Which frame fits? Policy learning with framing for climate change policy attitudes

Pre-analysis plan

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Introduction

Climate change denial poses a large societal risk by slow walking important policies that could be crucial in protecting the environment, people's lives, and the global economy. However, despite the risks associated with climate change, much of the public has doubts relating to the validity of climate change (Newell and Pitman). As a result, communicating the science to the public in an approachable way remains an important policy priority. Our research seeks to expand the current literature on framing effects on public policy, specifically climate-change-related policy. Often, when presenting governmental programs and ideas, agencies use framing, a method used in deciding how to present information most effectively to produce a desired response (Newell and Pitman). As Foust and Murphy assert, framing can be important in ascertaining the possible ways people can interpret and contextualize information. "While frames 'cannot guarantee how a reader will interpret or comprehend' an issue or text, they 'play a fundamental role in structuring the range of likely decodings' (Greenberg & Knight, 2004, p. 157), often in ways that support dominant ideologies." Discovering which types of framings are most effective for climate change remains a crucial task to garner support for governmental organizations and think tanks to enact policy. This policy will help to mitigate the worst effects of climate change as discussed by experts and provide a broader contribution to the literature by examining what ways scientists can converse with the larger public.

This project builds on and modifies the frames proposed by Severson & Coleman (2015). The original study presented scientific, moral, religious, and economic framings to achieve increased support in climate change-related policy. Our experiment builds upon this existing experiment, using five of the six original moral frames, divided into scientific, moral, religious, and economic (efficiency and equity) categories, as well as a pure control condition. We have adapted the wording used in Severson & Coleman (2015), making warnings more specific and adding some modifications on the source of recommendations.

The original study reports treatment effects under each of the frames, but we may not be interested in each frame in isolation, but the relative performance of the frames. In our analysis, we first target the average effect of each framing on support for climate change policies. Next, we determine what the best framing for survey respondents is, on average, and we test whether this framing statistically outperforms the control. Severson & Coleman (2015) examined heterogeneity based on political ideology, prosociality, scientific confidence, political trust, and

church attendance. However, with as few as 46 observations per condition, power to detect heterogeneity is limited. We also explore heterogeneity and attempt to discover the effects of providing a more personalized framing assignment. We do so by fitting random forest models under each counterfactual policy, and predict the best policy for a given individual conditional on their covariate profile. We test whether this personalized framing statistically outperforms the control condition. Our methods for policy learning, both for fixed and personalized policies, use sample splitting to ensure valid treatment effect estimates. More details on the exact procedures are in the design section.

This approach to policy learning, combined with a larger sample size obtained through the Cloud Connect survey platform, provides more precise quantitative analyses and will allow us to make conclusions regarding the relative effectiveness of each individual frame as well as personalization of framing. Overall, the study aims to contribute to the way we understand framing methods related to climate change policy. By providing additional insights into the effectiveness of several different scientific, moral, religious, and economic framings related to climate change beliefs, and indirectly, policy support, we supply quantitative analysis of multiple potential framings to determine those that best influence individual attitudes. We also learn whether there are benefits to targeting different messages to different subgroups. Such gains may be applicable to fields such as political decision-making, policy advocacy, international cooperation, and others, serving as a foundation for future research to corroborate and deepen the insights gained through this experiment.

Frame selection.

In Severson's and Coleman's original paper they find that a negative science framing is the most effective method of communicating climate change related policy; science-based framing emphasizes the scientific consequences of climate change and is the "traditional communication approach of climate science and climate policy advocates," with the negative aspect highlighting "the negative consequences of inaction." In other research, Leeper and Mullinix (2015) find the negative science frame to be one of only two frames that significantly ($p < 0.05$) increased climate change policy support. In contrast to the negative science frame, the positive science frame emphasizes the positive results created by climate change mitigation policy and action; however, this frame was excluded from the experimental design due to its lower effectiveness compared to the negative science frame. In turn, by keeping this negative science frame, we can more effectively compare it to the other treatments we explore within the study. It also allows us to better analyze if non-scientific communication methods on climate change are relatively more effective for certain demographic groups.

From a moral framing perspective, existing research has found that moral convictions and relevant emotions significantly shape political attitudes (Emler, 2003; Mullen & Skitka, 2006; Skitka, Bauman, & Sargis, 2005), spark increased political engagement (Marietta, 2008), and promote ideas that different individuals on the political spectrum may have "different moral profiles" (Feinberg and Willer). Separately, as Markowitz and Shariff discuss in *Climate Change and Moral Judgement*, while there is evidence that moral intuition is a significant motivator for action, climate change does not emotionally register as a moral wrong. Thus, individuals may

not seek to pursue immediate action or change (243). Even so, researchers have found that greater consideration of individuals' "varying moral intuitions" may allow for more effective policy support and political action (Clifford and Jerit 2013; Haidt and Graham 2007). For instance, when pro-environmental arguments are framed to promote values that might resonate more with conservatives, differences between ideological groups almost completely vanish; indicating that moral framing may heavily impact individual policy responses and behaviors, subject to the specific wording of questions or prompts.

Regarding religious framings, current literature examines the relationship between science and religion in public discourse related to policy. Although current literature largely concludes that religious framing alone does not create large changes in policy support when added to other demographic divisions or framing tools, it may indirectly cause significant effects on respondent behavior and policy support. Despite Severson and Coleman's paper finding religious framing to be less effective, it remains an extremely dominant framing in media, specifically framing that targets a Christian audience. As such, we decided to keep this treatment and tailor the framing to align more closely with Christianity instead of being broadly targeted. Indeed, it was found that religious involvement predicted four measures of environmental concern (Kanagy & Nelsen 1995; Eckberg & Blocker 1989). Yet, when isolating the effects of religion away from other variables, such as gender, age, education, and income, other researchers found that neither of the two variables they used to measure religious beliefs was significantly related to environmental behaviors (Kanagy & Nelsen 1995; Kanagy & Willits 1993). Religion additionally functions as an important tool enabling the usage of metaphors, which is "one of the most salient framing devices" (Entman 1993; Nerlich et al. 2009). Nerlich et al. further indicate that religious metaphors may contribute to discourse relating to issues such as "truth, evidence, certainty, consensus, and belief" and be used to reject scientific findings contradicting existing beliefs. Importantly, the current literature exhibits problems related to framing religion in a way that is similar to how people experience it in their day-to-day lives. By providing very brief and high-level descriptions of religious appeals, people may doubt the effectiveness of religious framing in current literature as being representative of the idea it encompasses.

Finally, regarding economic framing, the costs of climate change are substantial, and greenhouse gasses "represent the biggest market failure the world has seen" (Stern, 2008). Economic frameworks can be presented in various ways, each with varying degrees of effectiveness toward shifting climate change policy support. Indeed, economic efficiency concerns often fail to change opinions on climate change policies, while a sample framework relating to economic equity did significantly increase support for climate change policy (Leeper & Mullinix 2015). However, using economic framing carries the risk of introducing a conflict between existing values surrounding materialism and environmentalism, which have been shown to be negatively related (Markowitz & Shariff 2012). Furthermore, Markowitz and Shariff state that "recent research demonstrates that promoting extrinsic values", in this case, the values incentivized by the economic framework, "can actively inhibit individuals from developing intrinsic, non-materialist motives" to respond to the problem at hand. Ultimately, the effectiveness of economic framings toward shifting policy support appears to vary based on the specific framing used, and it may be useful to test several different economic framings, in this

case the efficiency and equity framings, in order to provide a broader overall picture of the usefulness of economic framings as a whole.

Design

We recruit 2,330 respondents through the Cloud Connect Survey platform, enforcing balance on political party. Respondents are paid $1.50 to take a 5-minute survey, delivered over Qualtrics. Upon entering the study, respondents are engaged in informed consent. This is followed by a module of demographic questions. Demographic measures include pre-test response of our outcome measure.

Respondents are then randomly assigned one of the five framing conditions or a control condition. Treatment is assigned uniformly at random. We ask respondents to reflect on the text of the framing in an open-response question to encourage deeper engagement with the message content. Following treatment delivery, we measure post-test response.

Survey questions and full framing text are in the appendix. From Cloud Connect, we also receive measures of age, sex, race, education, occupation, household income, relationship/marital status, political party, and employment status.

Analysis

All cleaning and analysis code is available at our project GitHub repository, https://github.com/UChicago-pol-methods/ssi3-data-analysis/.

Post-test response is measured as the average of support for a gas tax, a carbon dioxide tax, a treaty to cut carbon dioxide emissions, and regulation of carbon dioxide, with support for each measure scaled from 0-3 (corresponding to various degrees of support) that match those used by Severson and Coleman.

Our analytical targets are as follows:

1. What is the mean response under each of the different framings, on average, and separately for Democrats, Republicans, and Independents?

- We report simple mean response estimates and standard error of the mean under each condition on average, and separately for Democrats, Republicans, and Independents, based on our 7-point party identification question.

2. What are average treatment effects under each of the different framings?

- We report simple difference in means estimates under each of the different framings as compared to the control. We report HC3 robust standard errors.

- We report regression adjusted estimates of treatment effects; in our regression adjustments, in addition to treatment indicators, we de-mean covariates and interact them with each treatment. We report HC3 robust standard errors. We separately report regression adjusted estimates:
    - Controlling only for pre-test response,
    - and for a suite of covariates: age, 7-point party identification, 7-point ideology, indicator for full-time employment status, indicator for white race, income, indicator for married or in a civil union/partnership, indicator for college educated, indicator for female, prosociality measure, scientific confidence scale, religiosity, attendance to house of worship, reward consequence scale, economic reasoning scale; as well as separate pre-test response measures for support of a gas tax, a carbon dioxide tax, a treaty to cut carbon dioxide emissions, and regulation of carbon dioxide.

3. Does the framing that is best for people on average statistically outperform the control?

- Procedure for estimating effect of policy that is best on average:
    - We split the data into five random folds.
    - Rotating through each fold of the data, holding that fold as a test set, we use the remaining four folds to estimate separate regression adjusted models controlling only for pre-test response, to determine which treatment had the largest treatment effect.
    - On the test fold, we create a new variable that is an indicator for being in the best condition as determined by the training fold model.
    - Across all folds, we estimate the treatment effect of being in this condition as compared to the control using a simple difference in means estimator. We report HC3 robust standard errors.

4. Does the best personalized assignment (i.e., where we give everyone the framing we estimate is best for them) outperform the control?

- Procedure for estimating effect of the best personalized policy:
    - We split the data into five random folds.
    - Rotating through each fold of the data, we use the remaining four folds to fit a random forest model under each counterfactual treatment condition.
    - For each observation in the test fold, we predict outcomes under each of the treatment conditions using the random forests from the training folds.
    - On the test fold, we create a new variable that is an indicator for being in the best personalized condition as determined by the model with the highest random forest prediction from the training folds for that observation.
    - Across all folds, we estimate the treatment effect of being in the best personalized condition as compared to the control using a simple difference in means estimator. We report HC3 robust standard errors.

Ethical Considerations

This study is a survey completed by survey takers enrolled as participants on a survey platform. We do not ask sensitive or personal questions, beyond questions on general attitudes and policy positions. As such, there are minimal to no risks associated with the study beyond what participants experience in their day-to-day lives. All responses submitted through the Qualtrics platform will remain anonymous and confidential. This study is deemed exempt under University of Chicago IRB protocol number: IRB23-0386.

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Appendix

Survey Questions:

Demographic Questions

1. To the best of your ability, identify your political views (**coded** from 0 (Very liberal) to 6 (Very Conservative))
    a. Very Liberal **(0)**
    b. Liberal **(1)**
    c. Somewhat Liberal **(2)**
    d. Neutral **(3)**
    e. Somewhat Conservative **(4)**
    f. Conservative **(5)**
    g. Very Conservative **(6)**
2. Generally speaking, do you usually think of yourself as a Republican, Democrat, Independent, or what? (**Coded** from -3 to 3, along with questions 3 and 4. No preference is coded as 0)
    a. Republicans
    b. Democrat
    c. Independent
3. To Dem/Rep: Would you call yourself a strong [Republican/Democrat] or a not very strong [Republican/Democrat]?
    a. Strong [Republican **(3)** /Democrat **(-3)**]
    b. Not very strong [Republican **(2)** /Democrat **(-2)**]?
4. To Independents: Do you think of yourself as closer to the Republican or Democratic party?
    a. Closer to the Republican party **(1)**
    b. Closer to the Democratic party **(-1)**
    c. No preference **(0)**

Attention Checks (one should be inserted in the demographic questions(**Coded** as 0-1, with all incorrect options as 0 and correct choice as 1):

1. Color Theory is the study of how colors can impact feelings and behavior. To what extent would you say you like the color brown? Please select “strongly like” to confirm that you are paying attention to this survey.
    a. Strongly dislike **(0)**
    b. Somewhat dislike **(0)**
    c. Neutral **(0)**
    d. Somewhat like **(0)**
    e. Strongly like **(1)**
2. To what extent would you say that it is important to read survey questions in full and answer them to the best of your knowledge? If you are paying attention, please select both “strongly disagree” and “neither agree nor disagree.” (multiple choice question, coded as 1 if both “Strongly disagree” and “neither agree nor disagree” are selected, and coded as 0 otherwise)

a. Strongly disagree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat agree
e. Strongly agree

Other Measures:

1. How much do you trust scientific advice? (Scale of 1 - 5)
    a. Never trust scientific advice **(1)**
    b. Tend to ignore scientific advice **(2)**
    c. Impartial to scientific advice **(3)**
    d. Tend to trust scientific advice **(4)**
    e. Always trust scientific advice **(5)**
2. Do you think you are better motivated by fear of a future consequence or a future reward? (Coded as 1 or 2)
    a. Consequence **(1)**
    b. Reward **(2)**
3. How religious are you? (Scale of 1 - 5)
    a. Not Religious **(1)**
    b. Not very Religious **(2)**
    c. Somewhat Religious **(3)**
    d. Very Religious **(4)**
    e. Extremely Religious **(5)**
4. *[Only for people responding (2) Not very religious (3) Somewhat Religious, (4) Very religious, and (5) Extremely Religious]* What religion do you identify with?
    a. Catholic **(1)**
    b. Protestant **(2)**
    c. Jewish **(3)**
    d. Muslim **(4)**
    e. Other **(5)**
5. *[should only be asked if they answer (1) Catholic or (2) Protestant (3) Jewish (4) Muslim in the previous question]* How often do you attend (church (if 1 or 2), synagogue (if 3), mosque (if 4)? *Also coded as 1 if missing.*
    a. Never **(1)**
    b. Rarely **(2)**
    c. Every few months **(3)**
    d. Monthly **(4)**
    e. Weekly **(5)**
    f. Daily **(6)**
6. How important is economic reasoning to you? (Scale of 1 - 5)
    a. I don't value economic reasoning **(1)**
    b. I think economic reasoning should play a role in few decisions **(2)**
    c. I think economic reasoning should play a role in some decisions **(3)**
    d. I think economic reasoning should play a role in all decisions **(4)**

e. I think economic reasoning is most important to all decisions **(5)**

7. Prosociality Test:
https://socialdilemma.com/wp-content/uploads/2017/07/triple-dominance-me1febc19.pdf

In this task we ask you to imagine that you have been randomly paired with another person, whom we will refer to simply as the "Other." This other person is someone you do not know and that you will not knowingly meet in the future. Both you and the "Other" person will be making choices by circling either the letter A, B, or C. Your own choices will produce points for both yourself and the "Other" person. Likewise, the other's choice will produce points for him/her and for you. Every point has value: the more points you receive, the better for you, and the more points the "Other" receives, the better for him/her.

Here's an example of how this task works:

	A	B	C
You get	500	500	550
Other gets	100	500	300

Depending on whether you pick A, B, or C, that would be the points added to you and the other person's total points. If you choose A you would receive 500 points and the other would receive 100 points.

Please keep in mind that there are no right or wrong answers. Choose the option that you, for whatever reason, prefer most. Also, remember that the points have value: the more of them you accumulate the better for you.

For each of the following nine situations, pick A, B, or C

1.

	A	B	C
You get	480	540	480
Other gets	80	280	480

a. A
b. B
c. C

2.

	A	B	C
You get	560	500	500
Other gets	300	500	100

a. A
b. B
c. C

3.

	A	B	C
You get	520	520	580
Other gets	520	120	320

a. A
b. B
c. C

4.

	A	B	C
You get	500	560	490
Other gets	100	300	490

a. A
b. B
c. C

5.

	A	B	C
You get	560	500	490
Other gets	300	500	90

a. A
b. B
c. C

6.

	A	B	C
You get	500	500	570
Other gets	500	100	300

a. A

b. B
c. C

7.

	A	B	C
You get	510	560	510
Other gets	510	300	110

a. A
b. B
c. C

8.

	A	B	C
You get	550	500	500
Other gets	300	100	500

a. A
b. B
c. C

9.

	A	B	C
You get	480	490	540
Other gets	100	490	300

a. A
b. B
c. C

The pro-sociality measure is coded as 1 if responses are primarily pro-social (joint outcomes are largest), 2 if they are pro-individual (own outcomes are largest), and 3 if they are pro-competition (gap between own and other outcomes are largest).

Pre-treatment and post-treatment:

1. How much do you support or oppose the following policies?
    a. Increase taxes on gasoline by 25 cents per gallon and return the revenues to taxpayers by reducing the Federal income tax. (0 - 3 scale)
        i. Strongly Oppose **(0)**
        ii. Oppose **(1)**
        iii. Support **(2)**

iv. Strongly Support **(3)**

b. Require companies that produce or import fossil fuels (coal, oil, and natural gas) to pay a tax (a "carbon tax") even if it costs the average household an average of $180 per year. (0 - 3 scale)
   i. Strongly Oppose **(0)**
   ii. Oppose **(1)**
   iii. Support **(2)**
   iv. Strongly Support **(3)**

c. United States signing an international treaty that requires the US to cut its emissions of carbon dioxide 90% by the year 2050. (0 - 3 scale)
   i. Strongly Oppose **(0)**
   ii. Oppose **(1)**
   iii. Support **(2)**
   iv. Strongly Support **(3)**

d. Regulate Carbon dioxide (the primary greenhouse gas) as a pollutant. (0 - 3 scale)
   i. Strongly Oppose **(0)**
   ii. Oppose **(1)**
   iii. Support **(2)**
   iv. Strongly Support **(3)**

Pre post-treatment question:

1. Please take a moment to share your thoughts on the text.
   a. Coded as an open response text box

Framing

Empirical-Science Frames

a. *Negative*:

According to scientific authorities, human emissions of greenhouse gasses are the primary cause of rising average global temperatures. If humans continue to emit greenhouse gasses at current rates future temperatures will rise even higher. According to the Intergovernmental Panel on Climate Change, we will have to halve carbon emissions by 2030, and completely stop emitting carbon entirely by 2050 to avoid the worst consequences of climate change. This has consequences. For example, climate change will raise sea levels as ice caps melt; higher temperatures will increase the damage to coastal ecosystems. The science is clear: unless we do something about climate change these ecosystems face dire consequences.

Deontological-Moral Frames

a. *Religious/Biblical:*

According to religious leaders, the bible says we have a duty to ensure that the environment is protected as stewards of God's creation. Religious leaders have acknowledged that human emissions of greenhouse gasses are the primary cause of climate change. These leaders have

emphasized human responsibility to take action to limit global warming and protect fragile environments. For example, climate change will raise sea levels as ice caps melt; higher temperatures will increase the damage to all types of coastal life. The message endorsed by religious leaders is clear: unless we do something about climate change, God's children, and all living things, face dire consequences.

b. *Secular*:
According to experts, we have a moral duty to ensure that the environment is protected. Human emissions of greenhouse gasses are the primary cause of climate change, and there is a human responsibility to take action to limit global warming and protect fragile environments. For example, climate change will raise sea levels as ice caps melt; higher temperatures will increase the damage to all types of coastal life. The ethical message is clear: unless we do something about climate change, our children, and all living things, face dire consequences.

Economic Frames
a. *Equity*:
The economic costs of climate change are unevenly and unfairly distributed. Lower income communities and communities of color will incur the largest costs due to climate change. This has consequences. For example, the poorest third of counties in the US are projected to face much larger relative costs of climate change compared to the richest third of counties. This will reduce living standards in these communities, and will widen the income gap between rich and poor parts of the country. The economics are clear: unless we do something about climate change there will be dire consequences for poor and marginalized communities.

b. *Efficiency:*
The economic costs of climate change are much larger than the costly investments needed to combat the problem. The United States emits greenhouse gasses—the primary cause of climate change. Without new policies, climate change will harm the U.S. economy, even with modest amounts of warming. This has consequences. For example, various sectors will be negatively impacted, including agriculture and energy; and there will be rising costs due to coastal storms and extreme weather events, with negative impacts on crime, human mortality, and labor. The economics are clear: unless we do something about climate change there will be dire financial consequences for the people of the United States.