RESPONSES TO CLIMATE CHANGE MESSAGES: THE EFFECTS OF MESSAGE FRAMING AND SCARCITY APPEALS ON CLIMATE CHANGE MITIGATION EFFORTS

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Introduction

In 2018, the Intergovernmental Panel on Climate Change stated that humans had 12 years to cut greenhouse gas emissions in half in order to adequately reverse the negative consequences of global warming (New York Times, 2019). According to recent scientific studies, scientists now believe that humans have less than eighteen months to reverse climate change before there is irreparable damage to the planet (BBC, 2019). With 2019 wrapping up the hottest decade recorded in human history (Forbes, 2019), the climate crisis is an increasingly serious problem and remains to be one of the most polarized political issues to date (Ma et al., 2019). There are currently 130 members of the United States House of Representatives who deny or doubt climate change (Business Insider, 2019), and only 53% of the American population believe that climate change is human caused (Psychology Today, 2017). Given the overwhelming scientific evidence for human-caused climate change (National Aeronautics and Space Administration, 2019), it appears that we now live in a world where scientific information itself has limited value and the need for effective persuasive communication regarding prominent environmental issues is essential (Ma et al., 2019). Thus, social scientists have begun to look for various ways (i.e. message dissemination, message framing, etc.) to understand how to communicate the risks of climate change in order to mobilize public support for collective action (Brügger et al., 2015; Dilliplane, 2010; Ma et al., 2019; Reser & Bradley, 2017).

Various research has aimed to understand which message features are effective at conveying the risk and outcomes of climate change, but results vary widely (Reser & Bradley, 2017). Reasons for ineffective climate change communications include audiences' perceptions that messages lack personal relevance (Brügger et al., 2015), instill too much fear (Reser & Bradley, 2017), and are too freedom-threatening (Dilliplane, 2010). As global warming progresses faster than first predicted (BBC, 2019), it is essential that researchers understand the

message features that are useful in garnering support for climate change solutions. This research aims to understand the various ways that message features commonly employed in climate change appeals impact support for climate change.

Scarcity appeals, messages that aim to increase the value of an advocated action by limiting its availability (e.g., "act now," Mukherjee & Lee, 2016), are one often used strategy in persuasive climate change messages. Translational scientific communicators have used scarcity appeals in order to convey the limited time there is to participate in collective environmental action. Article headlines such as "Act now and avert a climate crisis" (Nature, 2019), "Why we need to act now" (Climate & Clean Air Coalition, 2019), and "Our planet is warming. Here's what's at stake if we don't act now" (WWF, 2019) are just a few examples of scarcity messages in climate change appeals. One media organization, "Covering Climate Now," exists for the primary purpose of promoting the idea that there is scarce time to act in order to abate the negative consequences of climate change (Covering Climate Now, 2020). These communications aim to convey that there is limited time to act on this global issue, but there is little understanding about their (in)effectiveness in persuading targeted audiences. A better understanding of how the scarcity principle functions communicatively within the context of climate change can inform how translational science communicators convey the urgency to act in the realm of climate change.

Scarcity appeals are just one avenue that translational science communicators use in messages regarding climate change. The use of message framing is another integral aspect in climate change messaging. Framing refers to the communication of costs or benefits associated with behaviors (Kahneman & Tversky, 2013), such as collective environmental climate change (in)action. If we do not take collective environmental action towards climate change, the cost is irreversible damage to the planet, but if we do take collective environmental action towards

climate change, the benefit is that we can avoid irreversible damage to our planet. Recent examples of gain-and-loss framing include popular press articles like the ones seen in scarcity appeals. For example, a recent BBC article highlighted the various losses regarding ecological diversity that would result from climate change if we did not participate in reducing greenhouse gas emissions (2019). Oftentimes, scarcity appeals, and gain-and-loss framed messages are paired together in these articles. For example, article headlines such as, "The risks of climate change on water shortages" (Stanford, 2019) and "Climate change will cost us even more than we think --world leaders understand neither the magnitude of the risks to lives and livelihoods, nor the urgency of action." (New York Times, 2019). The combination of these message strategies begs the question as to how these concepts function together in regard to message outcomes in climate change communication research.

One common thread between climate change messages, scarcity appeals, and gain-and-loss framing is the notion of psychological reactance. Understanding how to reduce reactance as a result from climate change messages is essential in order to create effective persuasive messages (Dilliplane, 2010; Ma et al., 2019). Communication researchers have understood how scarcity appeals and gain-and-loss framed messages work separately and in other contexts, but we have yet to understand how they function in concert in the context of climate change. Investigating this issue is important because these messages co-occur in many message applications designed to engage people in climate change mitigation. Unfortunately, persuading individuals to engage in climate change mitigation efforts has been considered low, and induces greater levels of psychological reactance (Dilliplane, 2010; Ma et al., 2019). Because scarcity appeals and gain-and-loss framed messages are not only communication concepts, but also salient concepts used frequently in climate change research, understanding the ways in which they are (in)effective message features is important for not only the communication field, but

also the translational science community so scholars can continue to translate scientific research findings into meaningful outcomes. It is important to study scarcity appeals, gain-and-loss framed messages, and reactance in synthesis in order to understand how these concepts function together to create effective persuasive messages and engagement in climate change mitigation.

This study aims to understand the persuasive effects of scarcity messages in climate change appeals, particularly when paired with gain- or loss-framed messages about the consequences of climate change (in)action. The overall purpose of this research is to understand how the presence or absence of a scarcity appeal interacts with message framing (i.e. gain versus loss) to affect psychological reactance, and ultimately, message acceptance or rejection. Thus, this study will test whether scarcity appeals moderate how gain and loss framed messages function to affect reactions towards messages regarding climate change.

In order to understand how these theories influence message outcomes, it is first important to understand why climate change messages cause reactance (Ma et al., 2019) and what role psychological reactance plays in persuasive communication (Dilliplane, 2010; Ma et al., 2019).

Reactance

Psychological reactance theory posits that individuals value their perceived freedom to make choices and that people strive to maintain autonomy, especially when the freedom to choose is threatened (Brehm, 1966). Persuasive messages often provoke these perceived threats to freedom, which results in psychological reactance (Nan et al., 2018) --the motivation to re-establish such freedom (Font & Hindley, 2017). As a consequence of individuals' motivation to restore their freedom, they may resort to biased message processing and behavioral boomerang effects (i.e. adoption of the forbidden act) (Brehm, 1966). The level of reactance that individuals experience depends "on the importance placed on the compromised freedom, the implication of

additional threats, and the magnitude of the threatened or eliminated freedom" (Quick & Bates, 2010, p. 604).

Previous research has shown that climate change messages are innately reactance inducing because of the pressure for change that occurs when a person believes that a message threatens his or her agency or freedom (Nisbet et al., 2015). In the context of climate change, the pressure for change that is conveyed in messages can be in regard to a person's lifestyle (e.g. recycling more often, using public transportation, and conserving water) or adopting political views that may be different from their own (e.g. supporting the Green New Deal Policy). Psychological reactance occurring as a result of exposure to climate change messaging can be influenced by people's polarized political beliefs, worldviews, and prior knowledge. Previous research has shown that pre-existing beliefs or worldviews influence how an individual selects, processes, or recalls specific scientific issues (Lu et al., 2017). When individuals process scientific messages based on their pre-existing beliefs, if a message goes against those beliefs, they are more likely to experience reactance and reject the message (Lu et al., 2017). A climate change message is also considered reactance inducing because of the increasingly polarized beliefs regarding the issue (Ma et al., 2019). For example, 70% of Americans believe in climate change, but only 53% believe that it is human caused (Psychology Today, 2017). Because of the increase in polarizing beliefs and its relation to psychological reactance, it is important to account for those aspects in persuasive climate change messaging in order to understand how they influence message outcomes.

Research has shown that reactance is more likely to occur when people perceive opposing information as a threat to their attitudinal beliefs (Ma et al., 2019). Given the aforementioned opposition to global warming as a human-caused phenomenon, climate change messages can increase reactance due to their propensity for threatening people's freedom (Ma et

al., 2019; Reser & Bradley, 2017). That is, because reactance is triggered when choices are reduced, climate change messages have an inherent threat to freedom embedded in the message due to the assertive language and explicit intent that many persuasive climate change messages include (e.g. act now before it's too late). The persuasive nature of the message might elicit perceptions in message recipients that they are being forced or manipulated by others into forming a particular set of beliefs, which inherently threatens their freedom.

Nisbet et al., (2015) found that people who see messages that challenged their beliefs on politically dissonant issues (e.g. climate change, evolution, etc.) reported increased psychological reactance. Other research has shown that emphasizing a scientific consensus in a climate change message can shift beliefs in climate change, perceptions of risk, and support for scientific policies in a positive way, especially for those who are skeptic towards climate change (Ma et al., 2019). Given the extent to which the public disagrees with the existence, causes, and effects of climate change, it is likely that a message about climate change will be viewed as freedom threatening and therefore, cause reactance.

Gain-and-Loss- Framing

A key aspect for knowing how messages induce reactance is also understanding the role that message framing plays in persuasive communication. Oftentimes, messages will be framed in certain ways that cause more or less reactance in the individuals reading them. Because of this, messages can be rejected due to the threat to freedom they pose. Because the consequences of climate change are conveyed in gain- or loss-frames, it is important to understand how reactance and message framing function in tandem, as such frames can ultimately affect the motivations and behaviors towards climate change mitigation.

Message framing refers to either an emphasis on the positive consequences of action or the negative consequences of inaction (Tversky & Kahneman, 1979; Kahneman & Tversky,

2013). Gain- and loss-framed appeals can be articulated in two ways: whether the outcome is described as one that is attained or avoided, and whether the outcome is described as desirable or undesirable (Dillard & Marshall, 2003; Rothman & Salovey, 1997). Chesebro and Martin (2010), claimed that framing makes certain elements more salient and the more prominent information will be more noticeable and easily remembered, thus guiding the attention of the receiver in a particular direction. Framing also has an effect on an individual's motivation and intention to act. Even when the result or outcome remains the same, the language of the message will influence the decisions people make. In various meta-analyses, gain and loss-framed messages were seen to have a small difference in the amount of persuasiveness between them (O'Keefe & Jenson, 2008; O'Keefe & Nan, 2012), but when evaluating them on a case by case basis, gain-framed appeals are significantly more engaging than loss-framed appeals and have an effect on individual motivation (O'Keefe & Jensen, 2008).

Gain- and loss-framing can affect individuals' motivation, and framing can even be enough to invoke this motivation without actually administering the cost or benefit described in the message (O'Keefe & Jensen 2006). In multiple studies conducted by Reinhart et al. (2007), gain framed messages generated lower levels of psychological reactance and lower manipulative intent than loss-framed messages. Because loss-framed messages highlight the costs (i.e. what individuals will lose if they do not comply), individuals perceive their freedom to choose as being limited, which creates a greater amount of reactance.

Climate change provides an interesting investigation into gain-and-loss frame research. According to scientific predictions, humans have less than 18 months to begin critical environmental interventions in order to reverse climate change (BBC, 2019). Climate change advocacy can be framed either in people's partaking in collective environmental action (i.e. support for government regulation of fossil fuels) to help reverse the effects of climate change

(i.e., gain) or not partaking in collective environmental action so as to not help reverse the effects of climate change (i.e., loss). A study conducted by Morton et al. (2011), regarding climate change and uncertainty, found that a negative frame (highlighting the possible losses) decreased individual intentions to behave environmentally, while a positive frame (highlighting the possibility of losses not materializing), produced stronger intentions to act. Results from a study conducted by Spence & Pidgeon (2010), regarding the framing of climate change messages and the effects of distance outcomes, discovered that gain frames were superior to loss frames in increasing positive attitudes towards climate change mitigation and also increased the perceived severity of climate change impacts. This previous research supports the notion that gain-framed messages are more effective in increasing climate change mitigation action and increase intentions and engagement with climate change messaging, versus loss-framed messages.

In order to fully understand how message outcomes are influenced by the way a message is framed, it is important to recognize how individuals perceive and assess risk in regards to climate change. Prospect theory, a theory describing how individuals assess and perceive risk, provides insight into behavioral patterns that are relevant for climate response decisions (O'Keefe & Jenson, 2008).

Prospect Theory

Prospect theory states that people value the assessment of outcomes and risk in order to make informed decisions. The theory aims to understand why individuals make certain choices between possible behaviors when the outcomes are equal but framed differently (Kahneman & Tversky, 2013) and posits that people make decisions based on perceived losses and gains rather than actual outcomes. Prospect theory focuses on the individual compliance with an advocacy message and how that is affected by message framing (Nan et al., 2018). This involves the presentation of the message rather than the actual consequence of the choice. A study conducted

by Nan et al. (2018), found that "the effect of a frame on people's willingness to perform a behavior is contingent on whether the option under consideration is perceived to reflect a risk-adverse or risk-seeking course of action" (p. 372). When an option is framed as a loss, individuals tend to engage in risk-seeking behaviors, while a message framed in terms of gains leads individuals to become risk-averse (Nan et al., 2018). More often than not, individuals want to avoid experiencing loss, which triggers a state of "loss aversion." When individuals engage in loss aversion, they experience more fear in losing something than hope in gaining something. For example, if an individual loses or gains an equal amount of money, the distress of losing the money would be greater than the joy of gaining it (Kahneman & Tversky, 2013). People generally find avoiding losing $100 to be more important than gaining $100 because the value function of gain versus loss (Nan et al., 2018). Whenever more fear is induced, the likelihood of the boomerang effect increases (e.g. adopting the forbidden act), which increases psychological reactance, potentially leading to message rejection (Smith & Petty, 1996). Because loss-framed messages highlight the cost of what is at stake (e.g. explaining the consequences of not partaking in the recommended action) there is also an aspect of fear arousal involved. Since negatively framed information focuses on the things that are lost by not engaging in a behavior, it is possible that more fear and reactance may be induced (Smith & Petty, 1996).

Another key aspect that helps to understand the effects of message framing in prospect theory is a concept known as the negativity bias. The negativity bias helps to understand why individuals hold different judgements, specifically in regard to negatively framed information. Prospect theory taps into why the possibility of costs (loss) may be more motivating than benefits (gain), but also more fear arousing. This can be due to the framing of the message, the sensitivity to negative information, and desire for loss-aversion. Individuals tend to be more sensitive to negative information over equally weighted positive messaging (Smith & Petty,

1996). Baumeister et al. (2001) argued that people have the biological instinct to be successfully adaptive and therefore cannot disregard that fact when it comes to making decisions. Baumeister et al. (2001) claimed this is because people tend to learn from painful events that threaten the means to a longer life.

Based on the notion that prospect theory aims to understand how individuals perceive and assess risk as it applies to gain-and-loss framed messages, I argue that due to the increased amount of fear that loss-framed messages induce as well as the explicit focus on the costs of what is at stake, loss-framed messages will induce a greater amount of reactance in individuals. Because a gain-framed message is less freedom threatening than a loss-framed message in that it highlights the benefits that a person receives from participating in the desired action, I expect that this will increase the perceived value of partaking in the desired action and increase the likelihood that individuals would have positive attitudes towards climate change mitigation. Thus, I predict the framing of climate change messages to affect the amount of reactance experienced by individuals. The following hypothesis is posited:

H1: In the context of climate change, a loss-framed message will cause more reactance than a gain-framed message.

Scarcity

Scarcity appeals, a common persuasive technique used in climate change advocacy, is typically defined as the communication of restriction on the quantity available of a product or the amount of time the product is available (Mukherjee & Lee, 2016). The traditional notion of scarcity has been widely used in advertising research in order to understand why individuals assign more value to products that are less available. Previous research has shown when an item becomes less available, it causes individuals to perceive their freedom as being limited. When freedom is limited, the value of said object tends to increase, leading individuals to want it more

in order to restore their freedom (Cialdini, 1993). People seem to be more motivated by the thought of losing something than by the thought of gaining something of equal value, which coincides with aspects of gain and loss framing as mentioned above. For example, college students experienced much stronger emotions when asked to imagine losses as opposed to gains in their romantic relationships (Cialdini, 1993). Especially under conditions of risk and uncertainty as prospect theory explains, the threat of potential loss plays a powerful role in human decision making (Tversky & Kahneman, 2013). According to the scarcity principle, when things become less available it increases the threat to freedom, and individuals respond to the threat by wanting to have the item more than before in order to restore their freedom (Cialdini, 1993). Advertisers often use scarcity appeals to influence consumers with words and phrases such as "limited quantities," "time is running out," and "hurry while supplies last" (Mukherjee & Lee, 2016).

The use of the scarcity principle is based on the worth individuals assign things. When there is more scarcity, there is a higher perceived immediate value. Previous research has shown that scarcity appeals can often increase product evaluation in everything from detergent to cars (Aggarwal, Jun, and Huh 2011; Aguirre-Rodriguez 2013; Eisend 2008). Because individuals are consistently assigning worth to various products, consumers often want to minimize future regret, have a desire to compete with other consumers, and want a sense of uniqueness (Mukherjee & Lee, 2016). The time limits placed on customers keep them from taking the time to evaluate the deal by scaring them into believing they cannot have it later, which makes them want it now (Cialdini, 1993). Because of this, scarcity has an emotional-arousing quality that makes thinking difficult, therefore, individuals might try to be alert in situations involving scarcity.

Although the scarcity appeal has been seen to be successful in consumer advertising, its use in the climate change context remains to be seen. Differences between climate change and consumer contexts beg the question of whether scarcity appeals function similarly in social marketing and climate change contexts. The climate change context varies widely from the advertising context, but one of the biggest differences between the two is the idea that there is a guaranteed consequence with inaction. With consumer advertising research, individuals have the choice to opt into a desirable consequence (e.g., buy this product at a discount within the next 5 hours), whereas inaction is met with a low to no risk consequence (i.e. you won't end up with the discount, but that may not really matter to you) That is, inaction is less consequential. In both of those scenarios, you have a choice in the matter. As for climate change, individuals may experience undesirable consequences through inaction. That is, they are not able to opt-out. Because some scientists have posited that we only have 18 months to engage in stricter climate change mitigation efforts before there is irreversible damage done to the planet, it stands to reason that negative environmental effects will not only be something that individuals may experience presently, but may also affect future generations to come. Although people can choose not to participate in taking environmental action against climate change, the consequences of climate change will still be present regardless of their decision. Here, inaction is consequential. This key difference may explain why scarcity messages in the climate change context function differently from consumer advertising messages. Traditionally, a scarcity appeal has been successful when the outcome is perceived as positive and there is a tangibility to the outcome (e.g. act now and get two coffee makers for the price of one). In the context of climate change, the tangibility of the outcome is harder to operationalize, isn't immediately identifiable, and can be seen as negative (e.g. if we don't act now, there will be irreparable damage done to the planet).

Scarcity may also function differently in the context of climate change depending on the way individuals perceive risk due to the way a message is framed. Climate change messages are inherently reactance inducing and scarcity appeals limit people's freedom to act. When a scarcity appeal is paired with an already freedom threatening message, I argue that it will decrease the value and cause reactance. Because a loss-framed message elicits a higher threat to freedom, a loss-framed message paired with a scarcity message will increase the threat to freedom, decrease the value of the message, and cause more reactance than a loss-framed message without the scarcity appeal. Because a gain-framed message is less freedom threatening than a loss-framed message in that it highlights the benefits that a person receives from participating in the desired action, I argue that this will increase the perceived value of partaking in the desired action. Thus, paired with a gain-framed message, the traditional scarcity principle will be successful, causing less reactance than a gain-framed message with no scarcity appeal. Although scarcity in this context entails a threat to freedom by limiting the time to act, a gain-frame would increase the value by highlighting the benefits and the scarcity appeal would influence individuals to restore their freedom by partaking in the desired action. Because of this, a gain-framed message reflects a more traditional application of scarcity appeals. A gain-frame highlights the benefits of acquiring the scarce product and supports loss aversion. Even though a scarcity appeal may induce more reactance in a climate change context because of the increased threat to freedom due to consequences of inaction and the polarizing beliefs on the topic as mentioned previously, the current study aims to examine how scarcity appeals may moderate the ways in which gain and loss framed messages are perceived, therefore affecting the level of psychological reactance individuals feel towards messages regarding climate change. Therefore, the following hypotheses are posited:

H2: A loss-framed message paired with a scarcity appeal will elicit more reactance than a loss-framed message with no scarcity appeal, whereas a gain-framed message paired with a scarcity appeal will elicit less reactance than a gain-framed message with no scarcity appeal.

Method

Participants and Procedures

This study employed a 2 (scarcity appeal present versus absent) × 2 (gain versus loss framed message) between-subjects design. Participants from a medium sized private university in the southern United States were invited to participate in a web-based study about responses to climate change messages. All procedures were approved by the institutional review board (IRB), and participation was confidential and anonymous. The experiment took approximately 30 minutes to complete. Students who participated received extra credit in exchange for their participation in the study.

The sample included 274 participants enrolled in either a basic speech communication course or interpersonal course. Participants included 129 males, 145 females, with a mean age of 19.97 years (*SD* = 1.54). Participants reported being Caucasian (79.5%), Hispanic (8.1%), African American (3.7%), Asian/Island Pacific (3.7%), Native American (.7%), and other (4.4%). Participants identified as being Sophomores (72.9%), Juniors (15.8%), Seniors (8.4%) and Freshman (2.9%).

Participants were provided a URL to a Qualtrics survey in which participants were randomly assigned into one of the four message conditions. After giving consent, participants read a short message from an alleged New York Times op-ed article advocating for climate change action that contained the experimental manipulations. In a pre-test before exposure to the message, participants were asked to complete a short survey consisting of measures assessing

demographics. In a post-test survey after exposure to the message, participants were asked to complete a short survey consisting of measures assessing manipulation checks (i.e., perceived scarcity and perceived framing), threat to freedom, anger, negative cognition, state reactance, reactance restoration, attitude, intention, climate change risk perception, support for mitigation action, trait reactance, concern for the environment, and concern for future orientation. Upon completion, students were thanked and debriefed. After completing the survey, participants were taken to a separate page where they were able to enter their names and email addresses in order to receive credit for taking the survey. This page was not linked to their survey responses and data remained anonymous.

Message Stimuli

The main message consisted of information regarding the effects and acceleration of climate change and methods to reverse it. Manipulations in the messages were as follows: (a) scarcity appeal (present vs absent) and (b) framing of the message (gain vs. loss). Messages remained as similar as possible in both language and length in order to understand the influence of scarcity appeals on message outcomes. In order to do this, scarcity appeals were appended onto the end of sentences for the scarcity appeal condition and withheld in the scarcity appeal absent condition (e.g., "but we must act now"). Participants were told that they will read a message from an op-ed article from the New York Times and then answer questions regarding the article. Details of the experimental materials are described below.

Each message started with a main headline (i.e., title) and subheadline (i.e., dek), demonstrating the various manipulations (gain vs. loss and scarcity present vs. absent). For example, frame was manipulated within the title, with the gain framed title reading "The Benefits of Climate Change Action," and the loss framed title reading "The Costs of Climate Change Inaction". Scarcity was manipulated within the dek, with the scarcity-absent message reading

"Climate scientists predict that we can reverse climate change," and the scarcity-present message reading "Climate scientists predict that we can reverse climate change. But we must act now." Frame and scarcity were further manipulated throughout the article. In the gain frame scarcity present message, the article highlighted the benefits of partaking in collective environmental action (i.e. supporting the Green New Deal Policy) and the limited amount of time there is to reverse climate change (i.e. 18 months). In the loss-framed scarcity present message, the article highlighted the costs associated with not partaking in environmental action (i.e. not supporting policies such as the Green New Deal) and the limited time there is to reverse climate change (i.e. 18 months). In the scarcity-control conditions, gain- and loss-framed information were identical, but appeals to limited time were omitted. See Appendix A for full stimuli.

Pilot Study

A pilot study was conducted two weeks before the full experiment was available to participants. The pilot study was conducted with 58 students in four various communication courses in order to test if the messages designed accurately reflected each manipulation (i.e. gain versus loss and perceived scarcity). See Appendix B for measures. All scales were found to be reliable (i.e. perceived threat to freedom ($\alpha = .82$), perceived framing ($\alpha = .75$), and perceived scarcity ($\alpha = .73$). An analysis of variance was used in order to assess the main effect of each condition (frame and scarcity) and the possible (unintended) interaction between the two. Although the scarcity manipulation was successful on perceived scarcity (scarcity absent: $M = 4.42$, $SD = 1.71$; scarcity present: $M = 6.04$, $SD = 1.16$); $F(1, 54) = 14.54$, $p < .001$, $\eta_p^2 = .212$, the framing manipulation was unsuccessful on perceived framing (loss frame: $M = 4.96$, $SD = 1.13$, gain frame: $M = 5.32$, $SD = 1.05$); $F(1, 54) = 2.02$, $p > .05$, $\eta_p^2 = .036$. There was no significant interaction effect between the two manipulations (i.e. framing × scarcity). The perceived framing items ended up being negatively correlated and individuals perceived more

consequences regardless of the condition. Because of this, two more items assessing perceived gain and loss frames were added to the perceived framing measure, totaling four items in the composite measure (see Appendix B).

Measures

Unless otherwise noted, the following measures consisted of 7-point Likert scales ranging from 1 (strongly disagree) to 7 (strongly agree) with higher scores indicating greater agreement. Means and standard deviations appear in Table 3. See Appendix B for a full list of measures and their items.

Perceived framing of the message. A 4-item measure was adopted from Schneider et al. (2001) in order to check if the manipulations regarding gain and loss frames were accurately interpreted by participants in the presented message. An example item is: "This message portrayed the risks associated with not taking environmental action regarding climate change." In this study these items were averaged (M = 5.04, SD = .93, α = .75).

Perceived scarcity framing. A 2-item measure was adopted from Mukherjee & Lee (2016) in order to check if the manipulations regarding scarcity present vs scarcity absent were accurately identified by participants in the presented message. An example item is: "The message stated that there was limited time to reverse climate change." In this study these items were averaged (M = 4.69, SD = 1.25, α = .73).

Perceived urgency. An item regarding urgency to act was assessed on its own to understand if urgency played a factor in how individuals perceived the message or if it coincided with perceived scarcity. When running a reliability test including the two items from the perceived scarcity measure and the one item for perceived urgency, the three-item scale demonstrated a reduced reliability (α = .41), which suggests that urgency may function as separate from the concept of scarcity. Because of this, a factorial ANOVA was performed to

assess the effects of the scarcity and framing manipulation on the single item of perceived urgency alone. In this study these items were averaged (M = 5.54, SD = 1.30).

Freedom threat measure. A 4-item measure was adopted from Dillard & Shen (2005) in order to understand if participants felt that their freedoms were restricted. An example item is: "The message tried to make a decision for me." In this study these items were averaged (M = 3.82, SD = 1.38, α = .85).

State reactance. A 4-item measure was adopted from Lindsey (2005) in order to understand if the psychological reactance occurs because of the message presented. An example item is: "I am uncomfortable being told how to feel about climate change." In this study these items were averaged (M = 3.66, SD =1.51, α = .93).

Attitudes. Attitude was measured using a semantic differential scale (from extremely unlikely to extremely likely) adopted by McCroskey & Richmond, (1989) in order to examine attitudes toward government regulation (M = 5.10, SD = 1.66, α = .97), support for the Green New Deal (M = 4.75, SD =1.71, α = .96), and support for Federal Government mitigation efforts for climate change (M =5.22, SD =1.56, α = .97). An example item is: "In your opinion, the government regulation of fossil fuels would be."

Intention. Intention was measured using a semantic differential scale (from extremely unlikely to extremely likely) adopted by McCroskey & Richmond, (1989) in order to examine the intention to support representatives that are in favor of environmental policies (M = 4.50, SD = 1.71, α = .97), and support for federal government mitigation efforts (M = 4.89, SD = 1.45, α = .97). An example item is: "How likely would you be to vote for a representative that is in favor of the Green New Deal Policy?"

Results

Manipulation Checks

Framing. To determine whether the framing manipulation was successful, a factorial analysis of variance (ANOVA) was performed to assess the effect of the framing manipulation (i.e. gain vs. loss) on perceived framing while controlling for the scarcity manipulation. This test was chosen in order to understand if there were significant reported differences between gain and loss message framing. The results revealed there were no significant differences between conditions (see Table 2). Individuals did not perceive the loss framed message ($M = 5.10$, $SD = 0.90$) as conveying more risks compared to the gain framed message ($M = 5.00$, $SD = 0.96$); $F(1, 265) = .645$, $p > .05$, $\eta_p^2 = .002$. Thus, the manipulation failed according to the framing measure. Neither did the scarcity manipulation $F(1, 265) = .164$, $p > .05$, $\eta_p^2 = .001$, nor the interaction between the two experimental variables, predict perceived frame.

Scarcity. To determine whether the scarcity manipulation was successful, a factorial ANOVA was performed to assess the effects of the scarcity manipulation on perceived scarcity while controlling for frame condition. As seen in Table 2, there was a significant main effect of the scarcity manipulation on perceived scarcity $F(1, 265) = 49.15$, $p < .001$, $\eta_p^2 = .156$, with people who read the scarcity messages reporting higher perceived scarcity ($M = 5.20$, $SD = 1.27$) compared to those who did not ($M = 4.22$, $SD = 1.03$). Further, there was a main effect of the framing manipulation on perceived scarcity $F(1, 265) = 8.04$, $p < .01$, $\eta_p^2 = .029$, with people who read the loss-framed message reporting higher perceived scarcity ($M = 4.89$, $SD = 1.13$) compared to those who read the gain-framed message ($M = 4.51$, $SD = 1.33$). Additionally, there was no interaction effect between the scarcity and framing manipulation. Thus, the scarcity manipulation successfully induced levels of perceived scarcity, while also having an effect on the framing manipulation. Results showed that there was no significant effect on perceived urgency in regard to the frame and scarcity manipulations or their interaction (see Table 2). The scarcity manipulation appeared to uniquely affect perceptions of scarcity and not perceived urgency.

Hypothesis Testing

The purpose of this study was to identify the impact of framing (i.e. gain versus loss) and scarcity (i.e. scarcity present versus scarcity absent) on levels of perceived threat to freedom, psychological reactance, attitudes towards climate change mitigation efforts, and the intent to comply with those efforts. Pearson's product-moment correlations for all variables in the study are reported in Table 1. Additionally, means and standard deviations for experimental groups can be found in Table 3. Factorial ANOVAs were conducted to test each hypothesis, as reported below.

The first hypothesis expected framing to have a main effect on psychological reactance. The results (see Table 2) showed there was not a significant main effect from the framing manipulation on psychological reactance $F(1,265) = .426$, $p > .05$, $\eta_p^2 = .005$, or other dependent variables. Thus, the first hypothesis was not supported. The second hypothesis expected that the interaction between the framing and scarcity manipulations would affect psychological reactance. The results (see Table 2) showed that there was not a significant interaction effect between the frame condition and scarcity condition on any persuasive outcomes; thus, the second hypothesis was not supported. In fact, with the exception of the perceived scarcity manipulation check, the experimental variables do not appear to be suitable predictors of the persuasive outcomes given the nonsignificant omnibus tests (see Table 2).

Additional Analyses

Overall, results did not support the hypothesized associations, as no independent variables significantly predicted the theorized persuasive outcomes. Despite these results, there is evidence of significant bivariate correlations from the Pearson product-moment correlation that appears to be consistent with the reactance process. For example, perceived threat to freedom had a moderate positive relationship with state reactance, and a moderate negative relationship

with attitude and intention ($p < .001$), while state reactance had moderate negative relationships with both attitude and intention ($p < .001$). Other noteworthy correlations include a strong positive relationship between each attitude and intention variable ($p < .001$).

Table 1
Correlation Coefficients for Variables (N=274)

		1	2	3	4	5	6	7	8	9	10	11	12
1	Frame Manipulation	-											
2	Scarcity Manipulation	.01	-										
3	Perceived Frame	-.05	-.02	-									
4	Perceived Scarcity	-.15*	.39**	.20**	-								
5	Perceived Urgency	-.02	.03	.36**	.19**	-							
6	Perceived Threat to Freedom	-.05	.00	-.15*	.18**	-.36**	-						
7	State Reactance	-.03	.01	-.17**	.04	-.45**	.57**	-					
8	Attitude toward Gov't Regulation	-.03	.07	.16**	.05	.50**	-.28**	-.42**	-				
9	Attitude toward Green New Deal	-.01	.02	.26**	.00	.51**	-.40**	-.55**	.67**	-			
10	Attitude toward Federal Gov't	-.02	-.02	.19**	.04	.57**	-.33**	-.44**	.70**	.65**	-		
11	Intent to Vote for Rep.	.01	.01	.22**	-.01	.56**	-.45**	-.55**	.61**	.81**	.63**	-	
12	Intent to Support Federal Gov't	.00	-.01	.25**	.04	.59**	-.41**	-.56**	.63**	.69**	.73**	.79**	-

p < .05 p < .01** p< .001****

Note. Framing was coded 0 = loss-frame and 1 = gain-frame. Scarcity was coded 0 = no scarcity present and 1 = scarcity present

Table 2
Main Effects and Interaction Effects for Variables

	Framing		Scarcity		Frame x Scarcity		Overall F Test	
	F	η_p^2	*F*	η_p^2	*F*	η_p^2	*F*	η_p^2
Perceived Scarcity	8.04	.029**	49.2	.156***	.036	.000	19.0	.177***
Perceived Frame	0.65	.002	0.16	.001	0.58	.002	.474	.005
Perceived Urgency	0.15	.001	0.25	.001	0.79	.003	.405	.005
Perceived Threat to Freedom	0.81	.003	0.00	.000	0.05	.000	.284	.003
State Reactance	0.22	.001	0.06	.000	1.03	.004	.426	.005
Attitude toward Gov't Regulation	0.26	.001	1.18	.004	0.19	.001	.549	.006
Attitude toward Green New Deal	0.04	.000	0.09	.000	0.12	.000	.084	.001
Attitude toward Federal Gov't	0.07	.000	0.13	.000	0.45	.002	.217	.002
Intent to Vote for Rep.	0.07	.000	.008	.000	0.98	.004	.348	.004
Intent to Support Federal Gov't	.008	.000	0.43	.000	0.33	.001	.126	.001

p < .05* *p* < .01** *p*< .001***.
Note. df = 1, 265

Table 3
Means and Standard Deviations of Measured Variables for Experimental Conditions

	Loss		Gain	
	No Scarcity n = 69	Scarcity n = 64	No Scarcity n = 69	Scarcity n = 67
Perceived Scarcity	4.43 (.911)	5.38 (1.14)	4.01 (1.10)	5.01 (1.36)
Perceived Frame	5.16 (.846)	5.02 (.950)	4.98 (.974)	5.02 (.949)
Perceived Urgency	5.61 (1.10)	5.55 (1.34)	5.41 (1.56)	5.63 (1.17)
Perceived Threat to Freedom	3.87 (1.32)	3.91 (1.51)	3.78 (1.32)	3.72 (1.41)
State Reactance	3.56 (1.51)	3.82 (1.62)	3.68 (1.45)	3.54 (1.50)
Attitude toward Gov't Regulation	5.09 (1.74)	5.22 (1.75)	4.90 (1.63)	5.21 (1.54)
Attitude toward Green New Deal	4.78 (1.60)	4.77 (1.77)	4.67 (1.78)	4.80 (1.76)
Attitude toward Federal Gov't	5.35 (1.54)	5.15 (1.63)	5.17 (1.58)	5.23 (1.53)
Intent to Vote for Rep.	4.57 (1.66)	4.38 (1.66)	4.42 (1.85)	4.64 (1.71)
Intent to Support Federal Gov't	4.95 (1.36)	4.81 (1.47)	4.86 (1.53)	4.93 (1.45)

Discussion

The purpose of this study was to identify whether the use of gain-framed or loss-framed and scarcity-present or scarcity-absent messages would influence perceived threat to freedom and other variables associated with the experience of psychological reactance, including attitude toward climate change mitigation behaviors and intent to comply with these behaviors. On those whole, these results suggest that, in the context of the climate change messages utilized in this study, framing and scarcity do not affect people's levels of reactance and associated persuasive outcomes. Despite this, the findings suggest some theoretical and practical implications for translational scientific research, environmental communication, and persuasion research.

Theoretical Implications

Framing manipulation. Although the results did not support the hypothesized associations, there are some things to be learned from the non-significant effects of the message-based variables on persuasive outcomes.

As stated previously, various meta-analyses have shown small persuasive differences between gain and loss-framed messages (O'Keefe & Jenson, 2008; O'Keefe, 2012; O'Keefe & Nan, 2012). Not only is the persuasive difference small, but it is also difficult for individuals to correctly identify a gain-framed versus loss-framed message (O'Keefe, 2012). In the pilot study, the framing manipulation yielded insignificant results on perceived framing. Because of this, two additional items were added to the perceived framing measure in order to clarify for individuals if the message portrayed the risks or benefits of climate change (in)action. These items were added in hopes that the framing manipulation check would become clear and that perceived framing would be accurately identified consequently. I anticipated that the lack of significance for the framing manipulation in the pilot study was due not to the manipulation itself, but to how

the manipulation was assessed. Clearly, the manipulation failed in the main experiment even with the addition of the clarifying items.

On the one hand, it is plausible that the way the messages were designed blurred the line between what was perceived as a benefit versus what was perceived as a cost. This could be due to the inherent risk that comes with climate change outcomes. Individuals were told that in order to avoid the risks associated with climate change, they must engage in climate change mitigation, and if they do not engage in climate change mitigation, they will not be able to avoid the risks associated with climate change. In either message, there was some semblance of risk involved due to the nature of the outcomes associated with climate change, which could have confused participants as to what the message was conveying. In future studies, the design of gain-and-loss framed messages should be more clear and distinct and aim to diminish perceived risk in the gain-framed condition. For example, future gain-framed messages could focus on the benefits that come from engaging in climate change mitigation without solely focusing on avoiding the negative outcomes (i.e. climate change mitigation efforts will help us preserve the unique wildlife that is essential to our ecosystem and well-being as a planet). In this instance, the risk is embedded in the message (i.e. if we do not engage in mitigation, then we cannot protect those things), but not directly stated as it is in the loss-framed message. The loss-framed message could then focus on the inherent risk from not engaging in climate change action (i.e. without climate change mitigation efforts, we will not be able to preserve the unique wildlife that is essential to our ecosystem and well-being, and the entire planet will be affected). Although these examples are similar to the messages designed in the current study, it is important to note that the gain-framed example does not directly focus on the negative consequences being avoided and does not explicitly list the consequences like the present study does.

On the other hand, it is also possible that the type of message frame (i.e. gain-frame vs. loss-frame) is difficult to identify in this particular context, no matter what the message manipulation may look like. It is plausible that it wasn't necessarily the design of the manipulations, but rather that the context of climate change poses an issue for gain-and-loss framed messages holistically. As mentioned previously, because there is a semblance of risk involved in either message due to the nature of climate change outcomes, it may be hard for individuals to accurately identify the frames being presented and differentiate if the message displays the benefits versus the costs.

Although the framing manipulation did not significantly affect perceived framing, results showed that the framing manipulation did have a significant effect on perceived scarcity. Individuals in the loss-framed condition experienced higher levels of perceived scarcity than individuals in the gain-framed condition. This means that individuals perceived that there was limited time to take action in the loss-framed message, more than in the gain-framed message. These findings could expand on how individuals perceive risk in this context and speak to why message frames may be hard to accurately identify. It is possible that because the risk of not engaging in climate change action was heavily accentuated in the loss-framed message, that individuals believed the messages were conveying there was less time to act. It is plausible that individuals identified more risk in the loss-framed condition than they did in the gain-framed condition, which affected perceived scarcity. Even though the framing manipulation had a significant effect on perceived scarcity, it did not have significant effects on perceived framing as hypothesized, therefore the frame manipulation itself was unsuccessful.

Identifying risk. Along with the framing manipulation proving to be an issue, it seems that risk and uncertainty may also be difficult to assess and operationalize in the context of

climate change. As prospect theory proposes, people engage in assessments of outcomes and risk in order to make informed decisions which can then affect how individuals process gain-framed versus loss-framed messages (Kahneman & Tversky, 2013). Because of this, it is important that researchers understand how individuals perceive risk when reading a message about climate change. One limitation that is commonly stated in prospect theory literature is that individuals and researchers often have varying definitions of risk, which can cause researchers to incorrectly interpret how individuals perceive risk in persuasive messages (Kahneman & Tversky, 2013; O'Keefe, 2012). For example, communication researchers often operationalize risk as feelings of uncertainty, while individuals often operationalize risk as feelings of danger (O'Keefe, 2012). With this in mind, it may be hard to gauge how people assess risk in the context of climate change as mentioned previously, and there may be a potential gap between how researchers are operationalizing risk and how individuals are perceiving risk. Because individuals may not perceive climate change to be personally relevant or a severe risk, they may not engage with the message. Lack of engagement could explain the host of nonsignificant effects found here.

Other variables. Because they were not directly pertinent to the hypotheses, some measured variables were excluded from analyses. However, these variables could very well have altered the results were their effects considered. For example, a measure regarding beliefs in climate change was used in the pre-test to help gauge participants' attitudes and beliefs prior to the message about climate change. This particular measure could shed light on participants who did not engage with the message due to a lack of belief in climate change messages overall. One limitation of this study is that the research was conducted in a predominantly conservative state where environmental issues do not tend to have high priority (Texas Tribune, 2019). Therefore, beliefs in climate change may be vastly different here than other places in the United States.

Previous research has shown that pre-existing beliefs or worldviews influence how an individual selects, processes, or recalls specific scientific issues, and if a message goes against those pre-existing beliefs, then they are more likely to experience reactance and reject the message (Lu et al., 2017). If beliefs in climate change among this sample were relatively low overall, it is possible that a majority of individuals could disengage with the message entirely (i.e. reject the message).

Other measures included in the study but excluded from the analyses were negative cognition, trait reactance, anger, reactance restoration, climate change risk perception, support for mitigation action, concern for the environment, and concern for the future. These exclusions prove to be a limitation of this study because those variables could have altered the results were their effects considered. For example, the measure regarding climate change risk perception may shed light on some of the insignificant results seen in the data. If individuals do not perceive the risks of climate change to be personally relevant, then the message design will likely not affect perceived threat to freedom, therefore resulting in insignificant findings on psychological reactance. Another limitation that should be addressed regards the sample in this study. This study was conducted among undergraduate students at a medium sized private university. Although the sample was convenient, this is not representative of the population of people who experience climate change, and a broader sample is needed in order to better gauge an understanding of this issue. If the sample expanded across other demographics (i.e. region, race, age), it is possible that certain measures could have altered the results. Measures such as beliefs in climate change, climate change risk perception, etc., may affect how individuals engage in message processing, therefore altering the results. Collecting a more representative sample may provide insight as to how different people perceive the issue of climate change and engage in

persuasive climate change mitigation messages, which could be vastly different from the results seen in the current study.

The role of efficacy. Because effective climate change mitigation requires a global effort, it is possible that individual versus collective efficacy plays a key role in the study of persuasive messages in the context of climate change. Efficacy may play a key role in this study, because if individuals do not feel like they have the efficacy to engage in effective climate change mitigation, then they may reject the message entirely. The message tested in this study advocated for individuals' support of efforts made for climate change mitigation, including federal government regulation and support of the Green New Deal Policy. It is plausible that even if an individual does not partake in these recommended mitigation efforts, the mitigation efforts may still come to fruition. For example, if someone decides to vote against the Green New Deal, it is possible that a majority of people will vote in favor of the policy, and it will still be passed. The idea that climate change mitigation may still happen even if someone does not "opt-in" could potentially lessen the stake that people have in the issue or the urgency they contribute to taking climate change action. This could either pass along the mitigation responsibility onto other people, or make individuals feel like they do not really have a say in the outcomes associated with climate change. It is possible that messages regarding mitigation efforts need to be catered on an individual level, focusing more on self-efficacy efforts to combat climate change. For example, it may be wise to describe a specific behavior that individuals can implement into their everyday lives in order to combat a particular outcome related to climate change (i.e. taking public transportation at least three times a week to reduce pollution and improve air quality). Focusing on self-efficacy in these messages and advocating for one particular mitigation strategy may inspire people to feel like they have more of a voice in the

issue of climate change. Although it does not tackle climate change through direct collective action (i.e. gaining support to vote for the Green New Deal) and may cause some level of psychological reactance (Ma et al., 2019) it may be a step in the right direction to get to a point of collective efficacy. Because climate change is a threat to human existence, it can be difficult for individuals to know where to start to combat the issue and if their behaviors truly make a difference (BBC, 2018).

Psychological reactance. There are a few theoretical implications that may be gained from the findings of this study that have to do with reactance theory, scarcity appeals, and persuasion research. Although the intended manipulations did not affect the dependent variables as hypothesized, some findings are in line with reactance theory. For example, individuals who experienced higher perceived threat to freedom experienced more state reactance, more negative attitudes towards climate change, and a lower intent to comply with advocated behaviors. Individuals who experienced higher state reactance also experienced more negative attitudes and less intention to comply with advocated behaviors, and individuals with higher attitudes towards government regulation had more positive attitudes towards supporting the Green New Deal Policy, Federal Government mitigation, and higher intent to comply with advocated behaviors. These findings suggest that psychological reactance was noticeable in the climate change messages presented and falls in line with basic reactance theory principles. Perceive a threat to freedom associated positively with reactance, negatively with attitudes, and negatively with behavioral intent. Understanding these findings in the context of climate change is important because if individuals feel as if their freedom is being threatened, they are less likely to comply with advocated behaviors in order to mitigate climate change.

The role of urgency vs. scarcity. Although the concepts of perceived scarcity and perceived urgency seem quite similar, the evidence reported here suggests that they function quite differently in regard to how they may motivate reactance and behavior change. Individuals who experienced higher perceived urgency experienced less state reactance, more positive attitudes towards government regulation, more support of the Green New Deal Policy, as well as increased intent to comply with behaviors (e.g. vote for representative, and support for Federal Government mitigation). It is important to note that there were no significant relationships between perceived scarcity and persuasive outcomes (i.e. state reactance, attitude, and behavioral intention). These findings suggest that scarcity and urgency function as distinct concepts. Further, when an urgency item was added to the two-item scarcity measure, the reliability of the scale decreased (from $\alpha = .52$ to $\alpha = .41$), suggesting that the items assess different theoretical concepts. Scarcity appeals are described as the desire to acquire what is limited, while urgency appeals are described as the desire to act quickly on the importance or value of something (Moser & Dilling, 2004; Mukherjee & Lee, 2016). It is possible that climate change messages need to include an appeal to urgency in order for participants to a) understand the potential risks and frame (i.e gain-frame vs. loss-frame) that the message is displaying, b) be able to assess those risks and evaluate potential outcomes (i.e. climate change action vs. climate change inaction), and c) engage in behavioral change (i.e. change attitude and behavioral intent). Although the scarcity manipulation check proved to be significant on perceived scarcity, it did not significantly associate with psychological reactance. Because the scarcity manipulation check did not provide significant findings in relation to psychological reactance, it seems that the scarcity appeal was not necessarily reactance inducing, but it is something participants were able to identify. For example, individuals were able to identify that the message conveyed that there

was a limited amount of time to act (i.e. 18 months), but that ability did not translate into different levels of reactance. Therefore, a factor like urgency may be needed in order to influence the perceived threat to freedom which then affects the level of reactance.

Practical Implications

Along with theoretical implications, there are some unique and valuable practical implications for scholars and practitioners alike. The framing manipulation failed to influence perceived framing, which confirms previous understandings that people have difficulty identifying differences between gain-and-loss framed messages (O'Keefe, 2012). Because it is difficult for individuals to identify how the message is framed, it remains unknown as to which frame is most effective in persuading individuals to engage in climate change mitigation efforts. It is important for researchers to focus on designing a clear message in this context. It may be wise to use gain-and-loss framed messages when talking about specific outcomes of climate change that individuals can see are currently happening and include a realistic behavior they can take part in to help mitigate the issue. For example, messages could focus on one specific outcome of climate change that is currently happening (i.e. increase in greenhouse gas emissions) and provide individual behaviors to combat the negative outcome (i.e. reducing meat consumption). It is important to note that perceived risk must still be considered when designing persuasive messages regarding climate change. If individuals do not feel like they are at risk, then they will not be motivated to act (O'Keefe, 2012). One of the biggest obstacles that climate change communicators face is conveying that the negative outcomes will affect everyone, and it is important for researchers to shed light on what climate change outcomes currently look like (Moser & Dilling, 2004).

Because the scarcity manipulation had an effect on perceived scarcity (i.e. individuals were able to identify that time to act was limited), it seems that individuals are able to correctly discern when a message aims to give the impression that time is running out. But as mentioned previously, perceived scarcity did not relate to reactance or perceived threat to freedom. Perceived urgency did relate to these concepts. Therefore, maybe a sense of urgency is needed in order to coincide with a scarcity appeal, influence the importance of the issue, and increase perceived risk. If the message is trying to convey the importance of taking action, then it is possible an appeal to urgency would affect levels of reactance, perceived threat to freedom, and perceived framing, if the manipulation had been successful. In order to create urgency, a message must convey the importance of taking action. In the context of climate change, individuals must perceive a risk before they assign importance to the issue and decide to take action.

A unique aspect of this study is that climate change messages including these components (i.e. gain-and-loss framed messages and scarcity appeals) are commonly used by translational science communicators. Because these messages are widely used, it is important to understand how (in)effective they are in engaging support for climate change mitigation, and how to better communicate these things moving forward. It is apparent that gain-and-loss framed messages are difficult for people to identify in this context, and therefore may not be the most effective way to gain support for mitigation efforts. Researchers must first convey that climate change is a significant risk to us all and that each person has an individual role to play in mitigation efforts. Gauging people's beliefs and attitudes beforehand may be a key aspect for future direction in order to help researchers gain an understanding of how individuals with varying beliefs on climate change process these messages. It is especially important to gauge

prior attitudes and beliefs for individuals who do not believe in climate change, or believe it to be a natural occurrence, in order to better understand how to create messages that these individuals will engage with. One of the main goals for translational scientific communicators is to persuade those who are skeptical of climate change to believe that it is a serious issue that affects everyone as to increase engagement in mitigation efforts (BBC, 2019).

Conclusion

Overall, this study confirms the difficulty in designing effective gain-and-loss framed messages in the context of climate change (O'Keefe & Jenson, 2008; O'Keefe, 2012; O'Keefe & Nan, 2012). There remains a gap in literature regarding best practices for communicating the effects of climate change, and as this persists to be a salient issue that affects the population on a global level, it is important that communication research continues to search for ways to best communicate the issue. The current study considered the use of two strategies (i.e. gain-framed vs. loss-framed messages and scarcity present vs. scarcity absent appeals) in order to identify the persuasive (in)effectiveness of the messages currently being used by translational scientific communicators to communicate the effects of climate change. Findings provided theoretical and practical insights for communication scholars and translational scientific researchers alike. These implications offer a critique of the current messages being used as well as where future research should head. Additionally, because there remains a gap in research about designing effective and persuasive messages in the context of climate change, the implications challenge climate change communicators to seek more creative and effective ways to communicate the risks of climate change in order to get people involved with the issue. Future research can continue to explore the role of attitude and intention as it influences aspects of psychological reactance in the context of climate change. Furthermore, scholars should design and test climate change messages that focus

on perceived risk, efficacy, and urgency as mentioned previously. These techniques may influence important persuasive outcomes such as psychological reactance, perceived threat to freedom, attitude, and behavioral intent. Most importantly, scholars and practitioners should continue their commitment to climate change mitigation research considering any element that may get people involved in this issue.

References

Act now and avert a climate crisis (2019, September 15). In *Nature Research Journal*. Retrieved from https://www.nature.com/articles/d41586-019-02734-x

Arguedas Ortiz, D. (2018, November 4). Ten simple ways to act on climate change. In *BBC*. Retrieved from https://www.bbc.com/future/article/20181102-what-can-i-do-about-climate-change

Aggarwal, P., Jun, S. Y., & Huh, J. H. (2011). Scarcity messages. *Journal of Advertising*, *40*, 19-30. doi:10.2753/joa0091-3367400302

Aguirre-Rodriguez, A. (2013). The effect of consumer persuasion knowledge on scarcity appeal persuasiveness. *Journal of Advertising*, *42*, 371-379. doi:10.1080/00913367.2013.803186

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of general psychology*, *5*, 323-370. doi:10.1037/1089-2680.5.4.323

Brehm, J. W. (1966). A theory of psychological reactance.

Brügger, A., Dessai, S., Devine-Wright, P., Morton, T. A., & Pidgeon, N. F. (2015). Psychological responses to the proximity of climate change. *Nature climate change*, *5*, 1031. doi:10.1038/nclimate2760

Cialdini, R. B., & Cialdini, R. B. (1993). Influence: The psychology of persuasion.

Chesebro, J. L., & Martin, M. M. (2010). Message framing in the classroom: The relationship between message frames and student perceptions of instructor power. *Communication Research Reports*, *27*, 159-170. doi:10.1080/08824091003738107

Cranley, E. (2019, April 29). These are the 130 current members of Congress who have doubted or denied climate change. In *Business Insider*. Retrieved from

https://www.businessinsider.com/climate-change-and-republicans-congress-global-warming-2019-2

Dillard, J. P., & Marshall, L. J. (2003). Persuasion as a social skill. *Handbook of communication and social interaction skills*, 479-513.

Dilling, L., & Moser, S. C. (2004, December). Communicating the Urgency and Challenge of Global Climate Change: Lessons Learned and New Strategies. In *AGU Fall Meeting Abstracts*.

Dilliplane, S. (2010). Raising the specter of death what terror management theory brings to the study of fear appeals. *Annals of the International Communication Association*, *34*, 93-131. doi:10.1080/23808985.2010.11679097

Druckman, J. N., & Bolsen, T. (2011). Framing, motivated reasoning, and opinions about emergent technologies. *Journal of Communication*, *61*, 659-688. doi:10.1111/j.1460-2466.2011.01562.x

Eisend, M. (2008). Explaining the impact of scarcity appeals in advertising: The mediating role of perceptions of susceptibility. *Journal of Advertising*, *37*, 33-40. doi:10.2753/joa0091-3367370303

Font, X., & Hindley, A. (2017). Understanding tourists' reactance to the threat of a loss of freedom to travel due to climate change: A new alternative approach to encouraging nuanced behavioural change. *Journal of Sustainable Tourism*, *25*, 26-42. doi:10.1080/09669582.2016.1165235

Garthwaite, J. (2019, March 22). The effects of climate change on water shortages. In *Stanford University.* Retrieved from https://earth.stanford.edu/news/effects-climate-change-water-shortages#gs.2z9137

Green, E. (2017, October 13). The Existential Dread of Climate Change. In *Psychology Today*. Retrieved from https://www.psychologytoday.com/us/blog/there-is-always-another-part/201710/the-existential-dread-climate-change

Kahneman, D., & Tversky, A. (2013). Choices, values, and frames. In *Handbook of the fundamentals of financial decision making: Part I* (pp. 269-278). doi:10.1142/9789814417358_0016

Krosnick, J. A., Holbrook, A. L., Lowe, L., & Visser, P. S. (2006). The origins and consequences of democratic citizens' policy agendas: A study of popular concern about global warming. *Climatic change*, *77*, 7-43. doi:10.1007/s10584-006-9068-8

Kurtz, J. L. (2008). Looking to the future to appreciate the present: The benefits of perceived temporal scarcity. *Psychological Science*, *19*, 1238-1241. doi:10.18130/v30234

Lu, H., McComas, K. A., & Besley, J. C. (2017). Messages promoting genetic modification of crops in the context of climate change: Evidence for psychological reactance. *Appetite*, *108*, 104-116. doi:10.1016/j.appet.2016.09.026

Ma, Y., Dixon, G., & Hmielowski, J. D. (2019). Psychological reactance from reading basic facts on climate change: The role of prior views and political identification. *Environmental Communication*, *13*, 71-86. doi:10.1080/17524032.2018.1548369

Mack, E. (2019, December). 2019 Wraps Up The Hottest Decade In Recorded Human History. In *Forbes.* Retrieved from https://www.forbes.com/sites/ericmack/2019/12/03/the-hottest-decade-ever-is-wrapping-up-right-now-once-again/#2434f4a0f74e

Massi Lindsey, L. L. (2005). Anticipated guilt as behavioral motivation: An examination of appeals to help unknown others through bone marrow donation. *Human Communication Research*, *31*, 453-481. doi:10.1093/hcr/31.4.453

McGrath, M. (2019, July 24). Climate change: 12 years to save the planet? Make that 18 months. In *BBC News*. Retrieved from https://www.bbc.com/news/science-environment-48964736

Morton, T. A., Rabinovich, A., Marshall, D., & Bretschneider, P. (2011). The future that may (or may not) come: How framing changes responses to uncertainty in climate change communications. *Global Environmental Change*, *21*, 103-109. doi:10.1016/j.gloenvcha.2010.09.013

Mukherjee, A., & Lee, S. Y. (2016). Scarcity appeals in advertising: The moderating role of expectation of scarcity. *Journal of Advertising*, *45*, 256-268. doi:10.1080/00913367.2015.1130666

Nan, X., Daily, K., & Qin, Y. (2018). Relative persuasiveness of gain-vs. loss-framed messages: a review of theoretical perspectives and developing an integrative framework. *Review of Communication*, *18*, 370-390. doi:10.1080/15358593.2018.1519845

Nisbet, E. C., Cooper, K. E., & Garrett, R. K. (2015). The partisan brain: How dissonant science messages lead conservatives and liberals to (dis) trust science. *The ANNALS of the American Academy of Political and Social Science*, *658*, 36-66. doi:10.1177/0002716214555474

O'Keefe, D. J., & Jensen, J. D. (2008). Do loss-framed persuasive messages engender greater message processing than do gain-framed messages? A meta-analytic review. *Communication Studies*, *59*, 51-67. doi:10.1080/10510970701849388

O'Keefe, D. J., & Jensen, J. D. (2006). The advantages of compliance or the disadvantages of noncompliance? A meta-analytic review of the relative persuasive effectiveness of gain-

framed and loss-framed messages. *Annals of the International Communication Association*, *30*, 1-43. doi:10.1080/23808985.2006.11679054

O'Keefe, D. J. (2012). From psychological theory to message design: Lessons from the story of gain-framed and loss-framed persuasive appeals. In *Health communication message design: Theory, research, and practice*. Sage Publications.

O'Keefe, D. J., & Nan, X. (2012). The relative persuasiveness of gain-and loss-framed messages for promoting vaccination: A meta-analytic review. *Health communication*, *27*, 776-783.

O'Keefe, D. J., & Wu, D. (2012). Gain-framed messages do not motivate sun protection: A meta-analytic review of randomized trials comparing gain-framed and loss-framed appeals for promoting skin cancer prevention. *International journal of environmental research and public health*, *9*, 2121-2133. doi:10.3390/ijerph9062121

Oreskes, N., & Stern, N. (2019, October 23). Climate Change Will Cost Us Even More Than We Think. In *New York Times.* Retrieved from https://www.nytimes.com/2019/10/23/opinion/climate-change-costs.html

Our planet is warming. Here's what's at stake if we don't act now (n.d.). In *WWF*. Retrieved from https://www.worldwildlife.org/stories/our-planet-is-warming-here-s-what-s-at-stake-if-we-don-t-act-now.

Quick, B. L., & Bates, B. R. (2010). The use of gain-or loss-frame messages and efficacy appeals to dissuade excessive alcohol consumption among college students: A test of psychological reactance theory. *Journal of health communication*, *15*, 603-628. doi:10.1080/10810730.2010.499593

Ramsey, R. (2019, November 6). Texans say climate change is happening, but it's a highly partisan issue, UT/TT Poll finds. In *The Texas Tribune.* Retrieved from

https://www.texastribune.org/2019/11/06/texans-say-climate-change-happening-highly-partisan-issue-uttt-poll/

Reinhart, A. M., Marshall, H. M., Feeley, T. H., & Tutzauer, F. (2007). The persuasive effects of message framing in organ donation: The mediating role of psychological reactance. *Communication Monographs*, *74*, 229-255. doi:10.1080/03637750701397098

Reser, J. P., & Bradley, G. L. (2017). Fear appeals in climate change communication. In *Oxford Research Encyclopedia of Climate Science*. doi:10.1093/acrefore/9780190228620.013.386

Rothman, A. J., Salovey, P., Antone, C., Keough, K., & Martin, C. D. (1993). The influence of message framing on intentions to perform health behaviors. *Journal of experimental social psychology*, *29*, 408-433. doi:10.1006/jesp.1993.1019

Rothman, A. J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: the role of message framing. *Psychological bulletin*, *121*, 3. doi:10.1037/0033-2909.121.1.3

Smith, S. M., & Petty, R. E. (1996). Message framing and persuasion: A message processing analysis. *Personality and Social Psychology Bulletin*, *22*, 257-268. doi:10.1177/0146167296223004

Spence, A., & Pidgeon, N. (2010). Framing and communicating climate change: The effects of distance and outcome frame manipulations. *Global Environmental Change*, *20*, 656-667. doi:10.1016/j.gloenvcha.2010.07.002

Tversky, A., & Kahneman, D. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*, 263-291. doi:10.2307/1914185

Wagner, G., & Samaras, C. (2019, September 19). Do We Really Have Only 12 Years to Avoid Climate Disaster? In *New York Times*. Retrieved from https://www.nytimes.com/2019/09/19/opinion/climate-change-12-years.html

Why we need to act now (n.d.). In *Climate & Clean Air Coalition*. Retrieved from https://www.ccacoalition.org/en/content/why-we-need-act-now

Wicklund, R. A. (1974). *Freedom and reactance*. Lawrence Erlbaum. doi:10.1017/s0003055400267907

Appendix A

Below is the gain and scarcity manipulation as it appeared to participants.

The New York Times

Opinion

By: Henry Fountain

Published January 12th, 2020

The Benefits of Climate Change Action

Climate scientists predict that we can reverse climate change. But we must act now.

Climate change and its effects are accelerating, with climate related disasters piling up, season after season. Heat waves in Europe in June and July, extreme rainfall in Texas during Tropical Storm Imelda in September, the drought that precipitated the "Day Zero" water crisis in Cape Town in 2018 are among many events shown to have been made more likely, more intense, or both, by climate change. Science predicts that our options are running out and we don't have much time to reverse the damage that has been done. If we choose to take part in collective environmental action, we will be able to reverse the effects of climate change and be part of the environmental benefits for years to come.

According to Petteri Taalas, Secretary General of the World Meteorological Organization, if we want to reverse the effects of climate change, we need to reduce greenhouse gas emissions and get rid of fossil fuels in power production, industry and transportation. To combat this, it is imperative that we collectively support policies in which the government mitigates climate change action. One policy that is on the horizon to help mitigate climate change is the Green New Deal.

"If we partake in reducing greenhouse gas emissions to fight climate change, we will be able to take steps to reverse climate change and avoid the irreparable damage that is on the horizon"

The Green New Deal calls on the federal government to dramatically reduce greenhouse gas emissions, create high-paying jobs, ensure that clean air, clean water and healthy food are basic human rights.

To achieve those goals, the plan calls for the launch of a "10-year mobilization" to reduce carbon emissions in the United States. It envisions sourcing 100 percent of the country's electricity from renewable and zero-emissions power, digitizing the nation's power grid, upgrading every building in the country to be more energy-efficient, and overhauling the nation's transportation system by investing in electric vehicles and high-speed rail.

If we succeed in supporting policies such as the Green New Deal, we can avoid the negative consequences associated with climate change, such as increased heat, drought and insect outbreaks, increased wildfires, and decreased water availability.

But time is running out. Climate scientists estimate that we only have 18 months to proceed with mitigation in order to reverse the effects of climate change. If we partake in reducing greenhouse gas emissions to fight climate change, we will reverse climate change and avoid the irreparable damage that is on the horizon.

The benefit is clear: we need to support policies such as the Green New Deal in order to avoid the threat of climate change.

Below is the loss and scarcity manipulation as it appeared to participants.

The New York Times

Opinion

By: Henry Fountain

Published January 12th, 2020

The Costs of Climate Change Inaction

Climate scientists predict that we can reverse climate change. But we must act now.

Climate change and its effects are accelerating, with climate related disasters piling up, season after season. Heat waves in Europe in June and July, extreme rainfall in Texas during Tropical Storm Imelda in September, the drought that precipitated the "Day Zero" water crisis in Cape Town in 2018 are among many events shown to have been made more likely, more intense, or both, by climate change. Science predicts that our options are running out and we don't have much time to reverse the damage that has been done. If we do not take part in collective environmental action, we will not be able to reverse the effects of climate change and we will be part of the environmental costs for years to come.

According to Petteri Taalas, Secretary General of the World Meteorological Organization, if we want to reverse the effects of climate change, we need to reduce greenhouse gas emissions and get rid of fossil fuels in power production, industry and transportation. To combat this, it is imperative that we collectively support policies in which the government mitigates climate change action. One policy that is on the horizon to help mitigate climate change is the Green New Deal.

“If we do not partake in reducing greenhouse gas emissions to fight climate change, we will not be able to take steps to reverse climate change and avoid the irreparable damage that is on the horizon”

The Green New Deal calls on the federal government to dramatically reduce greenhouse gas emissions, create high-paying jobs, ensure that clean air, clean water and healthy food are basic human rights, and end all forms of oppression.

To achieve those goals, the plan calls for the launch of a “10-year mobilization” to reduce carbon emissions in the United States. It envisions sourcing 100 percent of the country’s electricity from renewable and zero-emissions power, digitizing the nation’s power grid, upgrading every building in the country to be more energy-efficient, and overhauling the nation’s transportation system by investing in electric vehicles and high-speed rail.

If we fail in supporting policies such as the Green New Deal, we cannot avoid the negative consequences associated with climate change, such as increased heat, drought and insect outbreaks, increased wildfires, and decreased water availability.
But time is running out. Climate scientists estimate that we only have 18 months to proceed with mitigation in order to reverse the effects of climate change. If we do not partake in reducing greenhouse gas emissions to fight climate change, we will not reverse climate change or avoid the irreparable damage that is on the horizon.

The cost is clear: without supporting policies such as the Green New Deal, we cannot avoid the threat of climate change.

Below is the gain-only manipulation as it appeared to participants.

The New York Times

Opinion

By: Henry Fountain

Published January 12th, 2020

The Benefits of Climate Change Action

Climate scientists predict that we can reverse climate change.

Climate change and its effects are accelerating, with climate related disasters piling up, season after season. Heat waves in Europe in June and July, extreme rainfall in Texas during Tropical Storm Imelda in September, the drought that precipitated the "Day Zero" water crisis in Cape Town in 2018 are among many events shown to have been made more likely, more intense, or both, by climate change. If we choose to take part in collective environmental action, we will be able to reverse the effects of climate change and be part of the environmental benefits for years to come.

According to Petteri Taalas, Secretary General of the World Meteorological Organization, if we want to reverse the effects of climate change, we need to reduce greenhouse gas emissions and get rid of fossil fuels in power production, industry and transportation. To combat this, it is imperative that we collectively support policies in which the government mitigates climate change action. One policy that is on the horizon to help mitigate climate change is the Green New Deal.

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If we succeed in supporting policies such as the Green New Deal, we can avoid the negative consequences associated with climate change, such as increased heat, drought and insect outbreaks, increased wildfires, and decreased water availability.

If we partake in reducing greenhouse gas emissions to fight climate change, we will reverse climate change and avoid the irreparable damage that is on the horizon.

The benefit is clear: we need to support policies such as the Green New Deal in order to avoid the threat of climate change.

Below is the loss-only manipulation as it appeared to participants.

The New York Times

Opinion

By: Henry Fountain

Published January 12th, 2020

The Costs of Climate Change Inaction

Climate scientists predict that we can reverse climate change.

Climate change and its effects are accelerating, with climate related disasters piling up, season after season. Heat waves in Europe in June and July, extreme rainfall in Texas during Tropical Storm Imelda in September, the drought that precipitated the "Day Zero" water crisis in Cape Town in 2018 are among many events shown to have been made more likely, more intense, or both, by climate change. If we do not take part in collective environmental action, we will not be able to reverse the effects of climate change and we will be part of the environmental costs for years to come.

According to Petteri Taalas, Secretary General of the World Meteorological Organization, if we want to reverse the effects of climate change, we need to reduce greenhouse gas emissions and get rid of fossil fuels in power production, industry and transportation. To combat this, it is imperative that we collectively support policies in which the government mitigates climate change action. One policy that is on the horizon to help mitigate climate change is the Green New Deal.

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If we fail in supporting policies such as the Green New Deal, we cannot avoid the negative consequences associated with climate change, such as increased heat, drought and insect outbreaks, increased wildfires, and decreased water availability.

If we do not partake in reducing greenhouse gas emissions to fight climate change, we will not reverse climate change or avoid the irreparable damage that is on the horizon.

The consequence is clear: without supporting policies such as the Green New Deal, we cannot avoid the threat of climate change.

Appendix B

Below are the questions and item scales used in the experiment.

Directions: Please select the most appropriate response to each question. If there is a separate set of directions, please read those directions carefully and answer each question to the directions for that section of the questionnaire.

1. What is your age in years? _____
2. What is your biological sex?
    1. Male
    2. Female
3. What is your ethnicity?
    1. White/Caucasian __
    2. African American __
    3. Asian/Island Pacific __
    4. Native American __
    5. Hispanic__
    6. Other __
4. What is your year in school?
    1. Freshman
    2. Sophomore
    3. Junior
    4. Senior
    5. Nontraditional/Other

Directions: Generally speaking, which of the options on the scale best describes your party identification? using a scale of "a strong Democrat" (1) to "a strong Republican" (7)

(Strongly Democrat) 1 2 3 4 5 6 7 (Strongly Republican)

Directions: On the scales below, please indicate the degree to which you believe the following statements. (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

1. The climate is always changing and what we are currently observing is just natural fluctuation.
2. The burning of fossil fuels over the last 50 years has caused serious damage to the planet's climate.
3. Human CO2 emissions cause climate change.
4. Humans are too insignificant to have an appreciable impact on global temperature.
5. Climate change is a process that is already underway.
6. Climate change is not happening.

Directions: On the scales below, please indicate the degree to which you believe the following statements. (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

Perceived loss:

1. This message portrayed the risks associated with not taking environmental action regarding climate change:
2. This message portrayed the negative consequences from avoiding environmental action regarding climate change:

Perceived gain:

1. This message portrayed the benefits associated with taking environmental action regarding climate change:
2. This message portrayed the positive consequences from engaging in environmental action regarding climate change:

Directions: On the scales below, please indicate the degree to which you believe the following statements. (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

1. The message stated that there was limited time to reverse climate change
2. The message indicated that time is running out to counteract the consequences of climate change
3. How urgent is it for the U.S. to partake in collective environmental action?
   (Not at all urgent) 1 2 3 4 5 6 7 (Very Urgent)

Directions: On the scales below, please indicate the degree to which you believe the following statements. (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

1. The message tried to make a decision for me.
2. The message tried to pressure me.
3. The message threatened my freedom to choose.
4. The message tried to manipulate me.

Directions: The next set of items are designed to help us to understand your thoughts about the message you just read. How did this message make you feel?

1. Did you feel angry while viewing this message?
   (No Anger) 1 2 3 4 5 6 7 (A great deal of anger)
2. Did you feel annoyed while viewing this message?
   (No Annoyance) 1 2 3 4 5 6 7 (A great deal of annoyance)
3. Did you feel irritated while viewing this message?
   (No Irritation) 1 2 3 4 5 6 7 (A great deal of irritation)
4. Did you feel aggravated while viewing this message?
   (No Aggravation) 1 2 3 4 5 6 7 (A great deal of aggravation)

Directions: Please write down all the thoughts that came to mind as you read the message. List each thought separately using a different line for each thought. Don't worry about your use of

grammar and punctuation. You only need to list as many thoughts as you had. Don't worry about filling every line.

Thought 1:
Thought 2:
Thought 3:
Thought 4:
Thought 5:
Thought 6:
Thought 7:
Thought 8:
Thought 9:
Thought 10:
Thought 11:
Thought 12:
Thought 13:
Thought 14:
Thought 15:

Directions: For each thought you just listed on the previous page, please choose whether it is: "Favorable" if you consider the thought you recorded to be in agreement with, or in support of the message "Unfavorable" if you consider the thought to be in opposition to, or countering the message "Neutral" if neither. ALSO, for each thought, please choose whether it is: "Relevant" if you consider the thought you recorded to have something to do with the message. (i.e.) "I am worried about climate change," would be a relevant thought. "Irrelevant" if you consider the thought you recorded to have nothing to do with the message. (i.e.) "I'm hungry," would be an irrelevant thought. DO NOT code lines for which you did not have a thought. Just leave them blank and continue with the survey.

Response 1-15:
Favorable (1)
Unfavorable (2)
Neutral (3)

Relevant (1)
Irrelevant (2)

Directions: The next set of items are designed to help us to understand your thoughts about the message you just read. How did this message make you feel? (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

1. I am uncomfortable being told how to feel about climate change.
2. I do not like that I am being told how to feel about climate change.
3. It irritates me that the PSA told me how to feel about climate change.
4. I dislike that I am being told how to feel about climate change.

1. ''Right now, I am _____ to oppose the Green New Deal"

Motivated : _____ :_____ :_____ :_____:_____ :_____ :_____ : Unmotivated
Determined : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not determined
Encouraged : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not encouraged
Inspired : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not inspired

2. ‘‘Right now, I am _____ to be around others who oppose the Green New Deal”

Motivated : _____ :_____ :_____ :_____:_____ :_____ :_____ : Unmotivated
Determined : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not determined
Encouraged : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not encouraged
Inspired : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not inspired

3. ‘‘Right now, I am _____ to do something to harm the environment”

Motivated : _____ :_____ :_____ :_____:_____ :_____ :_____ : Unmotivated
Determined : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not determined
Encouraged : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not encouraged
Inspired : _____ :_____ :_____ :_____:_____ :_____ :_____ : Not inspired

In your opinion, the government regulation of fossil fuels would be:

Bad : _____ :_____ :_____ :_____:_____ :_____ :_____ : Good
Harmful : _____ :_____ :_____ :_____:_____ :_____ :_____ : Beneficial
Foolish : _____ :_____ :_____ :_____:_____ :_____ :_____ : Wise

In your opinion, the Green New Deal legislature is:

Bad : _____ :_____ :_____ :_____:_____ :_____ :_____ : Good
Harmful : _____ :_____ :_____ :_____:_____ :_____ :_____ : Beneficial
Foolish : _____ :_____ :_____ :_____:_____ :_____ :_____ : Wise

One of the options for the government’s regulations of fossil fuels is the Green New Deal Policy. The Green New Deal calls on the federal government to wean the United States from fossil fuels and curb planet-warming greenhouse gas emissions across the economy. Imagine you are asked to vote for this policy and answer the following questions.

(Extremely Unlikely 1 2 3 4 5 6 7 Extremely Likely)

1. How likely would you be to vote for a representative that is in favor of the Green New Deal Policy?
2. If you were faced with the decision to vote for a representative today, how likely is it that you would choose one that is in favor of the Green New Deal Policy?
3. How likely would you be to vote for a representative who is in favor of the Green New Deal Policy in the future?

In your opinion, the federal government instituting climate change mitigation actions would be:

Bad	: _____ :_____ :_____ :_____:_____ :_____ :_____ :	Good
Harmful	: _____ :_____ :_____ :_____:_____ :_____ :_____ :	Beneficial
Foolish	: _____ :_____ :_____ :_____:_____ :_____ :_____ :	Wise

The Federal Government has outlined a variety of ways in which they can support climate change mitigation actions. Some of these actions include the launch of a: "10-year mobilization" to reduce carbon emissions in the United States. It envisions sourcing 100 percent of the country's electricity from renewable and zero-emissions power, digitizing the nation's power grid, upgrading every building in the country to be more energy-efficient, and overhauling the nation's transportation system by investing in electric vehicles and high-speed rail. Imagine you are asked for input on this plan and answer the following questions. (Extremely Unlikely 1 2 3 4 5 6 7 Extremely Likely)

1. How likely would you be to support the Federal Government climate mitigation actions?
2. If you were faced with the decision to vote for the federal government climate mitigation action plan, how likely is it that you would choose to vote in favor of that plan?
3. How likely would you be to support the Federal Government climate mitigation actions in the future?

Directions: On the scales below, please indicate the degree to which you believe the following statements. (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

1. To what extent does climate change pose a risk to human health
2. To what extent does climate change pose a risk to prosperity
3. To what extent does climate change pose a risk to safety
4. People should do more to address climate change
5. People should support the Green New Deal
6. The private sector should support the Green New Deal
7. The private sector should do more to address climate change
8. The government should do more to address climate change
9. The government should support the Green New Deal

Directions: On the scales below, please indicate the degree to which you believe the following statements. (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

1. Regulations trigger a sense of resistance in me
2. I find contradicting others stimulating
3. When something is prohibited, I usually think "that is exactly what I am going to do."
4. The thought of being dependent on others aggravates me
5. I consider advice from others to be an intrusion
6. I become frustrated when I am unable to make free and independent decisions
7. It irritates me when someone points out things which are obvious to me
8. I become angry when my freedom of choice is restricted

9. Advice and recommendations induce me to do just the opposite
10. I am content only when I am acting on my own free will
11. I resist the attempts of others to influence me

Directions: On the scales below, please indicate the degree to which you believe the following statements. (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

1. I am interested in protecting the environment
2. I have respect for the earth
3. I am interested in preserving nature
4. I believe in correcting injustice towards the environment

Directions: On the scales below, please indicate the degree to which you believe the following statements. (Strongly Disagree) 1 2 3 4 5 6 7 (Strongly Agree)

1. I have a plan for what I want to do in the next 5 years of my life.
2. I often save money or use layaway to buy things I can't afford right now.
3. The choices I have made in life clearly show that I think about the future.
4. When I plan a party or get-together, I always start weeks ahead of time.
5. I often think about how my actions today will affect my health when I am older.

VITA

Personal Background	Brooke Danielle Damico Mountain View, California Daughter of Mike and Kristy Damico
Education	Diploma, Liberty High School, Brentwood California, 2012 Bachelor of Science, Communication, Boise State University, Boise, 2018 Master of Science, Communication Studies, Texas Christian University, Fort Worth, 2020
Experience	Legislative Writer, Idaho Nonprofit Center Boise, 2017-2018 Research Assistant, Boise State University Boise, 2017-2018 Research Assistant, Texas Christian University Fort Worth, 2018-2020 Graduate Assistant, Texas Christian University, Koehler Center, Fort Worth, 2019 Graduate Assistant, Texas Christian University, Interdisciplinary Studies, Fort Worth, 2019 Graduate Teaching Assistant, Texas Christian University Fort Worth, 2019-2020
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ABSTRACT

RESPONSES TO CLIMATE CHANGE MESSAGES: THE EFFECTS OF MESSAGE FRAMING AND SCARCITY APPEALS ON CLIMATE CHANGE MITIGATION EFFORTS

by Brooke Danielle Damico, M.S., 2020
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This study considered strategies for persuading individuals to comply with climate change mitigation. Specifically, this study examined how the use of gain-and-loss framed messages and scarcity appeals influenced individuals' attitudes toward climate change mitigation efforts and their intent to comply. I predicted that scarcity would moderate levels of psychological reactance when paired with message framing. Participants were 274 undergraduate students who read a fabricated New York Times op-ed article about climate change (in)action and mitigation efforts. They then completed an online questionnaire that asked them about their perceptions of the article, attitudes regarding climate change mitigation efforts, and their willingness to comply with those efforts. Results revealed that the manipulated variables of message framing and scarcity appeals did not individually or collectively predict persuasive outcomes. Theoretical and practical implications discussed provide direction for future research in this domain.

Keywords: climate change, scarcity, gain-and-loss framing, persuasion