmentally-friendly alternatives to their private car, such as walking, cycling, taking public transport, or car-sharing, but, on average, this fraction is perceived to be only 41%. Likewise, 73% of Americans think that one should regularly use these climate-friendly alternatives, but again Americans strongly underestimate this share, and on

[10]Reassuringly, we show that these concrete beliefs measures are strongly correlated with the abstract measure which indicates that the abstract measure serves well as a summary measure (see Appendix Table A.6).

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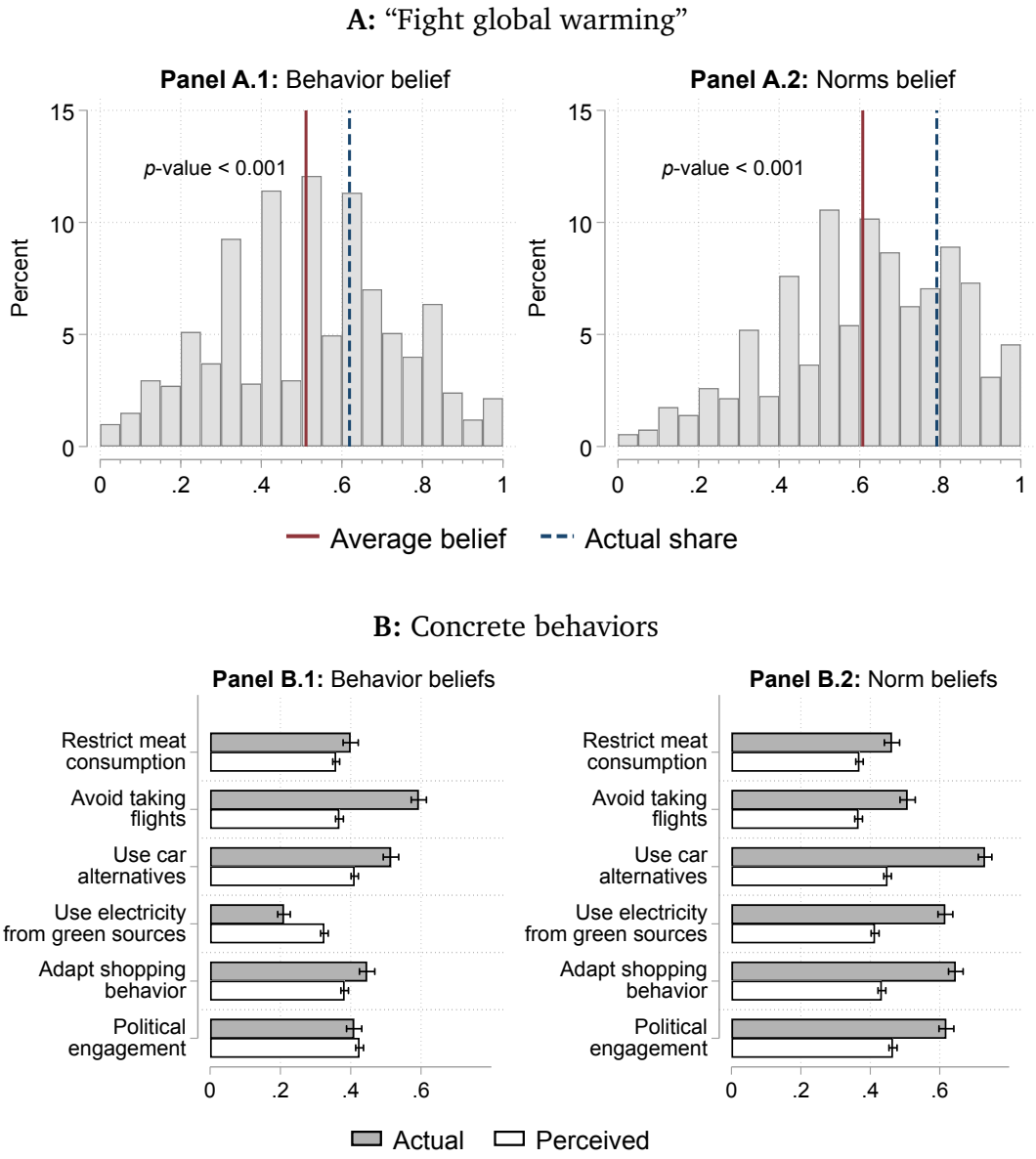
Figure 2: Perceived social norms: fight global warming



Notes: This figure shows the distribution of perceived social norms in wave 1. Panel A.1 shows the distribution of people's beliefs about the share of Americans who say that they try to fight global warming. Panel A.2 shows the distribution of people's beliefs about the share of Americans who say that one *should* fight global warming. Panel B.1 shows the share of respondents who indicate that they engage in different concrete climate-friendly behaviors ("Actual"), and the average belief about the share of Americans that engage in these concrete behaviors ("Perceived"). Panel B.2 shows shows analogous averages for the share of Americans who say that one should engage in these concrete behaviors ("Actual") as well the average belief about the share of Americans who say one should engage in these concrete behaviors ("Perceived"). See Figures A.3 and A.4 for the full distribution of beliefs.

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average they believe that only 45% of other Americans endorse this norm. Two notable exceptions are political engagement and the use of electricity from green sources, where US Americans hold, respectively, accurate or even somewhat too optimistic perceptions of the climate-friendly behaviors of their fellow citizens.[11]

We corroborate these results in an additional study in which we measure perceptions about incentivized pro-climate behavior, which – as discussed in Section 2.3 – should be less prone to potential social desirability effects. In an experiment conducted on *Prolific* in November 2022, we elicit beliefs about the average amount that respondents in wave 1 of our main study donated to the pro-climate charity *atmosfair*. As shown in Figure A.5, 86% of respondents underestimate the actual average amount that other Americans donated. The difference between the average belief of $128 and the actual average amount of $225 indicates a substantial perception gap of 41%.

Taken together, while many Americans try to fight global warming and a vast majority actually agrees that people in the US should try to fight global warming, most Americans underestimate the degree to which other Americans engage in climate-friendly behaviors and share those normative views. This underestimation of climate norms is likely to hamper individual willingness to fight climate change.

3.3 Correcting misperceived social norms

As established in the previous sections, beliefs about prevalent behaviors and norms strongly predict individual willingness to fight climate change. At the same time, there are systematic misperceptions of the actual share of Americans fighting or thinking that one should fight climate change. Can information interventions that inform respondents about the true shares affect individual willingness to fight climate change?

The information experiment embedded in wave 2 allows us to study this question. Respondents are randomized into (i) a 'behavior treatment', in which they are informed that 62% of Americans try to fight global warming, (ii) a 'norms treatment', in which they are informed that 79% of Americans think that people in the US should try to fight global warm-

[11]For these two exceptions, it is conceptually difficult to explain why we observe pessimism in terms of perceived norms but not in terms of perceived behavior.

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ing, or a (iii) a control group. Appendix Table A.7 presents the balancing of characteristics across the three groups. We cannot reject the null hypothesis that the average characteristics of the three groups are the same and conclude that the randomization was successful. Appendix Figure A.6 displays the wedge between wave 2 respondents' beliefs about prevalent behaviors and norms and the actual shares. As can be seen from both figures, wave 2 participants also vastly underestimate the true shares, providing us with an ideal opportunity to exogenously correct inaccurate perceptions. The average gap between the perceived and actual shares is 10 percentage points in the case of perceived behaviors and 17 percentage points in the case of perceived norms.

To estimate the causal impact of the information treatments, we regress willingness to fight climate change – as measured through the incentivized donation decision (in $) – on treatment indicators and a set of control variables.[12] The results are reported in column 1 of Table 2 and reveal that the impacts of the information treatments are sizable and statistically significant. Being informed about the true share of Americans who try to fight global warming leads to a $12 increase in donations (p-value $= 0.012$), while being informed about the true share of Americans who think that people in the US should try to fight global warming increases donations by $16 (p-value < 0.001). The effects correspond to a relative increase of 4.7% and 6.3%, respectively. Given that not all respondents misperceive prevalent behaviors and norms at the baseline and some respondents might not fully revise their beliefs in light of the information provided, both effect sizes suggest a powerful impact of perceived social norms on individual willingness to fight climate change.

Using the posterior norm perception module, we provide evidence that the treatments indeed shift posterior beliefs in the way that one would expect. To study belief revisions, we regress the posterior beliefs about concrete climate-friendly behaviors and norms on the

[12]The set of control variables includes controls for gender (indicator), age (continuous), log income, college degree (indicator), employment (indicator), party affiliation (indicator), and census region (three indicators). Appendix Table A.8 presents results of the regressions without control variables. The estimated coefficients are very similar in magnitude and significance.

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Table 2: Treatment effects on climate donations and posterior beliefs

	(1) Donation ($)	(2) Behavior belief (post.)	(3) Norms belief (post.)
Behavior treatment	11.725**	0.279***	0.235***
	(4.675)	(0.030)	(0.030)
Norms treatment	15.674***	0.370***	0.350***
	(4.701)	(0.031)	(0.030)
N	5,991	5,988	5,976
Control group mean	249.31	0	0
z-scored	No	Yes	Yes
Controls	Yes	Yes	Yes

Notes: This table shows OLS regression estimates using respondents from wave 2. The dependent variable is the donation to the climate charity (in $). It is regressed on binary indicators that take the value of 1 for respondents in the behavior treatment and norms treatment, respectively. "Behavior belief" is an index of six post-treatment beliefs about the share of Americans engaging in concrete climate-friendly behaviors to fight global warming. "Norms belief" is an index of six post-treatment beliefs about the share of Americans who say that one should engage in concrete climate-friendly behaviors to fight global warming. Both indices are standardized to have a mean of zero and a standard deviation of one in the control group. All regressions include controls for gender (indicator), age (continuous), log income, college degree (indicator), employment (indicator), party affiliation (indicator), and census region (three indicators).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses.

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treatment indicators and the same set of control variables. As explained in Section 2.3, the set of concrete behaviors includes different actions such as reducing meat consumption or avoiding flights. The two posterior belief indices are standardized, and the results are reported in columns 2 and 3 of Table 2, respectively. Both information treatments successfully shift beliefs, which are revised upwards by 0.24 to 0.37 standard deviations.

While the point estimate of the coefficient for the norms treatment is somewhat larger than the point estimate of the coefficient for the behavior treatment, we note that the two are not significantly different from each other (p-value = 0.39). Importantly, we also observe spill-over effects in beliefs. Information about prevalent behavior also strongly shifts beliefs about prevalent norms and vice versa. Since respondents in the two treatment conditions also learn about statistical figures of varying magnitudes (62% vs. 79%), a direct comparison between the two treatments is not meaningful. The treatments should not be interpreted as comparable manipulations of orthogonal concepts but rather as statistically independent yet conceptually related treatments with a common effect: they both strengthen perceived social norms, which affects participants' pro-climate behavior.

3.4 Treatment effect heterogeneity

By prior We explore heterogeneity in treatment effects across different subgroups.[13] First, we examine whether the treatments are more effective for respondents whose priors are below the actual shares. Table 3 separately displays the treatment effects for respondents whose prior beliefs are below the true shares (Panel A) and those whose prior beliefs are equal to or above the true shares (Panel B). As can be seen from this table, the positive treatment effects that we document for the full sample are almost entirely driven by those individuals whose priors are below the actual shares. Among them, the behavior treatment increases donations by \$15 (p-value = 0.011), whereas the norms treatment increases donations by \$19 (p-value < 0.001). Reassuringly, we do not observe a back-firing effect. For respondents whose priors are equal to or above the actual shares, the estimated coefficients are positive albeit smaller in magnitude and insignificant. While we cannot reject the null

[13]See Appendix Section D for more information on which heterogeneity analyses were pre-registered and which are exploratory in nature.

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Table 3: Treatment effect heterogeneity: Prior above/below actual share

	Dependent variable: Donation ($)			
	Prior < actual share		Prior ≥ actual share	
	(1)	(2)	(3)	(4)
Behavior treatment	14.931**		5.231	
	(5.875)		(7.701)	
Norms treatment		19.111***		4.747
		(5.387)		(9.623)
N	2,579	3,054	1,399	946
Control group mean	243.09	241.67	260.69	273.71
Controls	Yes	Yes	Yes	Yes

Notes: This table shows OLS regression estimates using respondents from wave 2. The dependent variable is the donation to the climate charity (in $). It is regressed on binary indicators that take the value of 1 for respondents in the behavior treatment and norms treatment, respectively. We run separate analyses for respondents with prior norm perceptions strictly below the actual share (columns 1-2) and equal to or above the actual share (columns 3-4). We consider beliefs about others' behavior in the behavior treatment and beliefs about others' norms in the norms treatment. Given that the actual shares are different for the two beliefs, we do not pool all three treatment groups in this analysis. Instead, we only use respondents in the control condition and the behavior treatment in the analysis presented in columns 1 and 3, and only use respondents in the control condition and the norms treatment in the analysis presented in columns 2 and 4. All regressions include the set of controls described in Table 2.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses.

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hypothesis that the treatment effect coefficients are the same for both subgroups, we note that our results are consistent with the interpretation that the results are driven by genuine changes in beliefs as respondents with lower prior beliefs revise their beliefs significantly more in response to the information treatments (as shown in Table A.9 and Table A.10). Consistent with this interpretation, Appendix Figure A.7 shows that we obtain qualitatively similar results when examining non-parametric estimates of the moderating role of prior beliefs for our information treatments (Xu et al., 2017; Hainmueller et al., 2019), providing further suggestive evidence that the effects are driven by respondents with pessimistic prior beliefs.

By political affiliation Political polarization of climate change attitudes has proven to be an obstacle for climate action in the US where climate policies are often among the most contentious policy issues (Dunlap et al., 2016; Hornsey et al., 2018). We therefore ask whether our information treatments differentially affect Democrats and Republicans in the US. Indeed, we observe a sizable gap of about $75 between Democrats' and Republicans' average donations in the control condition of wave 2. Appendix Table A.11 shows that information about other Americans' behavior reduces this gap by $11. Republicans tend to respond more strongly to the provided information than Democrats, although the interaction effect is insignificant ($p = 0.249$). The table also shows that the norms treatment has almost identical effects on Democrats and Republicans. We obtain largely identical results when additionally controlling for treatment heterogeneity by priors (see Appendix Table A.12). These analyses suggest that – if at all – the treatments tend to have a depolarizing effect. However, ultimately, the comparison between Democrats and Republicans only weakly reflects respondents' baseline attitudes towards climate change. We will turn to this issue in the next paragraph.

By climate change skepticism In an exploratory analysis, we examine whether the information treatments lead to a stronger increase in individual willingness to fight climate change for respondents who tend to be more skeptical about the existence or threat of human-caused climate change. From a policy perspective, this subset of the population is particularly relevant as it is typically difficult to reach and convince that climate change

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matters.

We split our sample based on five indicators that capture different facets of climate change skepticism: having low trust in climate science, believing that the presence of climate change is still scientifically debated, not being worried about climate change, not perceiving it as a threat for the US, and believing that climate change is mainly the result of natural causes. The share of respondents we classify as skeptical of climate change ranges from 29% to 34% across the different facets of skepticism. To ease the exposition, we refer to these respondents who are more skeptical of climate change or its relevance as 'climate change skeptics'. In the control condition, those classified as climate change skeptics donate about \$57 to \$150 (depending on the indicator) less to the climate charity (see Appendix Table A.13).

Next, Figure 3 compares the treatment effects across respondents who express skepticism about climate change and those who do not. For all indicators and both treatments, we observe that the point estimates of the treatment coefficients are larger in magnitude for climate change skeptics. In the behavior treatment, most coefficients are also statistically different from each other across the two subgroups. For example, the behavior treatment increases donations by \$24 for those who report not being worried about global warming and by \$39 for those who do not believe that climate change is human-caused. By contrast, we do not find a statistically significant impact of the behavior treatment for respondents who do report being worried or who do believe that climate change is human-caused. These differences in effect sizes are statistically significant at the 5% level (see also Table A.14). As a consequence, the behavior treatment reduces the baseline differences between climate change "believers" and "skeptics" by 17–27% depending on the measure used to classify respondents into these groups. In the norms treatment, the differences are more muted.

Climate change skeptics tend to have more pessimistic prior beliefs about the prevalence of climate norms in the US. However, we observe largely identical results even if we control for treatment heterogeneity by priors (see Table A.15). Thus, the same information appears to have differential informational value for climate change skeptics – even conditional on the same prior belief.

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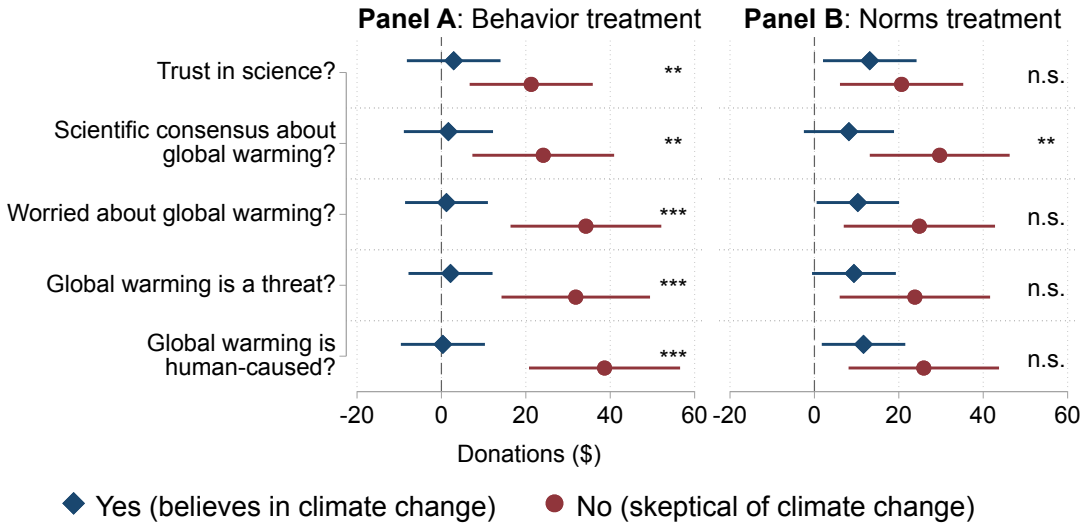
Figure 3: Treatment effect heterogeneity by climate change skepticism



Notes: This figure shows OLS estimates of the treatment effects of the behavior (Panel A) and the norms treatment (Panel B) on donations (in $) in different subsamples. We use respondents from wave 2 and include the set of controls described in Table 2. 95% confidence intervals are shown. Each panel shows treatment effects among respondents who are skeptical of climate change ("No") and those who believe in climate change ("Yes"), where we use disagreement with different statements as a proxy for skepticism: "Trust in science" means that the respondent trusts climate scientists "a lot" or "a great deal" (on a five-point Likert scale). "Scientific consensus about global warming" means that the respondent thinks that most scientists think that global warming is happening. "Worried about global warming" means that the respondent is "somewhat worried' or "very worried" about global warming (on a four-point Likert scale). "Global warming is a threat" means that the respondent thinks that global warming will do "a moderate amount" or "a great deal" of harm (on a four-point Likert scale). "Global warming is human-caused" means that the respondent thinks that global warming is caused by human activities. For each sample split, we indicate the level of significance of a test of equality of coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, n.s. $p \geq 0.10$.

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These results suggest that providing information about relevant peers – in particular, their behavior – is an effective tool to target, reach, and persuade individuals with more skeptical attitudes, even where other means of persuasion, such as moral suasion or fact-based education, have failed. In fact, presenting the information in a factual way without moralizing, blaming, or educating might have helped to mitigate potential backlash effects, though recent evidence would suggest that backlash effects might not be as common as previously thought (Wood and Porter, 2019; Guess and Coppock, 2020).

Another possible explanation for why the behavior treatment is so effective is that the behavior of fellow US Americans provides particularly important guidance to climate change skeptics. Climate change skeptics do not only have more scope to adjust their behavior.[14] They might also be surprised to learn that their views are in fact minority views and that the majority of their fellow citizens does take climate change seriously.

A more speculative account of why we observe larger effects among climate change skeptics relates to differences in moral values. We find that climate change skeptics exhibit much lower moral universalism (see Appendix Table A.16). This means that their moral compass places more weight on communal values, which might render them more sensitive to information about the behavior and normative expectations of fellow citizens. Consistent with this conjecture, Appendix Table A.17 provides suggestive evidence that individuals who score low on the moral universalism index, i.e., endorse communal values, respond more strongly to our information treatments.[15]

[14]It is unlikely that the much weaker treatment effect among respondents who believe in and are concerned about climate change can be attributed to a "ceiling effect". In the control treatment, the large majority of these climate change "believers" (about 73% to 75% depending on the question) can still increase their donation by at least $25.

[15]The linear interaction coefficient indicates that the behavior treatment increases climate donations by $9 for each additional standard deviation decrease in the universalism index. This interaction effect is robust to controlling for heterogeneous treatment effects by priors (Column 2, Table A.17) and is statistically accounted for by the treatment heterogeneity in climate change skepticism (Column 3). We obtain qualitatively similar patterns for the

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3.5 Treatment effects on policy support and political activism

Do the positive treatment effects of the information treatments also carry over to the political domain? To study this question, we collect post-treatment information on policy support and political activism (see Section 2.5). Columns 1 and 2 of Table 4 present the estimated treatment effects on the standardized indices of support for climate policies and willingness to engage in political activism. Column 3 presents the results for the standardized, joint index. We find that both treatments significantly increase support for climate policies. The behavior treatment significantly increases policy support by 0.09 standard deviations, while the norms treatment significantly increases policy support by 0.07 standard deviations. The estimated coefficients are positive albeit insignificant when we consider willingness to engage in political activism as the outcome, potentially reflecting that political activism is more costly and thus an outcome that is more difficult to move.[16] When we use the joint index as the outcome, we find that the behavior treatment significantly increases the index by 0.06 standard deviations, while the norms treatment has an insignificant positive effect of 0.03.

Consistent with the results reported above, we also find that the estimated impacts of the treatments on policy support and political activism tend to be stronger for the subgroup of climate change skeptics. Appendix Figure A.8 shows that both the behavior and the norms treatment significantly increase individual support for policies to fight global warming by 10 to 20 percent of a standard deviation among climate change skeptics. By contrast, our information treatments have hardly any impact on policy support among respondents who believe in climate change.[17]

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moderating effect of moral values for the norms treatment, although the effects are more muted (columns 4–6).

[16]A recent literature suggests that political activism and protest behavior can sometimes be a game of strategic substitutes. In this case, learning that more Americans endorse pro-climate norms and behaviors could lower the personal incentives to engage in activism (Cantoni et al., 2019).

[17]Appendix Table A.11 and Table A.18 present treatment effect heterogeneity by political affiliation and prior beliefs.

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Table 4: Treatment effects on support for policies and actions to fight global warming

	(1) Policies	(2) Activism	(3) All
Behavior treatment	0.088***	0.039	0.061**
	(0.026)	(0.027)	(0.026)
Norms treatment	0.066**	0.012	0.034
	(0.026)	(0.027)	(0.026)
N	5,999	5,994	5,993
z-scored	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Notes: This table shows OLS regression estimates using respondents from wave 2. Dependent variables: "Policies" is an index measuring individual support for policies to fight climate change (7 items). "Activism" is an index measuring political activism through different types of activities (11 items). "All" is a joint index comprising all 18 items. All indices are constructed by taking the sum of all positively coded items and standardizing the sum to have a mean of zero and a standard deviation of one in the control group. The indices are regressed on binary indicators that take the value of 1 for respondents in the behavior treatment and norms treatment, respectively. All regressions include the set of controls described in Table 2.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses.

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Taken together, we conclude that providing people with accurate information not only has the potential to increase individual willingness to fight climate change – especially among climate change skeptics – but that it can also increase individual support for climate policies.

4 Discussion

In this paper, we study the perception of climate norms in the US and its effect on individual willingness to fight climate change in a large-scale survey with 8,000 US adults. Our finding that Americans vastly underestimate the prevalence of climate norms in the US holds particular political relevance. We show both correlationally and causally that perceived social norms are a key driver of individual willingness to fight climate change. The fact that climate norms are commonly underestimated in the US can thus form a dangerous obstacle to climate action. It could trap Americans in an equilibrium with low climate engagement: Individuals are discouraged by the (mis)perceived lack of support, and they abstain from taking actions themselves, which sustains the pessimistic beliefs held by others – a phenomenon that has been dubbed pluralistic ignorance (Allport, 1924; Miller and McFarland, 1987; Bursztyn et al., 2020).

However, this diagnosis also implies a unique opportunity to promote and accelerate climate-friendly norms and behavior. We show that a relatively simple, scalable, and cost-effective intervention – namely informing respondents about the actual prevalence of climate norms in the US – reduces these misperceptions and encourages climate-friendly behavior. Importantly, we find that this intervention is depolarizing and particularly effective for climate change skeptics, the group of people who are commonly difficult to reach. Our results suggest that informing people about the behavior of relevant peers constitutes a particularly effective tool to target, reach, and convince skeptics.

Arguably, the effect of a single, minimalist message as embodied in our information treatments may dissipate with time. Also, we do not yet fully understand which features are critical to successfully communicate social norms in practice (Bicchieri, 2017; Constantino et al., 2022), for example, how important explaining the threat from climate change and highlighting concrete steps to act (CO_2 offsets in the experiment) are in addition to sending the

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normative message. Fortunately, large-scale information campaigns can diversify and speak to all of these aspects. They can repeatedly communicate the actual prevalence of climate norms, aiming for a long-lived correction of the existing misperceptions and permanently fostering climate norms (DellaVigna and Gentzkow, 2010; La Ferrara, 2016; Constantino et al., 2022; Chopra, 2023).[18] Such campaigns could also highlight that misperceptions are prevalent for many different types of climate-friendly behaviors, and they could draw on diverse channels and strategies, such as information via the news or edutainment via television. It is equally crucial to avoid giving undue attention to the small, vocal group that opposes climate action or even denies climate change (Boykoff and Boykoff, 2004; Oreskes and Conway, 2010), a factor that could have contributed to Americans' underestimation of their peers' readiness to take action. In sum, these measures could trigger a positive feedback loop where learning about the existing support of climate norms encourages Americans to take visible action against climate change, which encourages others to follow suit.

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[18] An important caveat is that social-norm-based campaigns could in principle also backfire if they highlight that too many people do not follow a norm (Schultz et al., 2007). Our results suggest that this is unlikely to happen in the US, where climate norms are widely underestimated. Moreover, in our experimental context, even initial overestimators do not reduce their climate donations.

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