Information Framing Effects on Individual Climate Urgency

Information framing is known to have impacts on political behavior. In particular, the way an issue is presented in either a positive or negative light can lead to differing responses to otherwise identical information. In this project, I apply "gain" and "loss" frames to climate information to test whether statistics presented in terms of chances of success or of failure would alter political behavior. The study finds that there is no significant shift in behavior at the aggregate level, but there is evidence suggesting variation in response to the stimulus by political identity and strength of prior belief.

In 1896, Swedish chemist Svante Arrhenius theorized that the burning of fuels could lead to a buildup of atmospheric gasses that would cause the average temperature of the planet to rise (Tanzi, 2022). Arrhenius was right, of course. However, his theory was not revisited until the 1990s. Today, climate change is not only a concern, it may be the greatest civilizational threat of the modern era. If current human behavior is not changed to a significant degree at a global scale, there will be irreparable damage to the very ecosystems that sustain life. To quote Council on Foreign Relations president Richard Haass, "Short of some technological revolution that would transform global energy use, we should be concerned, even alarmed, about the future impact of climate change on the world. It is the quintessential global challenge in that no single country can solve this problem on its own and there is no way for any single country to shield itself from its effects (Haass, 2022)." The Intergovernmental Panel on Climate Change (IPCC) stated in 2022 that climate change has caused damage to nature and humans as well as irreversible impacts on systems and their ability to adapt to the circumstances (IPCC, 2022). The

most cited problem is rapid weather change which has caused an overall harshness that impacts the ability of lifeforms to survive as well as an increased frequency of extreme weather events. Gasses are trapping heat in the atmosphere and raising the average temperature of the earth. Human activities such as agriculture, deforestation, and the use of fossil fuels have all accelerated this process.

Interestingly, the greatest challenge of the 21st century is not entirely believed by all to exist. The scientific community has undoubtedly reached a consensus on the topic, affirming that an atmospheric buildup of gasses has amassed, and it is the result of human activities (Hoffman, 2012). Survey data continues to report that the American public is not fully convinced by the data, with a quarter of US adults not believing that human activity affects the climate in a 2024 study (Pew, 2024). Given the overwhelming scientific evidence available, as well as the evidence that the potential damages caused by a warming planet are great enough that any chance of climate change being real should be taken seriously, policy should operate on the assumption that climate change is real and should be treated with the level of concern reflected by the IPCC.

In a democracy, this is not so simple. As citizens are able to voice their opinions in political matters, it is consequently their responsibility to determine what the collective must prioritize. The government is an instrument through which the citizens may organize their objectives, collect money, and develop policy (Tanzi, 2022). This model of problem solving thus requires the public to accurately assess what the issues of their time are, collectively determine their relative importance, and be willing to raise adequate funds, often through taxation, to address the identified problems. What science suggests is an important policy issue matters only if the public can properly digest and respond to the information they are presented. The first step

in successful climate mitigation, then, is identifying the most effective way to communicate scientific information.

In addressing climate change, it is crucial to recognize the finite limits of the biophysical environment and not attempt to supersede them. Human inventiveness can maximize the potential of natural resources, but it is bound by limits and ecological laws. The approach to climate change is not to overcome the environment technologically, but to adapt human behavior and processes socially (Harper and Snowden, 2017). It is difficult to convince a society to willingly implement large scale changes, particularly those that will inconvenience them in the short term. Personal experience largely shapes political behavior (Campbell et al., 1960). Additionally, it may be the case that some voters do not consider the future when making decisions and are dominantly voting retrospectively (Achen and Bartels, 2017). Thus, a successful policy should explain its motivation to citizens in terms of their own experience. Climate policy must make evident how and why it is relevant to an individual to have a chance of being supported.

People do not process all information equally. While the characteristics of an individual shape the way they think about something, so too does the information itself. By changing the way a fact is phrased or the context it is within, its meaning can drastically change. Particularly in dealing with a large, abstract concept such as climate change, people must rely on their personal experiences as well as the information they have acquired from others to piece together what they are being told (Lippmann, 1922). The way information is provided can impact democratic outcomes in meaningful ways. In this study, I hope to explore an aspect of this information framing process: the tone of the information provided. Specifically, I hope to

experimentally test whether individuals are more willing to support more ambitious climate policies when the information is presented in terms of gains or losses.

Information, Statistical Evaluation, and Framing Effects

Information is the currency of democracy. Politics is a process of making decisions about resources, a process which relies on participants being informed on the subjects at hand. There are many variables which complicate this relationship, however. People process the same information differently on an individual level based on their personal traits, prior beliefs, and life experiences (Jerit and Kam, 2023). The internal motivation to seek out and process information also varies from person to person and in different contexts (Lupia and McCubbins, 1998). There is great debate among political psychologists about the level of knowledge that one must possess in order to effectively participate in democracy (Converse, 1964; Delli Carpini and Keeter, 1996; Kuklinski and Quirk, 2000; Lau and Redlawsk, 2001; Achen and Bartels, 2017; and many others). Whether or not someone is able to make a political decision that accurately reflects their beliefs depends on their ability to determine the ideological position of a given policy or politician relative to their own ideal point (Freeder, Lenz, and Turney, 2019).

Before acting on information, citizens must be able to accurately process information. This process is less contested in the literature: in general, human cognition is very biased. Whether through the filter of personality (Bakker, 2023), emotions (Kushner Gadarian and Brader, 2023), motivated reasoning (Kunda, 1990; Lodge and Taber, 2013), social context and personal values (Feldman, 1988), or a number of other biases and cognitive processes, the meaning conveyed by information is unique to each individual recipient. The human brain developed for survival purposes. The modern day information environment is far more taxing

than the natural environment humans evolved within. The consequences of this dynamic are apparent in the general inconsistency in human capabilities in sociopolitical contexts.

More importantly for the purposes of this study, probability and statistics are inherently unnatural and complex information. The way people think about uncertain outcomes often engages the use of heuristics that can lead to severe and systematic errors (Tversky and Kahneman, 1974). When processing the facts motivating public policy, systematic bias can lead to policy outcomes that do not accurately reflect the beliefs of the public (Althaus, 1998). Optimal wording in a policy proposal or ballot measure can greatly affect democratic outcomes (Burnett and Kogan, 2015). Following this logic, there may be an optimal way of presenting statistics and probabilities. The evidence for this idea comes from Tversky and Kahneman's experiments in which participants were demonstrated to come to significantly different conclusions on the same information simply due to a manipulation of the framing of probabilities they were provided (Tversky and Kahneman, 1981). In environmental policy scenarios, it may be the case that the frame of the information provided may be influencing and systematically biasing the support of the public. In the interest of pro-environmental adaptation, it is advantageous to understand how to formulate climate change information in a way that positively impacts levels of public support.

The frames used by Tversky and Kahneman put outcomes in the context of either gains or losses. Choices involving gains activated greater risk aversion, whereas choices framed in terms of losses saw higher rates of risk taking (Tversky and Kahneman, 1981). In addition to this, the size of the probability and the perceived weight of the outcome are important factors in decision making. People are more likely to take action to protect themselves from high probability small risks than low probability large risks (Slovic et al., 1977). Climate change is a

low probability, high risk event when framed in terms of the likelihood of a specific impact happening by a specific time. The actual probabilities of environmental events are very uncertain, but the science suggests that the likely outcomes are severe (IPCC, 2022). Thus it is likely that willingness to support specific policies will vary greatly with the framing of the information.

Some studies have experimented with the framing of climate scenarios in the past. Hope is likely to play a critical role in explaining levels of ambition in climate policy support. Hope theory suggests that a motivating factor in behavior is the ability to identify pathways to desired goals (Snyder, 2002). Without the perception of efficacy, the framing of information is irrelevant. In the political context, a lack of hope can lead to individuals disengaging from what they otherwise believe to be an important issue (Nadeau, Niemi, and Amato, 1995). If the climate scenario appears overwhelmingly pessimistic, those who would otherwise support policy may lose hope and consequently fail to act on their beliefs.

It is important to distinguish between hope as political efficacy and hope as an emotion, as these have demonstrated different experimental effects in climate change policy contexts. When trying to manipulate emotional states of hope and fear, Ettinger and others found that the feelings could be successfully primed but neither one had an effect on perception of environmental risk nor pro-environmental behavior (Ettinger et al., 2021). Similarly, an experiment manipulating gain and loss frames with the goal of evoking hope or fear found that positive gain frames did increase the emotion of hope, but lowered perception of threat and willingness to act. Loss frames instilled fear and increased threat and willingness to act (Bilandzic, Kalch, and Soentgen, 2017). It would thus seem as though hope as an emotion does not positively affect pro-environmental behavior. However, by balancing fear and threat with

hopeful efficacy statements, high rates of pro-policy attitudes can be encouraged (Armbruster, Manchanda, and Vo, 2022). Hope as perceived efficacy motivates support for climate policy in an empirical, cognitive fashion, whereas emotional hope functions as affective optimism that leads to free-riding (Rand, 2018).

Hypotheses

The literature surrounding the perception of probabilities suggests that framing will have a strong impact on behavior. In particular, gain frames will encourage risk aversion while loss frames will encourage risk taking. In the context of environmental policy in this study, risk will be defined as the willingness to support policy that is less likely to succeed. I expect that those exposed to the gain frame will demonstrate higher rates of risk aversion and those exposed to the loss frame will demonstrate higher rates of risk taking.

Hypothesis 1:

Participants in the gain frame treatment will be less ambitious and more likely to support the policy with the higher expected probability of success (2.0°C). Participants in the loss frame treatment will be more ambitious and more likely to support the policy with the lower expected probability of success (1.5°C).

I also expect to see differences in policy support by partisan affiliation and age. Climate change continues to be a strongly polarized issue. Political party is a strong predictor of beliefs surrounding the relationship between human activities and the state of the environment (Pew, 2024). I expect Republicans to exhibit different behavior than Democrats in this experiment

regardless of their assigned treatment condition, but that the treatment effect will exist in both groups.

Hypothesis 2:

Republican respondents will support the less ambitious goal (2.0°C) at higher rates across both treatments, but there will still be a treatment effect. Democratic respondents will support the more ambitious goal (1.5°C) at higher rates across both treatments, but there will still be a treatment effect.

Concerning age, evidence suggests that older individuals are less likely to support environmental policies. This is attributed to the longer time horizon associated with climate focused politics and the expected individual experience in the absence of such a policy (Balestra and Dottori, 2012; Andor, Schmidt, and Sommer, 2017). Older individuals will be less likely to support an environmentally focused policy in either treatment, but I expect a mild treatment effect to still be present.

Hypothesis 3:

Older respondents will be more likely to support the less ambitious goal (2.0°C) at higher rates across both treatments, but there will still be a treatment effect.

These three hypotheses represent the findings I expect to find based on theory from previous research. There may be small differences by gender, education, or race, but I do not expect these to have a significant effect.

Experimental Design and Methods

To conduct the study, I performed a survey experiment on Connect by CloudResearch. This service has become popular in the social sciences for conducting surveys. While the study was constrained by a modest budget, I was able to collect data from 804 participants. Attention checks and political knowledge tests were performed to ensure the quality of the data.

I began by asking respondents to rate how important protecting and conserving the environment is to them on a 100 point scale, with 1 being not at all important and 100 being extremely important. This question will provide insight into whether environmentalism is one of the respondent's policy priorities. This is important to measure to ensure that prior beliefs are evenly distributed among the treatment groups. A randomization error in this sense would distort any findings. Additionally, if there is a consistent difference in treatment effects among individuals with different levels of belief strength, this is also a very important finding.

After these initial questions, participants move to the experimental component of the survey. Survey respondents were given a very brief overview of the current global climate situation to provide context for the experiment. Then, two policy options were introduced: a target to keep global warming below 1.5°C, and one to keep warming below 2.0°C. Participants were briefed on the fact that a lower target meant greater prevention of disaster but at the cost of greater systemic and social change. After considering the information provided, the respondents were asked to choose whether they wanted to support the 1.5°C goal or the 2.0°C goal. The design was set up to be a forced choice between the two policies to avoid people with weaker beliefs in the importance of climate change opting out or not making a choice.

The experimental manipulation changed the frame of the probabilities that survey respondents saw. In the gain frame, the statistic provided was the probability that each goal has

to succeed under current trends. For 1.5°C, there is a 10% likelihood that warming remains below the target goal by 2040. For 2.0°C, there is an 83% likelihood that warming remains below the target goal by 2040. The benefits of the 2.0°C target are lesser due to its lenience, but the chance of success is higher and social and political costs of achieving it are lower. The loss frame provided the complement of the information in the gain frame, instead providing the probability that each goal fails. For 1.5°C, there is a 90% likelihood that warming exceeds the target goal by 2040. For 2.0°C, there is a 17% likelihood that warming exceeds the target goal by 2040. To make the data more American-friendly, the temperature goals were also provided in Fahrenheit, making the target goals 2.7°F and 3.6°F respectively.

The two sets of facts are effectively identical, but are hypothesized to engage different styles of thinking and accordingly result in different rates of support based on the assigned treatment. The statistical framing is the only difference between the two treatments. All other information provided and its phrasing will be the same. To avoid deceiving the participants, all of the facts provided are derived from the 2022 IPCC report and are scientifically accurate as of the date of publication. This is true for the description of climate change, the predicted outcomes of both the 1.5°C and 2.0°C scenarios, and the outcome probabilities in each treatment.

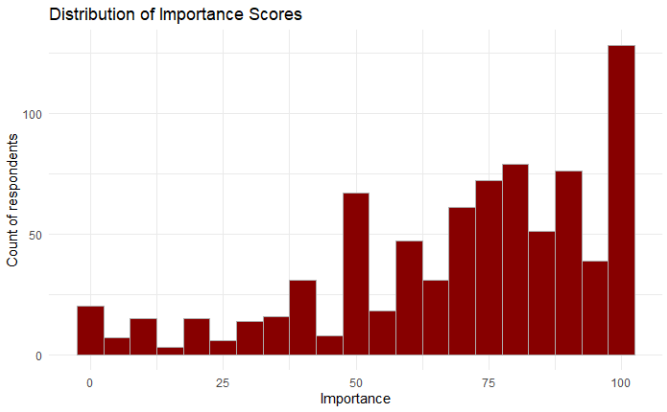
Finally, as a manipulation check, respondents were asked to explain why they chose the policy option they did. This question was optional and fully open ended. Of the 804 participants, 643 provided at least a brief explanation for their reasoning, allowing verification that the treatment worked the way it was meant to. By performing a simple manipulation check, I can ensure that respondents' policy selection aligns with their beliefs and their understanding of the information they were given.

I concluded the survey by collecting demographic information from the participants. I asked for their age, gender, race, educational attainment, and partisan affiliation. This will allow for the identification of any identity-based patterns, as well as for the analysis of the hypothesized effects of age and party. Age was measured by group, either 18-29, 30-44, 44-59, or 60+. Gender and race were measured by their existing US Census categories. Education level had the options of 11th grade, 12th grade with no diploma, high school, some college with no degree, Associate degree, Bachelor's degree, Master's degree, professional school degree, and Doctorate. Partisan affiliation will have the options Republican, Democrat, and Independent.

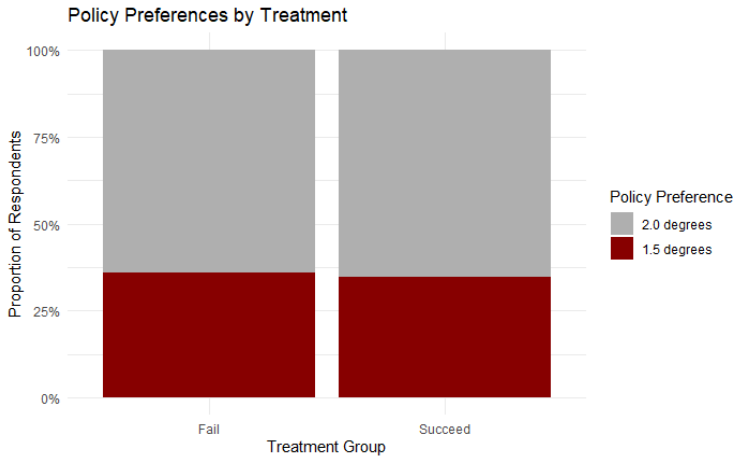
While great consideration was given to the design of this experiment, it is limited by the scope of the information it utilizes. The biophysical difference between the 1.5°C and 2.0°C scenarios is not very pronounced. There are certainly some changes that would be felt in the short term if the planet became that much hotter in such a short period of time, but the more significant impacts of this difference will be felt much later in history on a scale that is difficult to contextualize in this survey. While the large difference in their probability of success should be sufficient in creating different behaviors across treatments, the 15 year time scale and 0.5°C variation are admittedly small. However, in keeping with the commitment to using real facts, this is a sacrifice I am willing to make. I would recommend that future studies select more drastic cases, but the current design provides the advantage of using data that is publicly available, adding some external validity. The probabilities used are likely similar to the information citizens could encounter in the real world when researching the impacts of climate change.

Results and Analysis

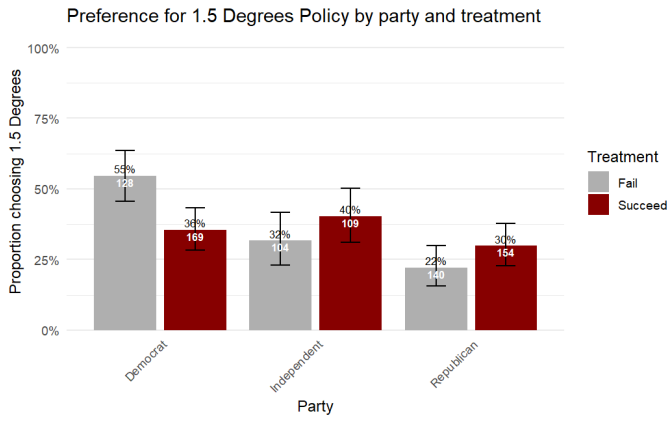
In total, the survey collected 804 responses. 432 received the success treatment, and 372 received the failure treatment. There were 297 Democrats, 213 Independents, and 294 Republicans. The ages ranged from 18 to 102, with the majority of participants being born between 1976 and 1994. Beliefs of the importance of climate change as an issue ranged from 0 to 100, with a mean of 70 and a median of 75. The sample was well educated, with the majority of respondents having college degrees. 574 of the 804 participants had an Associate degree, a Bachelor's degree, or a graduate degree.



To test hypothesis 1, I performed a chi-squared test comparing rates of support for the 1.5 degree policy option between the two treatment groups. The test reported a p-value of 0.7563. Hypothesis 1 was not supported by the data, as the test was not statistically significant. There was a very small difference in preference for the 1.5 degree option in the failure treatment group, but it was far from large enough to suggest a real difference between the treatments. In total, 34.72% of respondents in the success treatment chose the more ambitious 1.5 degrees policy option, compared to 36.02% of respondents in the failure treatment.



To test hypothesis 2, I ran a binomial test comparing the number of respondents that preferred the 1.5 degrees policy option to the total number of participants in their partisan

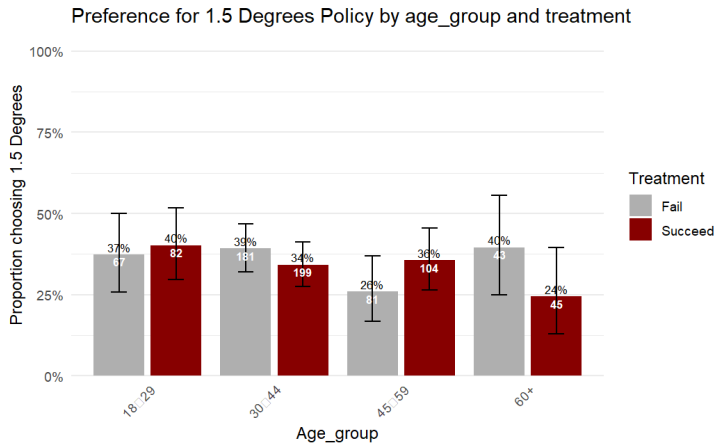


category in the same treatment. This test showed that there was more going on in the data than the test for Hypothesis 1 would suggest. There were noticeable differences in the baseline behaviors of Republicans and Democrats, and the treatment effect on them worked in opposite directions. Independents in this sample appeared to largely mirror the decisions of Republicans. The treatment effect for Democrats is statistically significant at a 95% confidence level. 55% of Democrats exposed to the failure treatment supported the 1.5 degrees policy, while only 36% of Democrats in the success treatment did so. The differences among Republicans and Independents, while not statistically significant, show evidence of the treatment working in the opposite way. 22% of Republicans exposed to the failure treatment supported the 1.5 degrees policy, while 30% of Republicans in the success treatment did so. For Independents, the respective proportions were 32% and 40%.

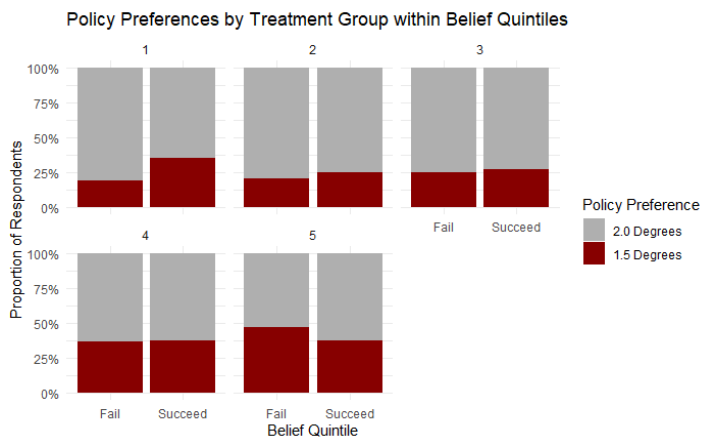
The results of this test suggest that partisanship played a major role in determining the effect of the treatment. My initial hypothesis was that the treatment effects would work in the same direction for all participants, but that there would be different floor rates of support. Democrats would be more willing to support the more ambitious goal in general, but the failure treatment would make participants in all groups more likely to do so than those in the success treatment. I fail to support this hypothesis, but instead find an arguably more interesting result.

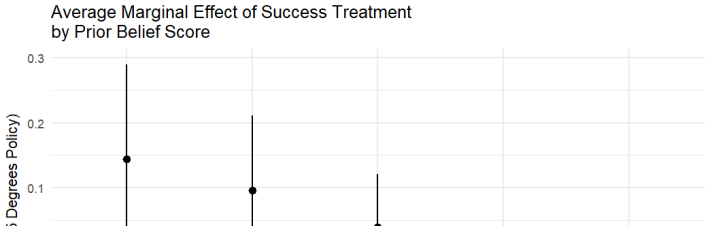
Exposure to chances of failure made Democrats more ambitious, whereas chances of success led to greater ambition for Republicans and Independents.

To test hypothesis 3, I used the same style of analysis as for hypothesis 2. Here, there are no significant findings. Support for the 1.5 degrees policy appears to be roughly the same across all age groups. There is no discernable pattern in how the treatment effect varies with age, so hypothesis 3 is rejected with a lack of supporting evidence. I had thought there would be a strong decline in support for climate policies as people get older, but the evidence from this survey did not reflect any pattern.



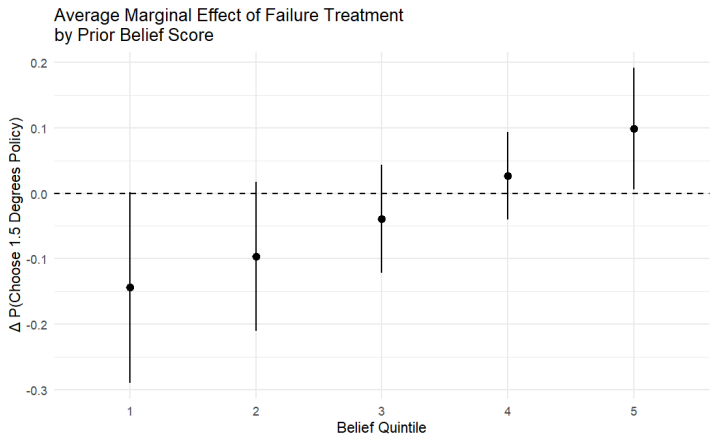
While the hypotheses of this study were not supported by the data, there were still some interesting patterns in the data worth noting. Something I had not predicted was the role that prior beliefs would play in shaping the participants' choices. Similar to what was found for partisanship, there was a change in the direction and magnitude of the treatment effect when analyzing the policy choices by strength of belief in the importance of environmentalism. The effect is not statistically significant, but the direction of the effect seems to suggest that there is a difference in how the treatment impacted those with the





weakest priors differently than those with the strongest priors. To isolate this effect, I ran a logit model to identify the heterogeneous treatment effects when the data is sorted by quintile of prior belief strength, controlling for party, education, age, and gender. The result is a statistically significant difference between the first and fifth quintile, suggesting that the success treatment in fact goes from a strong positive impact on likelihood of selecting the 1.5 degrees option to having a small negative effect for those with the strongest priors.

Conversely, the failure treatment became more effective on those with the strongest prior belief, but had a negative impact on the likelihood of choosing the 1.5 degrees policy for those with the weakest prior beliefs in environmentalism. This effect is also statistically significant at the 95% confidence level. The average marginal effects suggest that prior beliefs are important to consider when interpreting framing treatment effects.



To further explore the findings of this study, I considered how partisanship and prior beliefs may be interacting with each other. In modern American politics, climate change is a dominantly Democratic issue. Splitting the distribution by party does suggest that this pattern exists within the data set. The average prior belief scores were 81 for Democrats, 57 for Republicans, and 72 for Independents. The marginal effects did hold when controlling for party, so instead I will explore the interaction between party and beliefs. Creating a logit model to predict policy preference with interactions between treatment group and party, and treatment

group and belief. The logit reports a strong significant effect between treatment and partisanship but not between treatment and belief, suggesting that partisanship is likely the variable of interest in this relationship. However, the belief coefficient on its own is also statistically significant, so it is relevant to predicting the policy choice, it just does not interact with the treatment.

Discussion

The findings of this study, while not in accordance with my hypotheses, suggest that framing effects work differently from Tversky and Kahneman's original experiments when applied to a political context (Tversky and Kahneman, 1981). The classic framing effects paper presents scenarios in terms of life and death or financial decisions and lotteries. These are things for which people do not have priors to rely on. There is no social or informational cue for whether to choose a 10% chance to make $100 or a 50% chance to make $20. For political issues, however, participants are not a blank slate. As such, it makes sense that a treatment will have different effects for different participants.

A strongly pro-environmental individual, for example, comes into the study with a rigid predetermined belief about how they feel about climate change and how important of an issue it is to them. This person will interact with the treatment differently than a climate change denier. Information is thought to be processed through the lens of preexisting beliefs, so the same stimulus may encourage one person to be more ambitious while dissuading another (Lodge and Taber, 2013).

The data from this study suggest that whether doom and gloom or inspiring hope is more effective for climate change depends on the audience. For those who believe it is an important issue, inspiring fear is motivating and leads to more ambitious action. For those who are not

convinced that fighting climate change is a worthwhile cause, focusing on success makes them more willing to take a risk. This finding may be useful to politicians and interest groups looking to build support for climate policies. For more supportive crowds, a harsher reality may grab their attention and motivate them to act. For more hesitant crowds, there is a better chance of gaining their support by focusing on victories and potential positive outcomes. When framing a political issue, the prior beliefs and identities of the listener shape their experience and their reaction.

The null results of this study also suggest that framing does not lead to an aggregate change in behavior. While individual level effects were recorded, there was no significant difference between the two treatment groups. Individuals are sensitive to the information they are exposed to, but this has its limitations. This actually has some positive implications for democracy. It suggests that the way the statistics provided with policy information are presented will not affect outcomes. Thus, regardless of if a climate policy were written in a gain or loss frame, it would be expected to generate the same amount of support. If there was a major difference in behavior between the two treatment groups, it would suggest that campaign efforts and ballot issues may have succeeded or failed in the past in part due to their phrasing. However, the results of this study make political outcomes in this domain more trustworthy.

A future direction for research would be to test this finding in other policy domains to see if prior beliefs tend to moderate policy choices, or if this finding is unique to climate change. Climate change is a fairly polarized issue, one for which people are likely to have very strong pre-existing opinions. To see if the general effect of framing is moderated by prior beliefs, I would test the same setup on other polarized policy issues such as gun control, abortion, and healthcare policy. As a way of testing the role of partisanship, I would also like to test an issue

where partisanship likely would not predict belief being in a certain direction, using policy domains such as infrastructure, criminal justice reforms, or consumer protection. With these two additional tests, I believe a great deal could be learned about political behavior and the way individuals interact with information.

Appendix

Survey Questions:

1. How important is protecting and conserving the environment to you?
2. To address climate change, the government must set a target level of warming to stay below. The lower the goal, the more social changes will need to be made to decrease carbon emissions. However, the higher the global temperature becomes, the more serious the consequences are for human life. Global warming was recently measured at 1.1°C (2.0°F) above temperatures in 1900. Imagine that your government is trying to decide between a target of keeping global warming below 1.5°C (2.7°F) or 2.0°C (3.6°F) by the year 2040.

   Which goal would you want your government to work toward? Listed below are the goals' probabilities of success. The probabilities are based on current trends of carbon emissions and energy consumption.

   a. Keep temperature increases below 1.5°C (2.7°F) - 10% likely to succeed
   b. Keep temperature increases below 2.0°C (3.6°F) - 83% likely to succeed

3. If you would like to explain your decision from the last question, please do so here.

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