"What happens next is up to you:" Encouraging Americans' engagement in and communication about the issue of climate change

by

Nicholas P. Gallivan

B.A., University of Iowa, 2016
M.S., Kansas State University, 2020

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Psychological Sciences
College of Arts and Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2023

Abstract

The purpose of these studies was to examine persuasive methods of climate change (CC) advocacy among Americans who feel strongly about this issue. Specifically, using the Global Warming's Six Americas (Maibach, et al., 2011) framework, *Alarmed* and *Concerned* Americans were recruited to examine different appeals encouraging pro-environmental behaviors that varied by the number of proposed behaviors (seven versus one) and by the proposed actor of these behaviors (the participant themself versus legislators in the U.S. government; Study 1) and to establish the perceived efficacy of tools created to help individuals overcome behavioral barriers to CC opinion leadership (i.e., "Strategies" for initiating conversations about CC, "Counterarguments" to common misinformation and denial claims, and "Posts" that can be easily shared across social media sites; Study 2). In Study 1, participants were randomized to view one of four messages (*Single* Quantity–*Self* Actor, *Single–Legislator*, *Multiple–Self*, *Multiple–Legislator*) and completed a battery of attitudinal and behavioral measures related to CC. Against expectation, participants who read either of the two messages highlighting *Multiple* behaviors and either of the two messages highlighting *Self*-initiation were the more likely to engage, generally, in future pro-environmental behaviors; furthermore, participants who read the *Multiple–Self* message were more likely to engage in clean electricity practices and products. In Study 2, participants read four messages encouraging engagement in CC opinion leadership, with three of the messages including additional information to help overcome barriers to initiating difficult conversations. They also completed a personality assessment, which helped determine if participants' effectiveness ratings of the messages uniquely corresponded with specific aspects of their personality. As projected, Agreeableness was positively related to the effectiveness ratings of the *Posts* message; additionally, Agreeableness was positively related to the

effectiveness ratings of the *Strategies* message. However, lower Extraversion and higher

Neuroticism were not uniquely related to effectiveness ratings for either of the three

interventions as hypothesized. Clarification of these results, limitations of the study's

methodology, and future research possibilities are also discussed.

"What happens next is up to you:" Encouraging Americans' engagement in and communication about the issue of climate change

by

Nicholas P. Gallivan

B.A., University of Iowa, 2016
M.S., Kansas State University, 2020

A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Psychological Sciences
College of Arts and Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2023

Approved by:
Major Professor
Laura A. Brannon, Ph.D.

Copyright

Abstract

The purpose of these studies was to examine persuasive methods of climate change (CC) advocacy among Americans who feel strongly about this issue. Specifically, using the Global Warming's Six Americas (Maibach, et al., 2011) framework, *Alarmed* and *Concerned* Americans were recruited to examine different appeals encouraging pro-environmental behaviors that varied by the number of proposed behaviors (seven versus one) and by the proposed actor of these behaviors (the participant themself versus legislators in the U.S. government; Study 1) and to establish the perceived efficacy of tools created to help individuals overcome behavioral barriers to CC opinion leadership (i.e., "Strategies" for initiating conversations about CC, "Counterarguments" to common misinformation and denial claims, and "Posts" that can be easily shared across social media sites; Study 2). In Study 1, participants were randomized to view one of four messages (*Single* Quantity–*Self* Actor, *Single–Legislator*, *Multiple–Self*, *Multiple–Legislator*) and completed a battery of attitudinal and behavioral measures related to CC. Against expectation, participants who read either of the two messages highlighting *Multiple* behaviors and either of the two messages highlighting *Self*-initiation were the more likely to engage, generally, in future pro-environmental behaviors; furthermore, participants who read the *Multiple–Self* message were more likely to engage in clean electricity practices and products. In Study 2, participants read four messages encouraging engagement in CC opinion leadership, with three of the messages including additional information to help overcome barriers to initiating difficult conversations. They also completed a personality assessment, which helped determine if participants' effectiveness ratings of the messages uniquely corresponded with specific aspects of their personality. As projected, Agreeableness was positively related to the effectiveness ratings of the *Posts* message; additionally, Agreeableness was positively related to the

effectiveness ratings of the *Strategies* message. However, lower Extraversion and higher

Neuroticism were not uniquely related to effectiveness ratings for either of the three

interventions as hypothesized. Clarification of these results, limitations of the study's

methodology, and future research possibilities are also discussed.

Table of Contents

List of Figures

List of Tables

Acknowledgements

Foremost, I would like to express my deepest gratitude to my advisor, Dr. Laura A. Brannon, for her remarkable support and guidance through this project. I feel extremely lucky to have worked alongside such a thoughtful, sharp, and good-natured mentor, and I am extremely proud of all the research we conducted together. I would also like to give my sincerest thanks to the members of my dissertation committee: Dr. Jin Lee, Dr. Sarina Maneotis, and Dr. Charles Rice. Dr. Lee has also been part of every major milestone in my graduate school career, and I feel extremely lucky to have professionals like Dr. Rice and Dr. Maneotis to provide such valuable insight and encouragement. I must also thank my lab mates and mentees in the Brannon Attitudes and Persuasion Lab (BAPL!) and my colleagues in the KSU Department of Psychological Sciences, especially Dr. Kelsey Panfil. My cohort comrade, my concert connoisseur, and the sole reason I survived stats our first year–thanks for everything, bestie. I would also like acknowledge my wonderful family and friends, whose support was also crucial to my success through graduate school. Lastly, the following individuals deserve a special acknowledgement, having contributed significantly to my survival through graduate school: Julie Goldman, Brandy Howard, Heather McDonald, Megan Firester, Ezra Klein, Saul Griffith, George Raymond Richard Martin, Dave Bayley, and Kelon Campbell. Your art was a blessing, and I am forever grateful.

Dedication

This dissertation is dedicated to the following individuals:

To Barb & Rick Gallivan…

 for setting me on the path toward learning and success

To Nancy Asklund & Sharon Gallivan…

 for ALL the support you have provided me

To all the family and friends no longer with us, especially Rich Gallivan, Don Sheppelman, Ken Asklund, and Hollis Porter…

To any climate activist who takes the time to read this…

And to all the young, bright, hopeful minds in the world who are still figuring it out.

 You will.

Chapter 1 - Dissertation Background and Overview

Dissertation Summary

Across two studies, I investigated different ways of encouraging Americans to be more engaged and communicative about the issue of climate change. This dissertation document provides the relevant background research that informed these studies, before describing the methodologies I utilized. To begin, I review the issue of climate change, ranging from its causes to its projected effects. Next, I review the research literature illuminating Americans' views of climate change, including a specific theoretical framework of these views (known as the "Global Warming's Six Americas") and other psychology-based individual differences relevant to these views (including personality). Then, I inspect different types of recommended pro-environmental behaviors (i.e., "bottom-up" versus "top-down"), before exploring previously explored persuasive techniques–like tailoring–used to encourage pro-environmental attitudes and behaviors. Study 1 and Study 2 are presented in their totality following this preliminary review, including their overview and hypotheses, methodology, results, and discussion. This document closes with a general discussion of these studies, which includes a comprehensive overview of these studies and empirically supported takeaways to incorporate into future climate change advocacy efforts. Please note that study-relevant tables and figures are located at the end of each chapter they are introduced, and the studies' references and appendices can be found at the end of the document.

"What Happens Next is Up to You:" Encouraging Americans' engagement in and communication about the issue of climate change

The Issue of Climate Change

Climate Change (CC) is arguably the most serious issue humanity has ever faced. Having gained attention in the media across recent decades (Boykoff & Roberts, 2007; Moser, 2010; Schäfer & Schlichting, 2014), the ramifications of CC have continued to amplify since the first Industrial Revolution in the 18th century (IPCC, 2021). During this time, the proliferation of the internal-combustion engine ushered the transition from hand-made to mass-produced products and from animal- to coal-powered technologies (National, 2020). As a result, improvements in the speed and efficiency of transportation (e.g., automobiles, locomotives, ships, and airplanes) and other industries (e.g., energy, textiles, manufacturing, and agriculture) beckoned further integration of these new technologies into everyday life. Nevertheless, noteworthy drawbacks have also accompanied these changes after having gained increased adoption globally. Namely, the release of unnaturally high levels of carbon dioxide (CO_2) and other greenhouse gasses (GHGs) has triggered an accumulation of negative ecological shifts across the world (IPCC, 2005; IPCC, 2021), leading to what is known commonly today as "climate change."

As most organisms–including humans–continue to experience, the effects of CC are multifaceted. The United Nations (UN) Intergovernmental Panel on Climate Change (IPCC), the world's foremost group of climate scientists and experts, has gained valuable insight into the tracking, examining, and projecting of CC and its consequences since its commission in 1988 (e.g., IPCC, 2001; IPCC, 2007; IPCC, 2014; IPCC, 2021; IPCC 2022a; IPCC, 2022b). The most recent installment of the IPCC's Sixth Assessment Report, titled *Climate Change 2021: The Physical Science Basis*, echoes many of the troublesome sentiments of their past reports, such

that drastic, interconnected changes in Earth's ecology will continue to negatively affect all its inhabitants (IPCC, 2021). As mentioned, the most notable—and most predictive—of these changes include heightened concentrations of CO_2 and other GHGs, which consequently trap excess energy (i.e., heat) in Earth's atmosphere and oceans (Crowley & Berner, 2001; Hungate, et al., 2003; Montzka, et al., 2011). As seen in Figure 1, CO_2 concentrations had remained relatively steady over the past approximately 800,000 years until around the year 1850 A.D.; then, as concentrations began to increase through the Industrial Revolution, so too did Earth's surface temperature, continuing trends of covariation that have endured for millions of years (obtained from Arias et al., 2021).
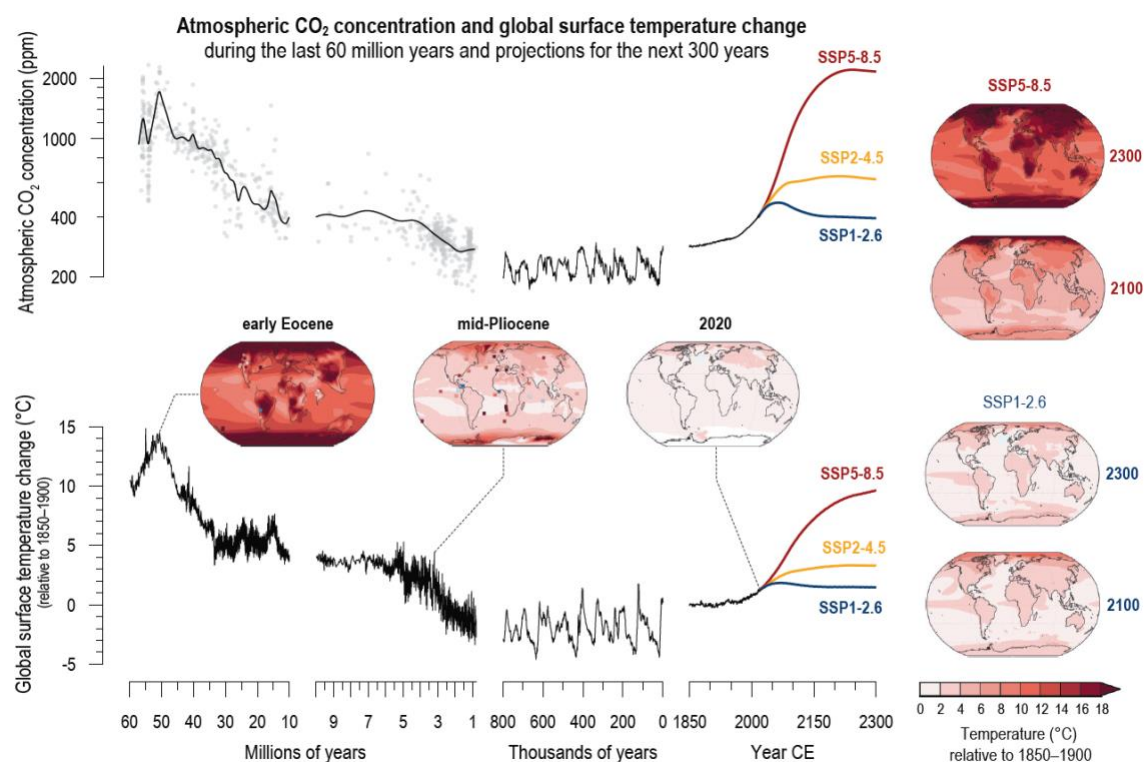
Figure 1. Timeline and Projection of Atmospheric CO2 Concentration and Global Surface Temperature Change (obtained from Arias et al., 2021)

Unfortunately, increases in the Earth's surface temperature are not the only consequence of intensified CO_2 concentrations we face. In Figure 2, three maps—in which the hexagons

represent inhabited areas of the world–display the degree to which Earth's inhabitants have experienced "hot [temperature] extremes," "heavy precipitation," and "agricultural and ecological drought" (obtained from Arias et al., 2021). As displayed, in the areas where evidence was accessible, these three consequences were experienced by over 95%, 70%, and 29%, of the inhabitants, respectively. As expected, these and other effects of CC generate considerable strain on the land and those who occupy it (Stenseth, et al., 2002; McCarty, 2001). For example, plant life and general vegetation must adapt to growingly harsh oscillations of multiple, important factors (e.g., temperature, precipitation, and soil microbiology, among others), threatening their ability to propagate adequately and sustainably (Allen, et al., 2011; Fahad et al., 2020; Malhi, et al., 2021). These consequences are especially worrisome when considering certain species of vegetation, especially those on which many of Earth's organisms rely. Accordingly, the animals inhabiting these regions must also adapt to survive, primarily by altering their hunting or foraging habits or relocating to more suitable areas (Hansen, et al., 2020; Koenig, 2002). Furthermore, humans across the globe are also subject to increased adversity across several matters, creating formidable issues such as energy vulnerability (Bang, 2010), coastline degradation (Sandifer & Scott, 2021), and food insecurity (Wheeler & Von Braun, 2013), among other consequences. While experts continue working to refine their methodologies and comprehension, the conclusions are clear: as CO_2 rises, so too do adverse climate consequences around the world.
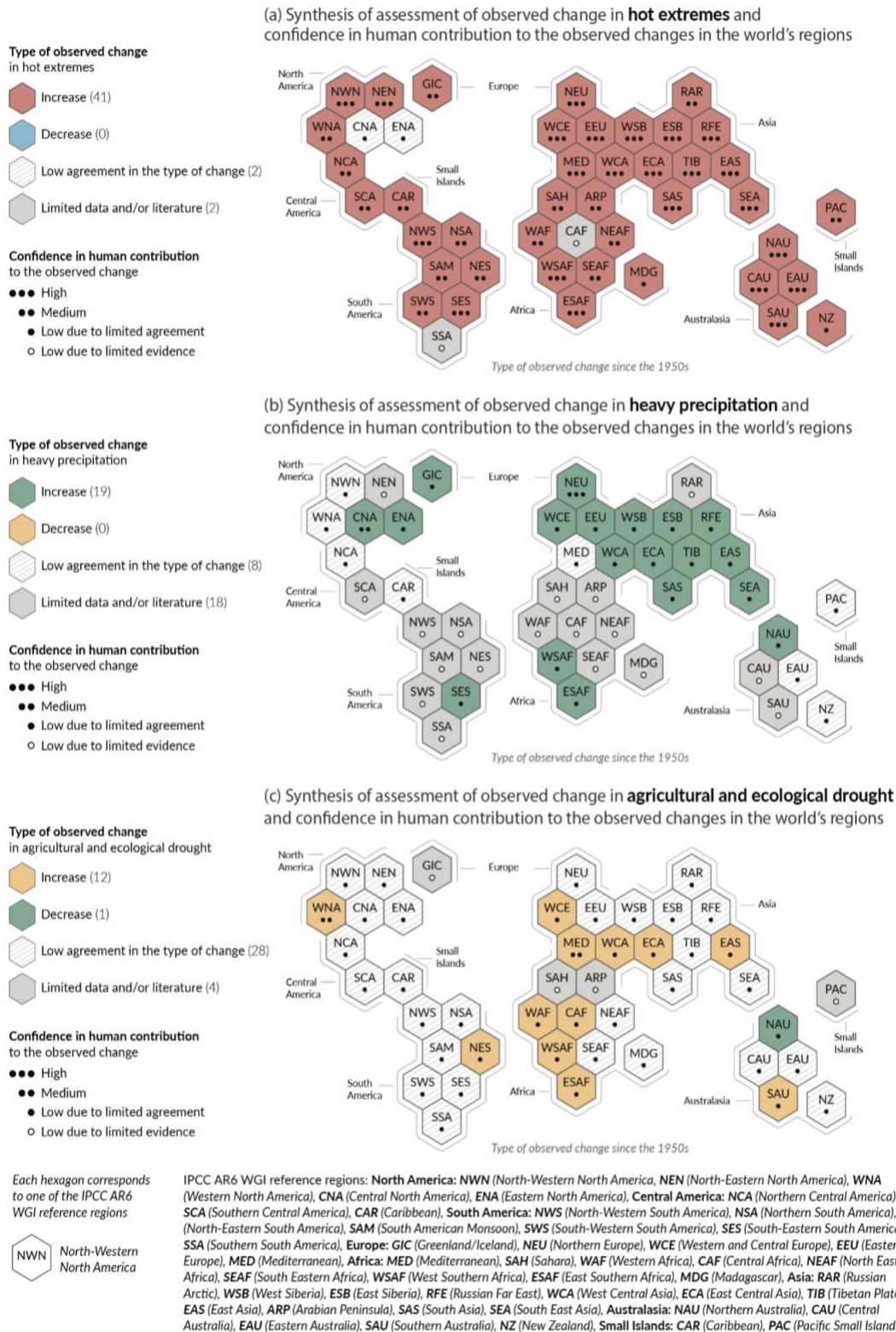
Figure 2. Observed Global Changes in High Temperature Extremes, Heavy Precipitation, and Agricultural and Ecological Drought (obtained from Arias et al., 2021)

The IPCC and others are clear regarding another facet of CC's consequences: if drastic changes in how we produce and consume energy are not made (i.e., if we do not meaningfully reduce global GHG emissions), CC will continue to wreak havoc on the Earth and its inhabitants. The IPCC has produced multiple reports projecting the consequences of CC (IPCC, 2007; IPCC, 2014; Lee et al., 2021). These projections incorporate a diverse set of ecological (e.g., global surface air temperature, global land precipitation, Arctic sea ice area, and global mean sea level), chemical (i.e., CO_2 and GHG concentrations), and economical models from more recent investigations (Amann, et al., 2013; Eyring et al., 2016; O'Neill et al., 2016; Rao et al., 2017), as well as approximations from data dating back to the pre-industrial age. These and other projections provide strong consensus regarding the effects on Earth's ocean, atmosphere, biosphere, and cryosphere (i.e., global ice accumulations). For example, Figure 3 displays future projections of nine distinct "climate impact drivers" (CIDs), the physical conditions of climate systems that affect elements of ecosystems (obtained from Arias et al., 2021). The figure divides the drivers into three distinct themes: heat (and cold), precipitation (and drought), and flooding. As depicted, each driver's projected degree of change is widespread, with different areas projected to experience varying degrees of adversity. For example, the most populated regions around the equator (i.e., Central Africa, India, and Southeast Asia) appear most vulnerable to these changes, with "hotter" and "wetter extremes or more precipitation" projected in many regions (Arias et al., 2021). Unfortunately, these projections show few regions around the planet will experience only minor escalations in these CIDs, highlighting the immensity of CC and its consequences.
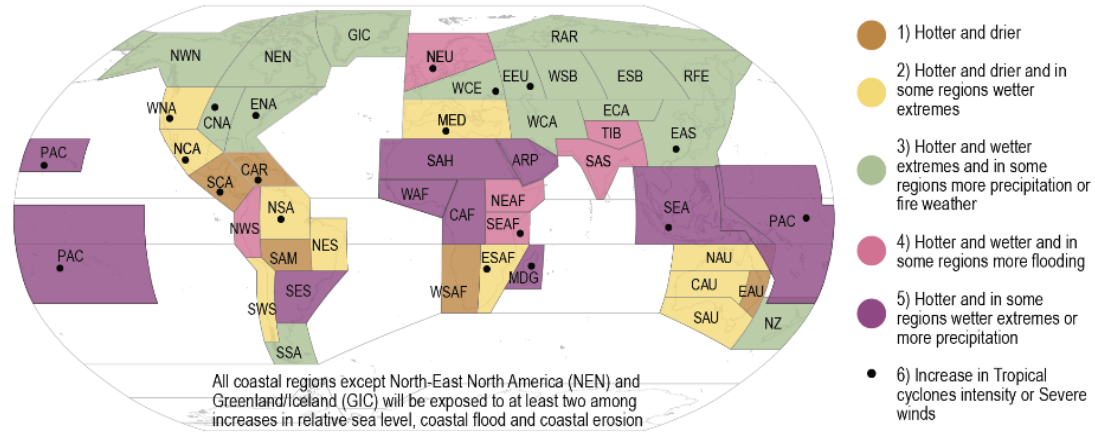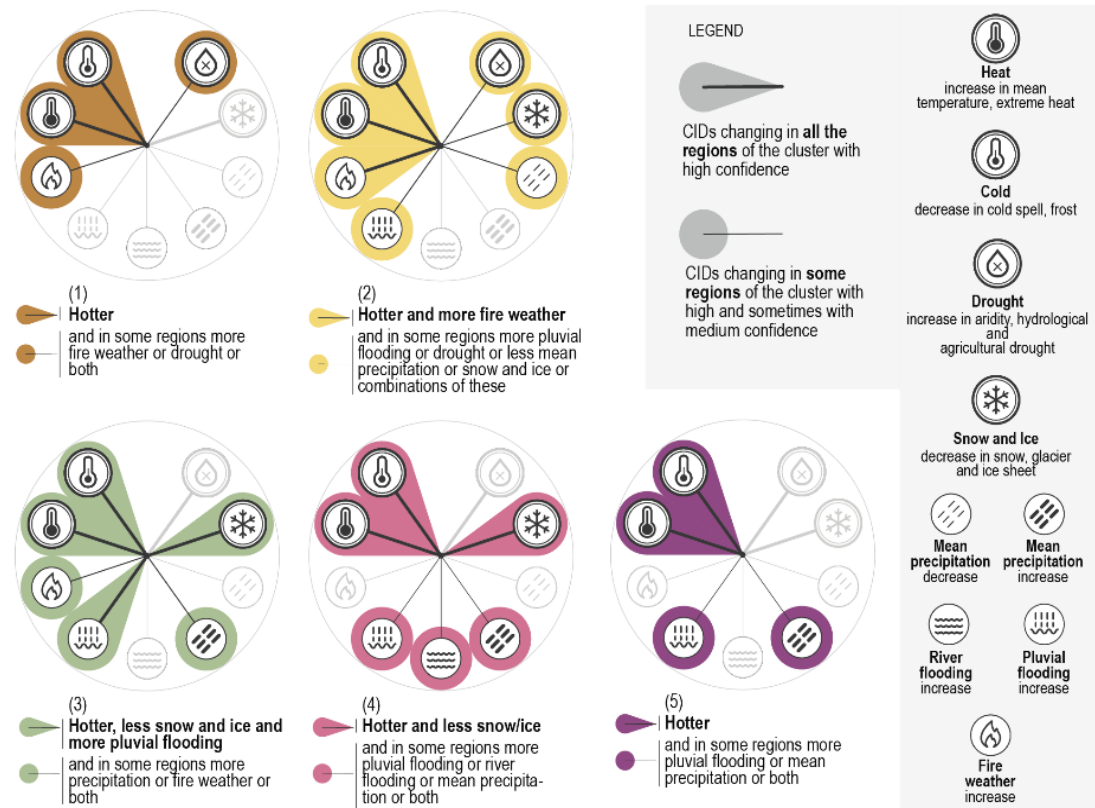
Figure 3. Projected Severity of Climate Impact Drivers (CIDs) Across Earth's Regions by 2050 if 2°C Warming Trends Persist (obtained from Arias et al., 2021)

As expected, these continued shifts in climate will force humans and other inhabitants of the land to adapt. For example, as surface temperatures continue to rise, increases in mountain glacial melt will also persist across the globe, leading to irreversible ecological changes in surrounding areas (Hock, 2005; Hock et al., 2019; IPCC, 2019; Oerlemans, 2001), as well as sustained increases in flooding at lower elevations. Over the past year alone, similar scenarios have been reported in regions surrounding the European Alps (Hruby, 2022), the Himalayan Mountains of South-Central Asia (Chaudhary & Clark, 2022), and other alpine and subalpine regions. Furthermore, viruses and bacteria suspended within these glaciers have caused concern for public health (Danovaro et al., 2011; El-Sayed & Kamel, 2020), while sustained melting of Antarctica's glaciers will continue to erode Earth's coastlines (DeConto & Pollard, 2016; DeConto et al., 2021; IPCC, 2019) and disrupt the oceans' ability to sequester carbon (i.e., by altering its chemical and physical composition; IPCC, 2019; Sarmiento, et al., 1998; Vichi et al., 2011). These ecological changes will negatively affect how societies across the globe operate, underscoring the importance of a comprehensive effort toward mitigation.

Despite the harsh projections offered by the IPCC and other organizations, the collective urgency and prioritization of CC is strikingly variable. As urban planners Horst Rittel and Melvin Webber first noted (1973), CC is one of the ultimate "wicked" problems humanity faces (see also Head, 2008; Incropera, 2016; Marshall, 2015; Termeer, Dewulf, & Breeman, 2013). While the causes, targets, and results of "tame" problems are clear, these facets of "wicked" problems tend to be sundry, even perplexing. A problem becomes "wicked" when its causes, targets, and results grow in complexity and interconnection (Rittel & Marvin, 1973). Because CC can be defined as an economic, technological, moral, governance, or even an ideological problem, a sense of overwhelm, confusion, ambivalence, and other related reactions can overtake

individuals who may be considering their participation in CC solutions. In turn, this can create a variety of barriers to engaging in pro-environmental behaviors, such as social loafing (i.e., the behavioral phenomenon of decreasing the effort an individual exerts as a result of perceptions that other members of the group–either physical or perceived–will; Karau & Williams, 1993; Simms & Nichols, 2014) and general avoidance of commitment to the targeted behaviors (Anderson, 2003; Wullenkord & Reese, 2021). With this understanding, it is more important than ever that researchers deepen our collective comprehension of people's CC perceptions, while simultaneously working to understand how we can most effectively alter these consequential beliefs.

Climate Change Attitudes and Individual Differences

As mentioned above, the "wickedness" of CC has induced notable differences in individuals' appraisal of its circumstances. Much of this research has been conducted using the social psychology lens of attitudes and behaviors, and, accordingly, pro-environmental attitudes and behaviors. For ease, this document will use "CC-related" and "pro-environmental" attitudes and behaviors interchangeably henceforth. Nevertheless, *pro-environmental attitudes* can be defined as the tendency to favor and support the natural environment, while *pro-environmental behaviors* can be defined as actions (or inaction) that positively affect the natural environment, whether intentionally or not (Soutter, et al., 2020). The empirical connection between these attitudes and behaviors has been well-established, typically rendering moderate correlations between these attitudes and behaviors (Bamberg & Möser, 2007; Hines, et al., 1987; Klöckner, 2013). This connection is in alignment with multiple psychological models of behavior, including the Theory of Planned Behavior (Ajzen, 1991; de Leeuw, Valois, et al., 2015; Valois et al., 2020) and the Value-Belief-Norm Model of environmental concern and behavior (Kaiser, et

al., 2005; Stern, 2000). Accordingly, obtaining knowledge of differences in people's attitudes toward CC and pro-environmentalism can be advantageous, yielding opportunities to unlock insights into CC-related behaviors.

Despite efforts by environmental advocates in the 1960s and 1970s (e.g., the recognition of Earth Day in 1969 and the establishment of the U.S. Environmental Protection Agency in 1970), it was not until the 1980s that public discourse on the issue of CC began to grow (Moser, 2010). Since then, scientists and advocates have made considerable efforts to document public opinion on CC-related issues (Brulle, et al., 2012; Leiserowitz, 2007;). Much of this effort took the form of inspection into relationships between perceptions of CC and experienced weather phenomena (Borick & Rabe, 2017; Capstick, et al., 2015; Howe, et al., 2019; Sisco, 2021; Weber, 2010, 2016). However, this research has garnered mixed results, as some studies provide evidence for the relationship between CC attitudes and increase in temperatures (e.g., Krosnick, et al., 2006) and increases in extreme weather (e.g., Spence, et al., 2011), while findings of other studies were less conclusive (e.g., Brulle et al., 2012; Shum, 2012).

Global Warming's Six Americas. In the late 2000s, members of the Yale Program on Climate Change Communication and the George Mason University Center on Climate Change Communication created the first comprehensive model of Americans' CC views. Known as the "Global Warming's Six Americas" (GWSA), this framework proposes six categories ("audiences") to which an American adult may belong (Maibach, et al., 2011). These six audiences can be conceptualized along a continuum from "high" to "low" regarding their CC beliefs (see Figure 4), based on the assessment of a variety of CC attitudes, motivations, risk perceptions, values, policy preferences, behaviors, and barriers to acting. Of course, it is difficult to interpret trends in audience membership over time in isolation; however, when looking at

Figure 4 holistically, certain trends emerge. For instance, over time, it appears that increases in membership of the *Alarmed* audience have been supplemented by Americans' general upward shift in memberships. That is, while membership in the lowest two audiences (i.e., the *Disengaged* and the *Doubtful*) and in the middle *Concerned* and *Cautious* audiences has remained relatively consistent, membership in the Disengaged audience experienced the largest decrease. Thus, it can be concluded that audience membership shifted upward, such that Americans' views of CC have strengthened since the inaugural study.
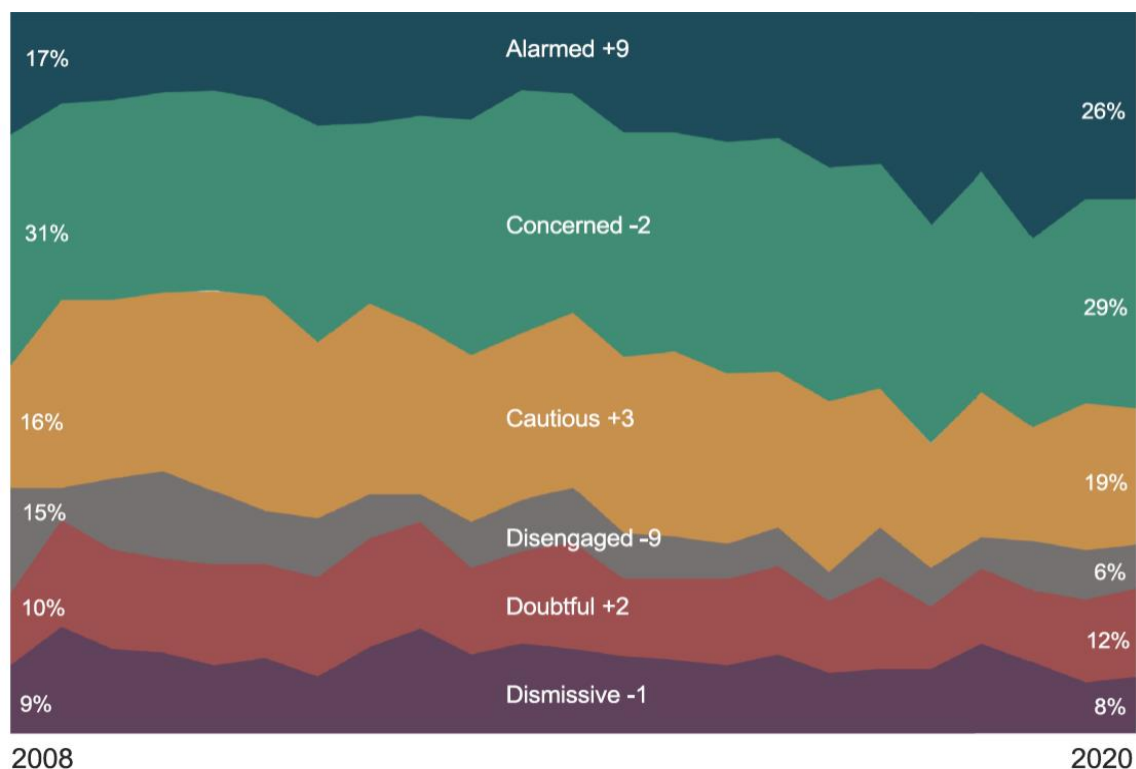
Figure 4. Updated Distributions of the Global Warming's Six Americas (obtained from Leiserowitz et al., 2021)

At the "high" end of the GWSA continuum (i.e., those who are most concerned about and most motivated by CC) lies the *Alarmed* America. This audience is most recently estimated to

comprise approximately 26% of Americans in 2020 (Leiserowitz, et al., 2021). According to the landmark report, almost all members of the *Alarmed* find the issue of CC either "extremely" (48%) or "very important" (47%) to them personally, and similar numbers believe that CC is a significant threat to plants and animals (91%) and future generations of people (91%). Additionally, nearly all the *Alarmed* report being either "very" or "fairly well informed" about causes, consequences, and solutions to CC (90%). While many *Alarmed* believe humans can reduce CC, they are unsure if we will be able to rise to the occasion (74%), and only a few of them are confident in humanity's success in overcoming CC (8%; Maibach et al., 2011). In all, the *Alarmed* have the "highest" CC attitudes, as they are most concerned about the issue of CC while simultaneously being the most hopeful it can be overcome.

Next on the GWSA continuum from "high" to "low" CC beliefs lies the *Concerned* America. This audience is most recently estimated to comprise approximately 29% of Americans in 2020, the largest of the six audiences (Leiserowitz et al., 2021). Overall, *Concerned* individuals tend to have much more moderate views of CC compared to the *Alarmed*, but they hold much higher views than the lower four audiences. For example, less than half report the issue of CC to be either "very" or "extremely important" to them (37%), with the remainder of them reporting the issue to be "somewhat important" (61%). Nearly all the *Concerned* believe that CC is a "great" (68%) or "moderate" (19%) threat to future generations, while over half expect increases in future extinction events for plants and animals (58%). Additionally, most of the *Concerned* feel either "very" (5%) or "fairly well informed" (65%) about the causes, consequences, and solutions to CC. When it comes to overcoming the negative effects of CC, over two-thirds of the *Concerned* report that humanity can reduce CC, they are unsure if we will

be able to rise to the occasion (64%), and only a few of them are confident in humanity's success in overcoming CC (8%; Maibach et al., 2011).

In all, the *Concerned* America is relatively more moderate than the *Alarmed*, but they tend to hold much higher beliefs about CC than the remaining four groups: the *Cautious*, the *Disengaged*, the *Doubtful*, and the *Dismissive*. While the *Concerned* remain distinct on the CC-related issues mentioned above, others are considerably less worried about the potential consequences of CC and are less willing to modify their habits (i.e., the *Cautious* and the *Disengaged*), if they are worried or willing at all (i.e., the *Doubtful* and the *Dismissive*; Maibach et al., 2011).

When mapping the audiences' *issue involvement* (i.e., individuals' engagement with the issue of climate) and *attitudinal valence* (i.e., the inclination to accept or reject climate change science) regarding CC, certain trends emerge. As depicted in Figure 5, while attitudinal valence tends to decrease as the audience continuum descends, issue involvement takes more of a quadratic trajectory (Roser-Renouf, et al., 2015). That is, while those in the two middle audiences (i.e., the *Cautious* and the *Disengaged*) tend to have low issue involvement, those in the two higher audiences (i.e., the *Alarmed* and the *Concerned*) and those in the two lower audiences (i.e., the *Doubtful* and the *Dismissive*) tend to have higher issue involvement. Interestingly, while the *Alarmed* and the *Concerned* and the *Doubtful* and the *Dismissive* all tend to process and respond to CC information carefully, the former two audiences tend to do so to achieve confirmation of what they already know about the seriousness of CC, while the latter two audiences tend to do so with the motivation of arguing or refuting such claims (Roser-Renouf, et al., 2015). With this understanding, it appears that the higher the audience one belongs to (i.e., those who are *Alarmed* or *Concerned*), the more seriously they take the issue of

CC. As a result, individuals in these two groups may be the most suitable to help contribute to the fight to overcome climate change.
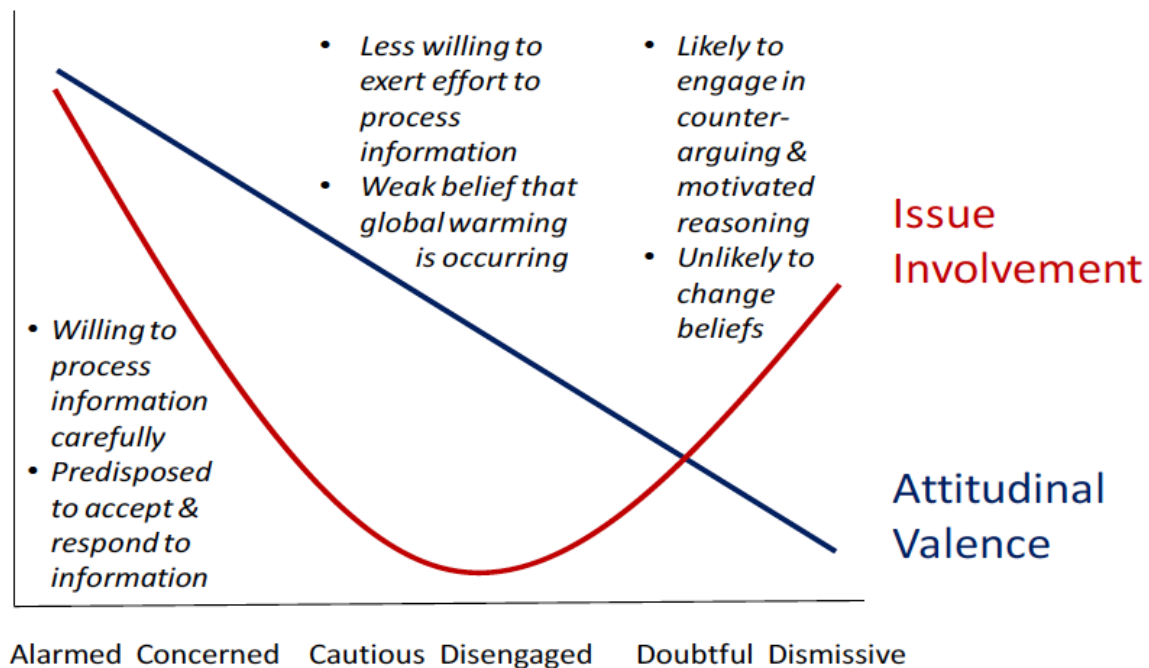
Figure 5. Trends in Climate Change Issue Involvement and Attitude Valence across the Global Warming's Six Americas (obtained from Roser-Renouf et al., 2015)

Other Individual Difference Variables Relevant to Climate Change Attitudes. Given the human involvement in anthropomorphic climate change, examination of other psychological factors relevant to CC attitudes can provide insights into the antecedents of these beliefs. For example, a meta-analysis conducted by Stanley and Wilson reviewed the relationships between attitudes about the environment and certain ideological attitudes (2019); namely, they investigated, Social Dominance Orientation (SDO; i.e., support for social hierarchies and subsequent inequality; Sidanius & Pratto, 2001) and endorsement of Right Wing Authoritarianism (RWA; i.e., preference for submission to authority, for confirming to

traditional norms, and for punishing those who deviate from these norms; Altemeyer, 1998).

Across 16 studies, they found that both SDO and RWA are strongly predictive of environmental attitudes, such that those who endorse these ideologies are less likely to hold pro-environmental attitudes and support action taken against climate change. Furthermore, compared to student samples, these findings were stronger in samples reflecting the general population (Stanley & Wilson, 2019).

On the other hand, researchers have also examined the connections between CC attitudes and certain moral values (Corner, et al., 2014). For example, exploration into the Values-Beliefs-Norms theory of environmental concern and behavior (Stern, 2000) shows that humanistic altruism (i.e., selfless concern directed at people in the greater community), biospheric altruism (i.e., selfless concern directed at other species or the state of ecosystems), and egocentrism (i.e., morality centered on self-interest) are some of the most stable determinants of pro-environmental attitudes (Dietz, et al., 2005). As expected, altruism and egotism relate to environmental attitudes in opposite fashions, such that environmentalism is positively related to these forms of altruism, while it is negatively related to egotism (Conte, et al., 2021; De Groot & Steg, 2008, 2009; Knez, 2016). Moreover, meta-analyses examining the links between CC-related attitudes and other psychological phenomena such as personality (Soutter, et al., 2020), endorsement of materialism (Hurst, et al., 2013), and perceptions of social norms (Alló & Loureiro, 2014), have provided important insights into perceptions of CC.

The Five Factor Model of Personality. As alluded to above, the examination of personality has gained considerable attention in the context of pro-environmentalism (e.g., Hirsh, 2010, 2014; Markowitz, et al., 2012; Milfont & Sibley, 2012; Soutter et al., 2020). Researchers typically define personality traits as features of individual differences in how people show

consistent patterns of thought, feeling, and behavior (McCrae & Costa, 1990). Specifically, much of the existing literature emphasizes a specific taxonomy of traits, called the Five Factor Model of Personality (known commonly as the "Big Five;" Goldberg, 1981, 1990; McCrae & John, 1992). Often represented by the acronym "OCEAN," the Big Five includes the following factors, which most broadly, but most discernibly, represent the range of human personality: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Each of these five factors is conceptualized along a continuum, in which all individuals fall between low and high on each of these factors (John & Srivastava, 1999). Additionally, these factors are generally stable, tending to manifest consistently across contexts and situations (Cobb-Clark & Schurer, 2012). Evidence for fluctuation over time exists, particularly across adulthood (Roberts & Mroczek, 2008); however, researchers generally regard these changes as complex processes whose antecedents are subject to many influences (Srivastava, et al., 2003). It is important to note a sixth unique personality factor, "Honesty-Humility" was identified following the establishment of the Five Factor Model (Ashton & Lee, 2007, 2009), but its distinction lies outside the scope of this program of studies.

Openness to experience is the general extent to which an individual exhibits inventiveness and curiosity versus consistency and caution (Goldberg, 1990; McCrae & John, 1992). Those higher in Openness tend to have diverse interests, are insightful, and exhibit resourcefulness; contrarily, those lower in Openness tend to be described as commonplace, have a restricted set of interests, and prefer simplicity (John & Srivastava, 1999). Research into the manifestation of (higher) Openness has revealed insights into its connection to several phenomena, including a preference for "deeper" approaches to learning (Chamorro-Premuzic &

Furnham, 2009), propensity to make risky financial decisions (Kleine, et al., 2016), and greater capacity for stress resilience (Williams, et al., 2009).

Openness is relevant to understanding CC attitudes due to its influence over how individuals process information (McCrae & Costa, 1997), especially information that may be complex and controversial to some (Soutter et al., 2020). That is, those who are higher in openness tend to possess a more flexible repertoire of cognitive and behavioral approaches to information (McCrae, 1987), potentially making them more willing and able to process information about CC (e.g., ecological data, news stories about the effects of CC, reports on solutions to CC, etc.) and to consider altering certain behaviors (e.g., energy consumption practices, consumer behaviors, travel methods, etc.) in light of such information. Attaining the motivation and ability to process compelling information is regarded as crucial to the process of persuasion by the Elaboration Likelihood Model of Persuasion (Petty & Cacioppo, 1986), which forecasts a target's capacity for information processing (i.e., central, effortful processing versus peripheral, weaker processing) and strength of the attempted persuasion (i.e., the attitude is enduring, resistant to backsliding, and predictive of behavior versus temporary, susceptible to backsliding, and non-predictive of behavior) as a direct function of the target's motivation and ability to process new or persuasive information (Petty & Cacioppo, 1986). Openness to experience holds the strongest empirical link to pro-environmental attitudes and behaviors compared to the other four factors (Brick & Lewis, 2016; Hirsh & Dolderman, 2007; Markowitz et al., 2012; Nisbet, et al., 2009; Soliño & Farizo, 2014). A 2020 meta-analysis of 58 journal articles confirmed these findings, in which Openness was most strongly associated with pro-environmental attitudes [r ($k = 27$) = .22, $p < .001$] and pro-environmental behavior strategies [r ($k = 22$) = .21, $p < .001$; Soutter et al., 2020].

Conscientiousness is the general extent to which an individual exhibits efficiency and organization versus carelessness and frivolity (Goldberg, 1990; McCrae & John, 1992). While individuals higher in Conscientiousness tend to be thorough, reliable, and deliberate, those lower in Conscientiousness tend to be disorderly, irresponsible, and forgetful (John & Srivastava, 1999). The influence of Conscientiousness is most evident in the research literature regarding a diverse range of behavior domains, especially those involving performance outcomes. For example, research shows that those who are higher in Conscientiousness achieve higher job performance (Brown, et al., 2011) and academic performance (Vedel, 2014), demonstrate higher adherence to medication regimentation (Molloy, et al., 2014) and general health behaviors (Bogg & Roberts, 2004), and more frequently practice safe behaviors while working (Beus, et al., 2015).

Understanding individuals' Conscientiousness is, additionally, relevant to their adherence to pro-environmental behaviors. Personality researchers John and Srivastava define conscientiousness as a "socially prescribed impulse control that facilitates task-and goal-directed behavior, such as thinking before acting, delaying gratification, following norms and rules and planning, organizing and prioritizing tasks" (1999, p. 121). That is, they suggest Conscientiousness functions as an ancillary check on behaviors, especially those that tend to be thoughtless or automatic. As such, Conscientiousness is germane to a variety of motivational processes relevant to successful behavioral alteration required of CC mitigation, such as behavioral control (Sniehotta, et al., 2006), impulsivity (Sharma, et al., 2014), and self-regulation (Hofmann, et al., 2012), among others. That is, while those who are higher in Conscientiousness tend to have a higher capacity to adhere to specific changes in behavior, those who are lower in this trait tend to struggle and ultimately fail at such objectives. Accordingly, Conscientiousness

is also significantly related to pro-environmental attitudes [r ($k = 29$) = .12, $p < .001$] and behaviors [r ($k = 25$) = .11, $p < .001$], but to a lesser extent (Soutter et al., 2020).

Extraversion represents the general extent to which an individual is outgoing and energetic versus solitary and reserved (Goldberg, 1990; McCrae & John, 1992). Individuals higher in Extraversion tend to be outspoken, enthusiastic, and sociable, while those lower in Extraversion tend to be quiet, reserved, and shy (John & Srivastava, 1999). According to the research literature, differences in Extraversion are most strongly related to various domains of interpersonal interaction. For example, those who are higher in Extraversion tend to have larger social networks (Roberts, et al., 2008), have a greater level of social influence on others (Hu, et al., 2019), and experience greater success in business leadership (Do & Minbashian, 2014).

While the direct relationship between Extraversion and pro-environmental attitudes and behaviors may be less clear, evidence suggests its indirect connection to these matters. For example, research on collaboration in the workplace displays the influence of Extraversion on creativity, such that those who were higher in Extraversion were more likely to stimulate creative business ideas through sharing information with colleagues (Chiang, et al., 2017). Additionally, Extraversion has been implicated as a form of coping, as those who were higher in Extraversion were more likely to engage in help-seeking in the face of life issues (Amirkhan, et al., 1995). Overall, like Conscientiousness, Extraversion is empirically linked with both pro-environmental attitudes [r ($k = 27$) = .09, $p < .001$] and behaviors [r ($k = 21$) = .10, $p < .001$], but to a lesser extent than Openness (Soutter et al., 2020).

Agreeableness is the general extent to which an individual is friendly and compassionate versus stern and critical (Goldberg, 1990; McCrae & John, 1992). While individuals higher in Agreeableness tend to be trusting, forgiving, and pleasant, those lower in Agreeableness tend to

be cold, unfriendly, and quarrelsome (John & Srivastava, 1999). Like with Extraversion, the research literature examining Agreeableness reveals much information about individuals' interactions. For example, research shows that Agreeableness is associated with higher expression of prosocial motivation (i.e., the drive to protect and promote the well-being of others; Graziano, et al., 2007), and it is implicated as an antecedent to communication and cohesion in work dynamics (Bradley, et al., 2013).

Reflection on the foundational traits of (high) Agreeableness, like "trusting, helpful, and good-natured" (John & Srivastava, 1999) reveals its connections to the processes of adopting and holding certain pro-environmental attitudes and behaviors. That is, those who are higher in Agreeableness may have more pliable motivation to learn about CC-related information (Oreg & Sverdlik, 2014) and may be more willing to make certain changes to their behavior if requested. In this fashion, people's predisposition to Agreeableness can be wielded by CC researchers and advocates for subsequent effortful processing of CC-related information later (Petty & Cacioppo, 1986). Indeed, like Conscientiousness and Extraversion, Agreeableness is empirically linked with both pro-environmental attitudes [r ($k = 27$) = .15, $p < .001$] and behaviors [r ($k = 22$) = .10, $p < .001$], but to a lesser extent than Openness (Soutter et al., 2020).

Lastly, *Neuroticism* represents the general extent to which an individual exhibits sensitivity and nervousness versus resilience and confidence (Goldberg, 1990; McCrae & John, 1992). While individuals who are higher in Neuroticism tend to be anxious, temperamental, and self-punishing, those who are lower in Neuroticism tend to be stable, calm, and content (John & Srivastava, 1999). The research literature on Neuroticism most commonly highlights its connections to physical and mental health (e.g., Lahey, 2009; Zhang et al., 2021) and performance across different domains (e.g., Kaplan, et al., 2009). Neuroticism is unique among

the five factors, as higher scores are generally regarded as socially undesirable compared to the other four dimensions (Hudson & Fraley, 2016; Hudson & Roberts, 2014). Additionally, Neuroticism is unique in that it is not empirically linked to the endorsement of pro-environmental attitudes [r (k = 26) = .02, p = .082] or behaviors [r (k = 22) = -.02, p > .05; Soutter et al., 2020].

Another factor related to personality and pro-environmentalism that deserves discussion is social media use. As expected, the relationship between personality and social media use is well documented. For instance, a 2019 meta-analysis revealed social media use had positive relationships with Extraversion and Neuroticism and a negative relationship with Conscientiousness; however, no significant relationships were revealed with Openness and Agreeableness (Huang, 2019). These findings are supported by other research examining the acceptance of social media site use, such that Extraversion was positively related to perceived usefulness and perceived ease of use, while Conscientiousness was also positively related to perceived ease of use (Rosen & Kluemper, 2008). Furthermore, other research suggests that the "Big Five" traits hold unique relationships with different motivations for social media use (Kircaburun, et al., 2020). Specifically, findings show Conscientiousness was the only trait (negatively) related to "expressing or presenting more popular self," while the four dimensions but Neuroticism are positively related to "maintaining existing relationships," only; furthermore, these same four traits were (each positively) related to "informational and educational." In all, the "Big Five" trait of (higher) Extraversion tends to hold the most robust relationships with social media perceptions, motivations, and uses.

As reviewed earlier, the empirical connection between attitudes and behaviors has been well-established (Bamberg & Möser, 2007; Hines, et al., 1987; Klöckner, 2013), aligning with

multiple psychological models of behavior (Ajzen, 1991; de Leeuw, et al., 2015; Valois et al., 2020; Kaiser, et al., 2005; Stern, 2000). This notion is also further supported by another model called the consistency theory (Heider, 1958). This theory projects that individuals are primarily motivated by the desire to maintain congruence between their cognitions, a topic originally explored in the foundational research of cognitive dissonance theory (Festinger, 1957; 1962) Since then, compelling evidence has emerged highlighting people's inclination to engage in and ''spend time in situations that will foster, promote, and encourage the behavioral manifestations of their own traits and dispositions'' (Ickes, et al., 1997, p. 177; see also Emmons, et al., 1986; Hampson, 2012). That is, people tend to seek situations that allow them to display their authentic selves, based on the internal characteristics (i.e., their personality) that naturally manifest. Subsequent research suggests the motivation for congruence may result from negative experiences people have when they engage in behaviors not in accordance with their personality traits, along with the positive experiences gained from congruent behaviors (Côté & Moskowitz, 1998).

This phenomenon of consistency is also, thus, relevant when considering personality traits and behaviors, and it has been recently investigated in the context of interpersonal communication. Researchers Frederickx and Hofmans examined whether the Big Five personality traits relate to interpersonal communications that participants engaged in (2014). In this study, college students rated their frequency and perceptions of engaging in eight types of conversations from the previous five-day period. As they expected, participants higher in Extraversion and Agreeableness initiated a higher number of conversations compared to those lower in both of those dimensions (Frederickx & Hofmans, 2014); additionally, those higher in Neuroticism were more likely to initiate conversations when they were uncertain of the topic

beforehand and less likely to initiate conversation when they were certain of the topic, compared to those lower in Neuroticism. Each of these findings aligns with the congruence principle, such that those who are higher in Extraversion possess a higher affinity for social contact and attention (Costa & McCrae, 2011), those who are higher in Agreeableness often engage in positive conversations (Zellars & Perrewé, 2001), and those who are higher in Neuroticism experience higher levels of emotional instability and insecurity (Hampson, 2012), which can also emerge when initiating interpersonal communication. Additionally, individual differences in Openness and Conscientiousness were not associated with the propensity to initiate conversation (Frederickx & Hofmans, 2014). These findings also align with the congruence principle, as these two personality dimensions are regarded as intrapsychic, rather than interpersonal, in nature (Costa & McCrae, 2011). With multiple barriers to initiating conversation identified (Sandstrom & Boothby, 2021), it is important to consider how else the congruence principle can be applied, especially in the context of pro-environmental behavior.

Pro-Environmental Behaviors and Climate Change Solutions

In the face of a bleak outlook regarding the future of earth's ecosystems, overcoming CC requires an unprecedented level of adjustment to how humans operate, interact, govern, and live. That is, it is most strongly agreed upon that members of developed and developing nations across the globe must pivot from behaviors that emit GHGs and harm ecosystems to those that do not (IPCC, 2005; Montzka, et al., 2011). Despite the immensity of this objective, knowledge of the connection between attitudes and behaviors (Ajzen, 1991; Kaiser et al., 2000; Petty & Cacioppo, 1984) and pro-environmental attitudes and behaviors (e.g., Bamberg & Möser, 2007; Hines, et al., 1987; Klöckner, 2013) can provide important insights into the behaviors that we must begin modifying.

Bottom-Up Versus Top-Down Pro-Environmental Behaviors. Depending on the scale and manner involved, pro-environmental behaviors and solutions to CC can take several forms and behaviors. One way to organize these behaviors involves the comparison between "bottom-up" versus "top-down" approaches to CC solutions. While smaller-scale, "bottom-up" solutions typically give focus to micro-level efforts to adapt to and mitigate the effects of CC (i.e., behaviors that are adopted at the individual and community levels), larger-scale, "top-down" solutions emphasize macro-level efforts of CC adaptation and mitigation (i.e., business- and industry-level adoptions or adaptations of practices; Burton, et al., 2005; Füssel, 2007). To achieve the highest level of success in overcoming CC, a synergy of bottom-up and top-down changes must be achieved globally.

Numerous national and international institutions have produced information describing the different types of "bottom-up" behaviors individuals can–and should–perform. For example, the U.S. Environmental Protection Agency (EPA) hosts a webpage called "What You Can Do To Fight Climate Change" in which it provides information on six different areas of behaviors (i.e., "Energy," "Waste," "Transportation," "Water," "Environmental Justice (EJ)", and "Do More!") that individuals can begin making changes within (United States, 2022a). Each of these six pages provides a range of simple and short-term suggestions to more complex and longer-term suggestions, such as "Heat[ing] and cool[ing] your home smartly" and "Switch[ing] to green power generated from renewable energy sources" on the "Energy" webpage (United States, 2022b). Alternatively, the UN has also published its list of proposed measures on its "Start with these ten actions!" webpage (United Nations, n.d.). This page is similar to that of the EPA's, as each of these 10 action groups (i.e., "Save energy at home," "Walk, bike, or take public transportation," "Eat more vegetables," "Consider your travel," "Throw away less food,"

"Reduce, reuse, repair, recycle," "Change your home's source of energy," Switch to an electric vehicle," Make your money count," and "Speak up") are accompanied by additional context to help explain how individuals can adopt these changes. Additional internet searches can also provide a large variety of resources from other government agencies (e.g., Herring, 2020), media sources (e.g., Wilkinson, 2021), and professional groups (e.g., Union, n.d.) echoing many of these same suggestions.

On the other hand, attention has also been given to larger-scale, "top-down" changes that are most effective. The most recent installment of the IPCC's Assessment Report, titled "Mitigation of Climate Change," urges the need for "top-down" changes in a variety of forms, but they also specifically declare, "Long-term deep emission reductions, including the reduction of emissions to net zero, is best achieved through institutions and governance that nurture new mitigation policies, while at the same time reconsidering existing policies that support the continued emission of GHGs" (IPCC, 2022b, p. 108). As industries across the globe are regulated by the policies of certain governing bodies, the IPCC recognizes "top-down" changes to how we operate must be generated by these institutions. Like their previous reports, this information is synthesized in a "Summary for Policymakers," which provides substantive recommendations that can be facilitated through legislation (IPCC, 2022c).

With GHG emission reduction in mind, the foci of legislation and government action should prioritize the sectors that most directly and abundantly contribute to GHG emissions. The U.S. EPA cites five major groups of GHG emitters: transportation (from both personal and commercial methods; responsible for 27% of total GHG emissions), electric power (25%), industry (24%), commercial and residential (primarily through heating, cooling, and waste management of buildings; 13%), and agriculture (from both land and animal management; 11%;

United States, n.d.). While there has been much deliberation over how changes to these industries should be legislated (e.g., Burke et al., 2016, Flatt, 2007; Gowdy, 2008; Hallegatte, et al., 2011), clean electrification of our energy systems has received considerable support from economists and researchers across the globe (e.g., Griffith, 2022; Jaccard, 2022; McCollum, et al., 2014; Sugiyama, 2012; Yadoo & Cruickshank, 2012; Zhang & Fujimori, 2020). Regardless, the IPCC projects Earth will hit 2.8°C (5°F) warming if current GHG emission trends continue without reprieve (2022b). Accordingly, they propose widespread alterations to how we live and operate are necessary, at a rate and scale never seen.

  Psychological Foundations of Behavior. Along with understanding the specific types of behaviors and solutions that are most impactful, it is also important to understand the underlying psycho-social factors driving individuals' intentions and behaviors. For example, the Theory of Planned Behavior identifies specific antecedents to behavior intentions and, ultimately, behaviors important to understand (Ajzen, 1991). Along with attitudes and "subjective norms" (i.e., the belief other people will approve or disapprove of the target behavior), another antecedent of relevance to pro-environmental behaviors is that of "perceived behavioral control." This is the individual's perceptions of the ease or difficulty of achieving the target behavior (Ajzen, 1991). Perceived control is also prevalent in goal-setting research (Locke & Latham, 1990), in which a review of this literature suggested goals must require a minimum level of difficulty while also being perceived as attainable (Lunenburg, 2011). Furthermore, Locke (1996) summarized high perceptions of both importance and attainability–whether through accomplishing the goal or making progress toward it–of the goal are necessary for commitment. Concerted evaluation of a goal requires available cognitive resources (Petty & Cacioppo, 1984), but it also, consequently, makes salient the difficulties associated with the goal's attempt (Lynch, et al., 2010).

Accordingly, when pursuing multiple goals simultaneously, the perceptions of potential barriers naturally increase (Dalton & Spiller, 2012).

Over the recent decades, the Theory of Planned Behavior has been used to evaluate a variety of pro-environmental behaviors (Stern, et al., 1995; Taylor & Todd, 1995) including recycling (Cheung, et al., 1999), water conservation (Trumbo, et al., 2001), green consumerism (Sparks & Shepherd, 1992), and stormwater management (Shaw, et al., 2011). Furthermore, as alluded to earlier in the text, the factors named in the Theory of Planned Behavior strongly overlap conceptually with those in other popular theories, such as the Elaboration Likelihood Model of persuasion (Petty & Cacioppo, 1984), the Values-Beliefs-Norms Theory of environmental concern (Stern, 2000), and the Social Action Theory of health behaviors (Ewart, 1991), among other theories.

The foundational research of the GWSA also provides many related insights into Americans' perceptions of specific CC-related behaviors (Maibach et al., 2011). For example, when the researchers evaluated expected outcomes from a national response to combat CC, the *Alarmed* and the *Concerned* were, expectedly, the most optimistic. Indeed, these audience members scored the highest in expected positive outcomes (eight and six positive outcomes out of 10, respectively) and the lowest in the expected negative outcomes (one negative outcome out of six for both audiences) compared to the other four audiences. Individual (bottom-up) approaches appear to be more highly regarded in general. That is, majorities of each of the *Alarmed*, *Concerned*, *Cautious*, and *Disengaged* audiences tend to believe their pro-environmental behaviors would have "some" or "a lot" of effectiveness if most people in industrialized nations also adopted them (Maibach et al., 2011).

The foundational GWSA research also provides important awareness into perceptions of and preferences for a wide range of impactful pro-environmental behaviors. For example, they reveal general support for international treaties to reduce GHG emissions, for regulation of CO_2 as a pollutant, and for cap-and-trade policies across the top four GWSA audiences: the *Alarmed*, *Concerned*, *Cautious*, and *Disengaged* (Maibach et al., 2011). They also found that the *Alarmed* (i.e., nearly a third of them) were notably more likely to have contacted an elected official over the previous year than all of the other audiences (i.e., less than 10% of members in each of the other five audiences), while nearly all of the *Alarmed* (nearly 100%) and *Concerned* (nearly 80%) were intending to engage in corporate activism over the coming year (compared to 40% or fewer in each of the remaining four audiences). Furthermore, the *Alarmed* and *Concerned* tend to be the most communicative regarding CC information, as over half of the *Alarmed* either "receive more information than they give" or "give and receive about the same amount of information," while around half of the *Concerned* report the same practices. Much like the trends comparing the six audiences across "issue involvement" (Figure 5), these information practices dip for Americans in the middle two audiences (i.e., the *Cautious* and *Disengaged*), but those in the lowest two audiences (i.e., the *Doubtful* and *Dismissive*) tend to be more communicative of CC misinformation, approaching levels of those in the second audience, the *Concerned* (Maibach et al., 2011). Through knowledge of these perceptions, researchers can identify what attitudes and behaviors can most easily–and should most effortfully–be modified.

Pro-Environmental Approaches to Persuasion

The growing gravity of CC necessitates investigation into how differences in CC attitudes and behaviors can be overcome. To be most impactful, the ultimate goal of CC-related persuasion is to improve people's knowledge of CC while increasing their perceptions that

specific, effective changes can and should be made. Additionally, behavior modification that contributes to the reduction in CO_2 and other GHG emissions has been identified as most imperative (Chapman, et al., 2018; IPCC, 2005). As such, researchers have tested a variety of persuasive techniques to achieve these and other pro-environmental goals.

For example, one popular persuasive technique is social norms messages to alter pro-environmental attitudes and behaviors. "Social norms" are the predominant thoughts, beliefs, and behaviors of a group of people; furthermore, these persuasion techniques typically take one of two forms (Reno, et al., 1993). While "descriptive" norms emphasize how most people behave, "injunctive" norms emphasize how most people believe someone *should* behave. For example, participants in one study received a several-page "Home Energy Report" which began with a "Social Comparison Model" using both descriptive and injunctive norms (Allcott, 2011). Specifically, the first part of this information included the descriptive norms aspect, which compared the target household's energy use to that of the mean (referred to as "All Neighbors" in the report) and 20th percentile (referred to as "Efficient Neighbors" in the report) of its "comparison group" (i.e., roughly 100 geographically affiliated households with comparable characteristics like square footage and heating type). Additionally, the same page included the injunctive norms aspect of the information, referred to as the "Efficiency Standing," which rated the household's energy use as either "Great," "Good," or "Below Average," based on how they compared to the "Efficient" and average neighbor. Accordingly, the researcher found those in the program–nearly 600,000 households across the United States–significantly reduced their energy consumption by an average of 2.0% (Allcott, 2011). Farrow and colleagues conducted a review of social norms-focused interventions targeting pro-environmental behaviors (2017). Although not every reviewed intervention was effective, social norms persuasion appears to be widely

successful across several behaviors, such as energy use (e.g., Costa, & Kahn, 2013; Nolan, et al., 2008) and recycling (e.g., Andersson & von Borgstede, 2010; Schultz, 1999), among other behaviors (Farrow, et al., 2017).

Moral and emotional appeals have also been utilized to improve individuals' pro-environmental attitudes and behaviors. Morality is generally conceptualized as a set of interconnected values, behaviors, and institutions that support the well-being of the greater population (Haidt, 2010). The functional links between moral appraisals and individuals' attitudes and behaviors are strong (Haidt, 2001; Luttrell, et al., 2016), and research shows that people who utilize a moral lens to deliberate CC and environmental issues tend to hold stronger pro-environmental attitudes and behavior intentions (Markowitz, 2012; Wang, 2017; Wolsko, Ariceaga, & Seiden, 2016). The realities of anthropomorphic climate change are strongly connected to various moral themes and have, subsequently, been used as foci of persuasive efforts, including appeals for upholding justice (e.g., Gustafson et al., 2020), preventing unjust behaviors (e.g., Grasso, 2007), engaging in the stewardship of land's purity (e.g., Shin & Preston, 2021), and ensuring viable spaces for future generations (e.g., Davidson, 2008). In another example, researchers Shin and Preston examined the efficacy of messages highlighting stewardship beliefs (i.e., that guardianship over Earth is a religious duty) or dominion beliefs (i.e., that humans were given dominance over Earth by God; 2021). While pro-environmental attitudes were positively related to stewardship beliefs and negatively related to dominion beliefs, the researchers also found that religious participants who read stewardship-fashioned messages expressed greater concern for CC, compared to those who read a dominion-fashioned message.

Another effective persuasive intervention utilized with pro-environmental aims is behavior feedback. Most common in health persuasion and modification (DiClemente, et al., 2001; Gallivan & Brannon, 2021;Kreuter, et al., 1999), these messages provide information to target individuals about specific features of their behavior(s) and connections to positive or negative outcomes. It is the personalized nature of the information that makes it especially appealing, as research shows personalized information is better remembered and attended to by individuals (Kreuter & Wray, 2003), a notion supported by the Elaboration Likelihood Model of persuasion (Petty & Cacioppo, 1986). Indeed, behavior feedback has shown to be a successful pro-environmental persuasion and modification tool. For example, Abrahamse and colleagues utilized personalized feedback regarding participants' home energy consumption costs to successfully encourage reduction in energy consumption (2007). Specifically, participant households either received or not a combination of tailored information about their energy use (based on self-report assessments they provided), information on individualized goal setting of 5% energy reduction, tailored individual feedback on ways to reduce energy consumption, and "group" goals and feedback that were prescribed for the group of participants. They found that those in intervention groups saved 5.1% (versus 0.7%) on energy costs, saved significantly more direct energy, adopted a significantly larger number of energy-saving behaviors, and had significantly higher levels of knowledge concerning energy conservation, compared to those in the control group (Abrahamse, et al., 2007). Applications of behavior feedback interventions targeting energy consumption are diverse, including mailed energy bills specifying peak-on and peak-off energy use rates that included personalized feedback information or not (Kasulis, et al., 1981), mobile text messages and at home-displays providing feedback on energy use and water consumption (Vassileva, et al., 2013), and monthly emails that provided group-level energy

consumption feedback to office workers (Carrico & Riemer, 2011). A 2010 meta-analysis demonstrated the overall efficacy of behavior feedback interventions on energy conservation; however, several variables appear to moderate its efficacy, such as frequency and duration of feedback, the medium by which it is delivered, and its combination with other interventions (Karlin, et al., 2015).

Tailored Approaches to Persuasion. As mentioned, the success of interventions like behavior feedback is attributed to the personalized nature of the intervention's information (Kreuter & Wray, 2003; Petty & Cacioppo, 1986). This notion of personalization is directly related to "tailoring," a specific approach to persuasion. Researchers Kreuter and colleagues defined tailored health messages as those that incorporate "any combination of strategies and information intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest, and derived from an individual assessment" (1999, p. 276). That is, tailored messages offer educational information that is unique to (i.e., is "tailored to") a specific, measured characteristic of the target individual. While tailoring is widely popular in the health persuasion literature (Krebs, et al., 2010; Lustria, et al., 2016; Noar, et al., 2007), tailored interventions can be applied to a wide variety of attitudes and behaviors, including those regarding pro-environmentalism.

Tailoring to GWSA Audience Membership. Indeed, the use of tailored persuasion has been encouraged by members of the GWSA research team. That is, a 2015 report outlines message strategies directly tailored to the beliefs and tendencies of the GWSA audiences (Roser-Renouf et al., 2015). After further segmenting the six audiences into thirds (i.e., the "High Involvement" audiences of the *Alarmed* and the *Concerned*, the "Low Involvement" audiences of the *Cautious* and the *Disengaged*, and the "Negative Climate Change Attitudes" audiences of

the *Doubtful* and the *Dismissive*), the report reviewed the foundational research of the GWSA project (see Maibach et al., 2011) and provided communication strategies for each third tailored to their general beliefs and tendencies. For example, these researchers propose three distinct strategies when attempting to persuade members of the "High Involvement" audiences of the *Alarmed* and the *Concerned*.

First, Roser-Renouf and colleagues propose "using centrally processed arguments to propose lasting behavior change" (2015, p. 11). As a tenet of the Elaboration Likelihood Model, centrally processed arguments provide sensible information with strong reasoning (Petty & Cacioppo, 1986). Because the *Alarmed* and the *Concerned* are typically highly knowledgeable about CC and pro-environmental information, they are typically better able to deliberate the merits of information they are presented, including high-level information regarding science and policy. Moreover, because more effort is required to process these messages, their content is more likely to be remembered, potentially leading to a longer-lasting change in behavior (Petty, et al., 2009).

Second, the GWSA researchers propose including elements of information that build perceptions of efficacy within these individuals (Roser-Renouf et al., 2015). Whether strengthening perceptions of self-efficacy (i.e., the belief that oneself can make a proposed behavior change) or collective efficacy (i.e., the belief one's group is capable of making a proposed behavior change; Bandura, 1986), they propose future interventions will benefit from distinct efforts to clarify the accessibility of effective behavior modification, as is supported in the research literature (Petty et al., 2009). The notion of strengthening participants' efficacy perceptions to aid persuasion is directly rooted in the health persuasion model of the Theory of Planned Behavior, which identifies "perceived behavioral control" [i.e., the individual's

33

perceptions of the ease of difficulty of the target behavior) as an antecedent of behavior and intentions (Ajzen, 1991)]. By improving people's perceptions of access to and attainability of pro-environmental goals, these individuals may be more open to processing persuasive efforts and potentially altering their pro-environmental attitudes and behaviors.

Lastly, the GWSA researchers suggest encouraging *Alarmed* and *Concerned* Americans to converse about CC and pro-environmentalism with people in their social network–especially members of the lower GWSA audiences (Roser-Renouf et al., 2015). Referred to as being an "opinion leader," members of the "High Involvement" audiences can utilize the familiarity and trust they hold with others–characteristics of communicators that are advantageous to persuasive efforts (Fiske & Dupree, 2014; Lui & Standing, 1989; Renn & Levine, 1991)–to initiate communication about potentially controversial topics, like CC. Utilizing communicators with higher levels of both issue knowledge and interpersonal trust has been suggested in a report proposing the "Two-Step Flow" Model of climate change communication (Nisbet & Kotcher, 2007). This model shifts the focus from large-scale and mass communication to more intimate, interpersonal communication. Through the lens of this model, members of the "High Involvement" audiences are designated to take responsibility for initiating discussions of issues– like CC–with their family members and friends. These CC advocates can utilize their personal influence within the social network as a foot-in-the-door persuasive technique (see Burger, 1999; Freedman & Fraser, 1966) to subsequently seize the opportunity to initiate conversations about CC. As members of the "High Involvement" audiences are the most knowledgeable about CC and most willing to discuss its issues (Maibach et al., 2011), they may be the best candidates to serve as "opinion leaders."

With these suggestions, the GWSA researchers also identify other important characteristics when attempting to persuade "High Involvement" audience members. Particularly, the primary challenge they cite with this group is motivating them to translate their beliefs into action, particularly into political action and opinion leadership (Roser-Renouf et al., 2015). Although these Americans tend to hold the relatively highest beliefs about CC and believe in the effectiveness of their pro-environmentalism, their likelihood to have, for example, contacted an elected official about CC is lower than expected (Maibach et al., 2011). This is especially interesting, as both the Alarmed and the Concerned tend to support international treaties to reduce GHGs, CO_2 regulation, and fuel-efficiency regulations for automobile manufacturers (Maibach et al., 2011). As such, interventions that bridge this gap between attitudes and behaviors may be especially desirable.

As with the top third of the GWSA audiences, the 2015 report also offered communication strategies for the other four audiences (Roser-Renouf et al., 2015). Because knowledge and perceptions of CC issues are lower for these four audiences, successful persuasion may be more difficult to attain if targeted toward these individuals. If nothing else, these efforts will require an advanced level of consideration, as is evident in the GWSA report. For example, for the "Low Involvement" audiences of the *Cautious* and the *Disengaged* (i.e. the middle two audiences), the researchers suggest five strategies: A) necessitate only peripheral (i.e., weaker) or heuristic information processing, B) promote positive social norms of pro-environmental attitudes and behaviors, C) show, rather than tell, the consequences of CC, D) accentuate the personal threat of CC, and E) generate involvement in pro-environmental tendencies through the use of narratives. For the "Negative Climate Change Attitudes" audiences of the *Doubtful* and *Dismissive* (i.e., the bottom two audiences), they suggest taking more

indirect and less confrontational approaches to persuasive communication. Because the members of these audiences are typically not open to–are even distrustful of–arguments for addressing climate change, the risk of backfire exists (Roser-Renouf et al., 2015). This phenomenon is known as a "boomerang effect," in which attempts at persuasion result in attitude change in the opposite direction than desired (Hart & Nisbet, 2012). Additionally, research shows that presenting individuals with counter-attitudinal information can also prime individuals to begin elaborating on counterarguments, a process known as inoculation (McGuire, 1964; Van der Linden, et al., 2017). In any case, tailoring persuasive efforts to attitudes and tendencies unique to GWSA audience membership may be an advantageous approach to pro-environmental persuasion and modification.

Tailoring to Personality. Considering the diversity of characteristics–like attitudes–that can be targeted by tailoring, differences in personality traits can also be highlighted. To reiterate, personality is generally defined as features of differences in how individuals show consistent patterns of thought, feeling, and behavior (McCrae & Costa, 1990) It is commonly conceptualized using the Five Factor Model of personality (known commonly as the "Big Five;" Goldberg, 1981, 1990; McCrae & John, 1992), which include the dimensions of Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Moreover, evidence suggests of the four factors–excluding Neuroticism–can predict both pro-environmental attitudes and behaviors (Soutter et al., 2020). Findings also suggest individuals evaluate persuasive communications that are compatible with their motivational orientation more positively than persuasion that is not (Cesario, et al., 2003; Lee & Aaker, 2004), a tactic directly related to tailoring, known as "regulatory fit" (Higgins, 2000). Accordingly, by using knowledge of

individuals' tendencies using frameworks such as the Five Factor Model, researchers may be able to boost persuasive efforts by crafting messages that relate to these tendencies. Evidence for the efficacy of tailoring to the "Big Five" personality traits exists through an experiment conducted by Hirsh and colleagues (2012). In this study, researchers constructed five advertisements for a fictional cell phone, each of which included text manipulated to highlight motivational values associated with one of the "Big Five" dimensions of personality. For example, the Extraversion-based advertisement included, "*With XPhone, you'll always be where the excitement is*," and the Neuroticism-based advertisement stated, "*Stay safe and secure with the XPhone*" (Hirsh, et al., 2012, p. 579). In their examination of congruence effects, advertisement effectiveness ratings increased with congruent participants' personality scores in all traits but Neuroticism ($p = .10$), while they did not identify relationships between effectiveness and personality in non-congruent cases. These results suggest researchers can strengthen an advertisements' effectiveness when tailoring them to the personality traits of the target individuals, highlighting their potential effectiveness as a persuasive technique.

Dissertation Program Overview

Advancements in establishing the connections between psychology and pro-environmentalism have provided many opportunities for continued progress toward overcoming CC. Through this research program of two studies, I sought to continue these efforts by investigating specific ways to successfully encourage Americans who care about the issue of CC to be more engaged with these issues. To achieve this, both studies preliminarily implemented an assessment of the GSWA audiences to identify and admit members of the *Alarmed* and the *Concerned* audiences (the two highest GWSA audiences) for participation in an online survey and message intervention(s). These audience members were targeted over the other four

audiences because they tend to hold the highest CC-related issue knowledge, care most about

overcoming CC, and be most willing to modify their behaviors toward pro-environmentalism

(Maibach et al., 2011). Additionally, the persuasive messages in both studies were fashioned

using the GSWA communications suggestions recommended by researchers of the same research

group (Roser-Renouf et al., 2015). By tailoring these interventions to the beliefs and tendencies

of these GWSA audience members (Kreuter & Wray, 2003; Petty & Cacioppo, 1986), especially

the barriers they might encounter, I sought to identify ways in which we can continue

successfully encouraging climate-minded Americans to enhance their pro-environmental

activism.

Chapter 2 - Study 1

Study 1 Overview & Hypotheses

Study 1 examined differences in pro-environmental behavior intentions when presented with information about CC solutions that vary by solution framing. Specifically, four intervention messages varied by "Solution *Actor*" [who will bear the responsibility of initiating the prescribed pro-environmental behavior(s): the participant themself through bottom-up action ("Self") or government Legislators through top-down directives and policy ("Legislators")] and by "Solution *Quantity*" [the number of prescribed pro-environmental behaviors: a set of seven behavior groups ("Multiple") or one behavior group ("Single")]. The highlighted pro-environmental behaviors covered a wide variety of behavior types and were gathered from multiple sources; however, each of the four messages underscored the importance of committing to clean sources of electricity, actions regarded as some of the most impactful pro-environmental actions that can be taken (e.g., Griffith, 2022; Jaccard, 2022; McCollum, et al., 2014; Sugiyama, 2012; Yadoo & Cruickshank, 2012; Zhang & Fujimori, 2020). Additionally, these messages were crafted to elicit central processing of the CC solution-related information (as suggested by Roser-Renouf's and colleagues' 2015 report on tailored communication strategies), which allowed for the examination of whether participants find many versus few and bottom-up versus top-down prescribed pro-environmental behaviors more achievable (an additional notion addressed by Roser-Renouf et al., 2015). Tailoring to the attitudes, cognitive styles, and motivations of the *Alarmed* and *Concerned* audience members can reveal new insights into how these individuals can be further encouraged to fight CC. Thus, the following hypotheses were tested through the implementation of Study 1:

Hypothesis 1.1a: There will be a main effect of Solution *Quantity* on perceptions of ease engaging in pro-environmental behavior, such that those in the two "Single" Quantity message conditions will report higher perceptions of ease engaging in general pro-environmental behaviors, post-intervention, compared to those in the two "Multiple" Quantity message conditions.

Hypothesis 1.1b: There will be a main effect of Solution *Quantity* on future intention of engaging in pro-environmental behaviors ("*over the next month*"), such that those in the two "Single" Quantity message conditions will report a stronger intention to engage in pro-environmental behaviors, post-intervention, compared to those in the two "Multiple" Quantity message conditions.

Hypothesis 1.1c: There will be a main effect of Solution *Quantity* on future intention of committing to clean sources of electricity ("*over the next month*"), such that those in the two "Single" Quantity message conditions will report a stronger intention to commit to clean sources of electricity, post-intervention, compared to those in the two "Multiple" Quantity message conditions.

Hypothesis Set 1 Rationale: When considering how to best contribute to overcoming CC, it is easy to get overwhelmed. As highlighted in the goal-setting research literature, consideration of the logistics of goals–like pro-environmental behaviors–alerts individuals to the difficulties and challenges associated with these goals (Lynch, et al., 2010); furthermore, as the number of goals increases, so do the perceived difficulties (Dalton & Spiller, 2012). Thus, I hypothesized that highlighting one set of pro-environmental behaviors, rather than multiple (i.e., seven), would receive higher ratings from participants.

Hypothesis 1.2a: There will be a main effect of Solution *Actor* on perceptions of ease engaging in pro-environmental behavior, such that those in the two "Legislator" Actor message conditions will report higher perceptions of ease engaging in pro-environmental behaviors, post-intervention, compared to those in the two "Self" Actor message conditions.

Hypothesis 1.2b: There will be a main effect of Solution *Actor* on future intention of engaging in pro-environmental behaviors ("*over the next month*"), such that those in the two "Legislator" Actor message conditions will report a stronger intention to engage in pro-environmental behaviors, post-intervention, compared to those in the two "Self" Actor message conditions.

Hypothesis 1.2c: There will be a main effect of Solution *Actor* on future intention of committing to clean sources of electricity ("*over the next month*"), such that those in the two "Legislator" Actor message conditions will report a stronger intention to commit to clean sources of electricity, post-intervention, compared to those in the two "Self" Actor message conditions.

Hypothesis Set 2 Rationale: Like the first set of hypotheses, it is easy to get overwhelmed when considering how best to behave pro-environmentally. Along with the number of behaviors considered, perceptions of barriers and overwhelm can also be applied to the responsibility of such behaviors. As reviewed, individuals must believe the behavior they wish to adopt is challenging enough, but not too challenging that it cannot be attained (Locke, 1996). Furthermore, insights into the "wickedness" of CC (Rittel & Webber, 1973; Head, 2008; Incropera, 2016; Marshall, 2015; Termeer, et al., 2013) and the subsequent negative outcomes that can result from group-related behaviors (Anderson, 2003; Karau & Williams, 1993; Simms & Nichols, 2014; Wullenkord & Reese, 2021). Accordingly, I hypothesized that encouraging another body–especially nonspecific facets and members of the U.S. Government–to take a top-

down initiative, rather than convincing yourself to take more of a bottom-up initiative, would receive higher perception and intention ratings from participants.

Hypothesis 1.3a: There will be an interaction effect between Solution *Involvement* and Solution *Quantity* on perceptions of ease engaging in pro-environmental behavior, such that those in the "*Multiple–Self*" message condition will report lower overall perceptions of ease engaging in pro-environmental behavior, post-intervention compared to, compared to those in the other three message conditions.

Hypothesis 1.3b: There will be an interaction effect between Solution *Involvement* and Solution *Quantity* on future intention of engaging in pro-environmental behaviors ("*over the next month*"), such that those in the "*Multiple–Self*" message condition will report lower overall future intention of engaging in pro-environmental behaviors, post-intervention, compared to those in the other three message conditions.

Hypothesis 1.3c: There will be an interaction effect between Solution *Involvement* and Solution *Quantity* on future intention of committing to clean sources of electricity ("*over the next month*"), such that those in the "*Multiple–Self*" message condition will report lower future intention of committing to clean sources of electricity, post-intervention, compared to those in the other three message conditions.

Hypothesis Set 3 Rationale: The third set of hypotheses continues the examination of strategies that are most encouraging of pro-environmental behaviors. As mentioned, I hypothesized that those in the *Single* Quantity and *Legislator* Actor conditions would internally evaluate these appeals as least difficult–and thus most appealing. In contrast, the *Multiple* Quantity and *Self* Actor conditions may induce appraisals of difficulties, specific to both perceptions of the attainability of the behaviors and the self-efficacy the target possesses. As

such, I hypothesized the combination of these factors may be perceived as more difficult factors–

that is, participants randomized into the *Multiple–Self* message condition–would report the

lowest perception and intention ratings, compared to participants in the other three intervention

conditions.

Study 1 Method

Study 1 Participants

A total of 135 [$M(SD)Age$ = 40.70(12.6) years, Male = 54%, White = 75%, at least

"Somewhat Liberal" = 67%] participants were recruited for Study 1. This sample size was

calculated to sufficiently fill each predictor cell. All participants were recruited and compensated

$0.50 via the CloudResearch marketplace to complete the online Qualtrics survey, which

included all study materials. The CloudResearch marketplace was chosen to recruit from a

nationally representative sample.

Study 1 Design

Study 1 utilized a 2x2 factorial between-subjects design to examine the efficacy of

different frames of CC solutions. The manipulated factor was the message intervention, which

varied in two ways, creating four messages: *Quantity* of the behaviors ("Multiple" versus

"Single") X *Actor* of the behaviors ("Legislator" versus "Self"). Each of the four messages

encouraged specific behavior-based solutions to climate change but varied in how many

solutions were suggested (i.e., seven solutions in the two "Multiple" messages versus two

solutions in the two "Single" messages) and whom the message implicated as the initiator of

these behaviors (i.e., Elected U.S. Government Officials in the two "Legislator" messages versus

the target participant in the two "Self" messages). An online Qualtrics survey presented

participants with one of the four messages, with a battery of other behavioral, attitudinal, and demographic items.

Study 1 Materials

Participant Prescreening. The Study 1 survey required workers to successfully complete a robot captcha and three prescreening items before being officially enrolled in the study. First, the GWSA's Six America's Short SurveY (SASSY) determined which of the six audiences participants belong to (Chryst et al., 2018). This was a four-item, multiple-choice assessment adapted from the original GWSA assessment (Maibach et al., 2009) to categorize respondents more quickly into one of the six GWSA categories in online settings. This scale shows adequate reliability and validity, with a high true positive classification rate (Chryst et al., 2018) compared to the original 36-tem scale (Maibach et al., 2011). Because these studies' foci centered on those passionate about and supportive of overcoming CC, only participants belonging to the highest two categories–the *Alarmed* and the *Concerned* categories–were permitted to continue.

Second, participants recorded whether they voted in a government election over the previous three years. Only those who responded "*yes*" were permitted to continue to ensure this sample had a baseline intention to engage in civic action (i.e., voting). Finally, workers were required to read a passage about turtles and answer a follow-up comprehension question. Those who meet the criteria listed above were enrolled in the study, internally assigned a participant identification code, randomly assigned to one of four message conditions, and permitted to begin the survey. Those not meeting these criteria were notified of their ineligibility to participate in this study and thanked for their time. See Appendix A for all Pre-Screening materials.

Pre-Intervention Questionnaire. The Pre-Intervention Questionnaire consisted of several items measuring participants' attitudes and inclinations toward pro-environmental behaviors. First, participants recorded the level of ease associated with pro-environmental behaviors, in general, and specifically with "*committing to clean electricity practices and products*" by rating how much they agree that engaging in these behaviors is "*Easy*," "*Demanding*," "*Attainable*," and "*Difficult*". Then they were asked to rate how likely they had been "*over the past month*" to engage in general pro-environmental behaviors and commit to clean electricity. Participants responded to these items using seven-point Likert scales created for each reaction. This questionnaire also included an attention check item, which participants requested participants to record "*Slightly Agree*." See Appendix B for the Pre-Intervention Questionnaire items.

Big Five Inventory (BFI; John & Srivastava, 1999). Participants completed the Big Five Inventory between the Pre-Intervention Questionnaire and the message intervention as a distractor task (see Appendix C). It was a 44-item assessment of the five dimensions of personality: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (see Appendix C). Participants responded to these 44 statements of "*I see myself as someone who…*" on a five-point Likert scale that ranges from "*Disagree Strongly*" to "*Strongly Agree*." Fifteen of these items required reverse scoring. Example items included "*Is talkative*" and "*Is reserved*" (measuring Extraversion), "*Tends to find fault with others*" and "*Is helpful and unselfish with others*" (measuring Agreeableness), "*Does a thorough job*" and "*Can be somewhat careless*" (measuring Conscientiousness), "*Is depressed, blue*" and "*Is relaxed, handles stress well*" (measuring Neuroticism), and "*Is original, comes up with new ideas*" and "*Prefers work that is routine*" (measuring Openness).

Message Interventions. This study incorporated a 2 (*Quantity*: *Multiple* vs. *Single*) X 2 (*Actor*: *Self* vs. *Legislator*) between-subjects design. Following enrollment, Qualtrics randomized participants into one of four categories, which determined the intervention message they received (i.e., *Multiple Quantity–Self Actor*, *Multiple Quantity–Legislator Actor*, *Single Quantity–Self Actor*, and *Single Quantity–Legislator Actor*; see Appendix D). These messages varied in the number of proposed behavior groups (i.e., the two *Multiple Quantity* messages presented seven behavior groups, and the two *Single Quantity* messages presented one) and who should take responsibility for their implementation (i.e., the two *Self Actor* messages promoted self-initiation of these behaviors and the two *Legislator Actor* messages promoted legislative initiation of these behaviors). Despite these manipulations, each message had the same structure, in which the issue of climate change was presented, behavior-based solutions were presented, and justification for the behaviors and their initiators was provided before encouraging participants to reflect on the information. Additionally, each of the four messages included "*Committing to Clean Electricity Practices and Products*" as a target behavior, which has been regarded as some of the most impactful pro-environmental actions that can be taken (e.g., Griffith, 2022; Jaccard, 2022; McCollum et al., 2014; Sugiyama, 2012; Yadoo & Cruickshank, 2012; Zhang & Fujimori, 2020). The collection of proposed pro-environmental behaviors represented a variety of economic and environmental resources people can find online and in the research literature (e.g., IPCC, 2005; Jaccard, 2020; Stern, 2000). Participants were required to remain on the intervention-specific message page for a minimum of 30 seconds to help encourage attention to and processing of the information.

   Multiple Quantity Messages. The two *Multiple Quantity* messages informed participants "*There are many different types of actions you can take*" to ensure we successfully overcome

climate change. The messages then provided a list of seven behavior categories described as the

"*most effective behavior-based solutions to climate change we all should be engaging in*." These

behaviors included *Committing to clean electricity practices and products, Conserving energy,*

Reducing water and food waste, Buying eco-friendly products, Helping to protect your local

ecosystems, Avoiding single-use goods, and *Eating More Plants*. Two example behaviors

accompanied these category titles, providing participants the opportunity to contemplate them

further (see Appendix D).

       Single Quantity Messages. On the contrary, the two *Single Quantity* messages informed

participants "*There is one specific type of action you can take*" to ensure we successfully

overcome climate change. Rather than displaying all seven behavior solutions, only the

Committing to Clean Electricity Practices and Products option was displayed, along with the

accompanying behavior examples (see Appendix D).

       Self-Actor Messages. Following the *Quantity* portion of the message, the two *Self-Actor*

messages continued by advocating for the strength of "*bottom-up (at the individual level)*"

efforts of overcoming CC. Specifically, they claimed, "*Taking the initiative of engaging in these*

behaviors–rather than waiting on others–is arguably our best path forward." To close, these

messages asked participants, "*So, what new actions can you start taking today?*" to encourage

processing and elaboration of the message's information (see Appendix D).

       Legislator-Actor Messages. On the other hand, the two *Legislator-Actor* messages

followed the *Quantity*-related information by advocating for the strength of "*top-down (at the*

legislative level)" efforts of overcoming CC. Specifically, they claimed, "*Passing legislation*

making it easier to engage in these behaviors–rather than relying on individuals to take different

actions themselves– is arguably one of our best paths forward. " To close, these messages asked

participants, "*So, what new policies can you start advocating for today?*" to encourage

processing and elaboration of the message's information (see Appendix D).

Rotter's Locus of Control Scale (1966). Rotter's Locus of Control Scale is a 29-item

scale that measures individual differences in the level of internal versus external control of

reinforcement (1966; see Appendix E). Those who have an external locus of control (i.e., those

who score higher on the scale) tend to believe the circumstances of their life are due to external

factors, while those who have an internal locus of control (i.e., those who score lower on the

scale) tend to believe that their life circumstances are the result of their own actions. Each item

presented subjects with two statements, (e.g., "*Many of the unhappy things in people's lives are

partly due to bad luck*" versus "*People's misfortunes result from the mistakes they make*."), and

participants were required to choose the statement they agree with the most. Research suggests

this scale possesses measurement reliability and validity (Zerega et al., 1976).

Post-Intervention Questionnaire. The Post-Intervention Questionnaire included the

same items as and format of the Pre-Intervention Questionnaire (see Appendix B). Specifically,

participants recorded the level of ease associated with pro-environmental behaviors, in general,

and specifically with "*committing to clean electricity practices and products*" by rating how

much they agree that engaging in these behaviors is "*Easy*," "*Demanding*," "*Attainable*," and

"*Difficult*" using seven-point agreement Likert scales. Then, they rated how likely they were to

engage in these behaviors "*over the next month*," also using seven-point Likert scales.

Demographic Questionnaire. The Study 1 survey measured participants' age, biological

sex, race, and political ideology (see Appendix F). Specifically, participants entered their age as

a whole number in a textbox and designated their political ideology on a seven-point Likert scale

ranging from "*Strongly Conservative*" (1) to "*Strongly Liberal*" (7), with a midpoint of

"*Moderate*" (4). Multiple choice items measured sex and race, in which participants recorded the response(s) to each item best describing them.

Attention and Manipulation Checks. To ensure participants are not distracted while completing this survey, the survey included multiple attention check items. First, within the BFI, participants were explicitly asked to respond "*Slightly Agree*" to an additional item (see Appendix C). Next, within the Post-Intervention Questionnaire (see Appendix B), participants were explicitly asked to respond "*Disagree*" to a specific item. Additionally, the Demographics Questionnaire at the end of the survey included a question asking participants to recall the information they viewed on the message intervention page earlier in the survey. Specifically, they responded whether they viewed "*Committing to Clean Electricity Practices and Products*" as a proposed behavior in the message they were asked to read earlier. Three additional responses will be included (i.e., *Avoiding Aviation Travel, Investing in Green Companies and Industries,* and *Protest Against Environmental Offenders*), which represented behaviors not described in any of the four intervention messages (see Appendix F). These responses were used in quality analyses during data cleaning.

Procedure

After successfully completing each prescreening item, participants were enrolled in the study. To begin the survey, participants completed the Pre-Intervention Questionnaire to measure specific environmental attitudes and behaviors. Next, to help mitigate the potential of demand characteristics later in the survey, participants answered the New Big Five Inventory (John & Srivastava, 1999) as a distractor task. Then, participants were given one of four messages to read, depending on the message condition they were randomized into at survey enrollment. Following, they completed Rotter's Locus of Control Scale (1966) before answering specific CC

solution-related attitudes and behaviors, mirroring those asked before the message intervention. To conclude the survey, participants recorded their demographic characteristics before being debriefed, thanked for their time, and provided instruction to receive compensation for their participation.

Study 1 Results

Data Preparation

Using the CloudReserach® Connect marketplace, data were initially collected from 146 participants who passed each of the three prescreening tasks at the beginning of the survey. Specifically, after being screened as a member of either the *Alarmed* or the *Concerned* using the GWSA SASSY questionnaire, only participants who recorded having voted in a U.S. government election over the last three years and those who passed the reading comprehension check (i.e., reading a passage about turtles and answering a multiple-choice comprehension question) were allowed to complete the survey. From this initial sample, six participants' data were removed before analyses under suspicion of careless or computer-generate responding (computed by Qualtrics' ReCAPTCHA Score), while another six participants' data were removed for failing two or more of the three attention checks presented within the survey. In total, analyses included 135 participants' data. Examination of Study 1 variable distributions revealed both the pre- and post-intervention scores of engaging in general pro-environmental behavior and engaging in clean electricity practices and products were negatively skewed. Accordingly, to remediate this issue, these variables were square transformed before they were used for analysis (Lee, 2020; see Table 1). Study 1 data were analyzed using jamovi® statistical software (2022).

Table 1. Study 1 Variable Transformations

	1	1^2	2	2^2	3	3^2	4	4^2
Mean (*SD*)	5.71 (0.97)	33.50 (9.86)	5.79 (0.90)	34.40 (9.84)	5.09 (1.45)	28.00 (13.50)	5.44 (1.34)	31.30 (12.80)
Min–Max	1–7	1–49	2–7	4–49	1–7	1–49	1–7	1–49
Skewness	-1.49	-0.53	-0.83	-0.24	-0.76	-0.11	-1.16	-0.36

1.   Pre-Intervention Pro-Environmental Engagement Likelihood
2.   Post- Intervention Pro-Environmental Engagement Likelihood
3.   Pre-Intervention Clean Electricity Commitment Likelihood
4.   Post-Intervention Clean Electricity Commitment Likelihood

A priori Hypothesis Testing

The first subset of each hypothesis projected perceptions of ease engaging, generally, in pro-environmental behaviors, such that those in the *Single* Quantity (H1a) and *Legislator* Actor (H2a) message intervention conditions were expected to record higher perceptions of ease compared to the *Multiple* Quantity and *Self* Actor participants, respectively, while those in the *Multiple^X Self* condition (H3a) were expected to record the lowest perceptions compared to the other three factorial message combinations. To test these hypotheses, a multiple regression analysis predicted the post-intervention perceptions of ease associated with engaging, generally, in pro-environmental behaviors, using a full factorial design of three main effects: condition assignment to Solution Quantity (*Single* versus *Multiple*), condition assignment to Solution Actor (*Self* versus *Legislators*), and the squared pre-intervention measure of the dependent variable. The perceptions of ease scores were constructed as the sum composite of responses to four items presented before and after the persuasive message intervention, with both the pre-intervention measure (Cronbach's α = .795) and post-intervention (Cronbach's α = .782) composite scores

demonstrating adequate reliability. This model was significant, $F(7, 127) = 30.30$, $p < .001$, Adj. $R^2 = .605$, accounting for nearly 61% of the variance in post-intervention ease perceptions. However, the only significant predictor within this model was the pre-intervention perceptions of ease composite score, $B(SE) = 0.82(1.87)$, $t(127) = 1.80$, $p < .001$ (see Table 2), demonstrating a positive relationship between it and the dependent variable, as is expected in pre-/post-intervention designs. Accordingly, the results of this multiple regression failed to support the first subsets of each hypothesis, as no significant differences in perceptions of ease were discovered when manipulating the number or proposed initiator of proposed pro-environmental behaviors.

Table 2. Multiple Regression Predicting Post-Intervention Perceptions of Ease Engaging in General Pro-Environmental Behaviors (Hypotheses 1a, 2a, and 3a)

	Estimate	SE	t	p
Intercept	3.36	1.87	1.80	.075
Pre- Behavior Ease Total	0.82	0.10	8.21	< .001
Solution Quantity	4.60	2.67	1.72	.087
Solution Actor	-2.52	2.78	-0.91	.366
Pre-Likely^{X}Quantity	-0.25	0.14	-1.76	.081
Pre-Likely^{X}Actor	0.13	0.15	0.87	.386
Quantity^{X}Actor	-2.04	4.14	-0.49	.622
Pre-Likely^{X}Quantity^{X}Actor	0.12	0.22	0.55	.586

Note: The *Multiple* Quantity and *Self* Actor levels were dummy coded as the reference levels.

The second subset of each hypothesis projected future likelihood of engaging in pro-environmental behaviors "over the next month," such that those in the *Single* Quantity (H1b) and *Legislator* Actor (H2b) message intervention conditions were expected to record higher post-intervention intention compared to the *Multiple* Quantity and *Self* Actor participants, respectively, while those in the *Multiple*^{X}*Self* condition (H3b) were expected to record the lowest intentions compared to the other three factorial message combinations. To test these hypotheses, a multiple regression analysis predicted the squared post-intervention likelihood of engaging, generally, in pro-environmental behaviors "*over the next month*" using a full factorial design of three main effects: condition assignment to Solution Quantity (*Single* versus *Multiple*), condition assignment to Solution Actor (*Self* versus *Legislators*), and the squared pre-intervention measure of the dependent variable. This model was significant, $F(7, 127) = 15.00$, $p < .001$, Adj. R^2 = .422 (see Table 3), accounting for over 42% of the variance in post-intervention likelihood. Regarding Hypothesis 1b, this model revealed a significant main effect of Solution Quantity, $B(SE) = -20.52(7.13)$, $t(127) = -2.88$, $p = .005$; however, the difference between the two levels of this category was opposite of what was hypothesized, such that those in the *Multiple* Quantity condition [$M(SD) = 36.00(0.94)$; square root back-transformed $M(SD) = 6.00(0.97)$] recorded a significantly higher likelihood of post-intervention behavior likelihood compared to the *Single* Quantity condition [$M(SD) = 32.60(0.90)$; square root back-transformed $M(SD) = 5.70(0.98)$; see Figure 6]. Regarding Hypothesis 2b, this model revealed a significant main effect of Solution Actor, $B(SE) = -13.05(5.97)$, $t(127) = -2.19$, $p = .031$; however, again, the difference between the two levels of this category was opposite of what was hypothesized, such that those in the *Self* Actor condition [$M(SD) = 36.1(0.94)$; square root back-transformed $M(SD) = 6.01(0.98)$] recorded a significantly higher likelihood of post-intervention behavior likelihood compared to

53

the *Legislator* Actor condition [$M(SD) = 32.6(0.90)$; square root back-transformed $M(SD) = 5.71(0.98)$; see Figure 7]. The only other significant predictor was the interaction between pre-intervention behavior likelihood and Solution Quantity condition assignment, $B(SE) = 0.48(0.20)$, $t(127) = 2.37$, $p = .019$. Accordingly, these results failed to provide support for the second subsets of each hypothesis, as intention to engage in pro-environmental behavior was most greatly affected when encouraging self-initiation of multiple behaviors rather than urging Legislator-initiation of a specific set of (i.e., clean energy-related) policies.

Table 3. Multiple Regression Predicting Post-Intervention Likelihood of Engaging in General Pro-Environmental Behaviors "Over the Next Month" (Hypotheses 1b, 2b, and 3b)

	Estimate	*SE*	*t*	*p*
Intercept	27.58	4.64	5.94	< .001
Pre- Behavior Likely^2	0.32	0.13	2.46	.015
Solution Quantity	-20.52	7.13	-2.88	.005
Solution Actor	-13.05	5.97	-2.19	.031
Quantity^{X}Pre-Likely^2	0.48	0.20	2.37	.019
Actor^X Pre-Likely^2	0.25	0.17	1.44	.153
Quantity^{X}Actor	11.16	9.53	1.17	.243
Quantity^{X}Actor^X Pre-Likely^2	-0.27	0.27	-0.98	.330

Note: The *Multiple* Quantity and *Self* Actor levels were dummy coded as the reference levels.
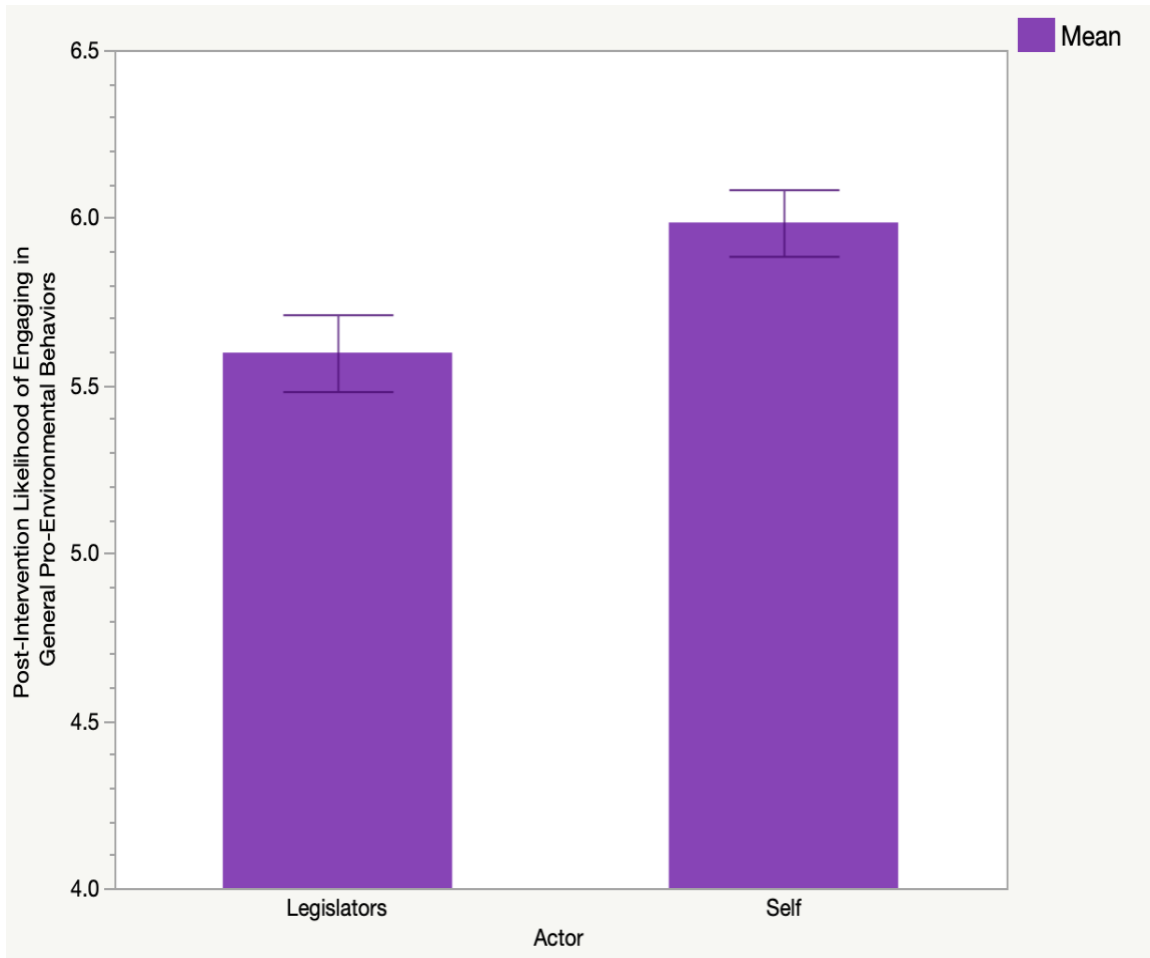
Please Note: Error bars were constructed using 1 Standard Error from the Mean

Figure 6. Main Effect of Solution Actor Predicting Post-Intervention Likelihood of Engaging in General Pro-Environmental Behaviors "Over the Next Month" (Hypothesis 2b)
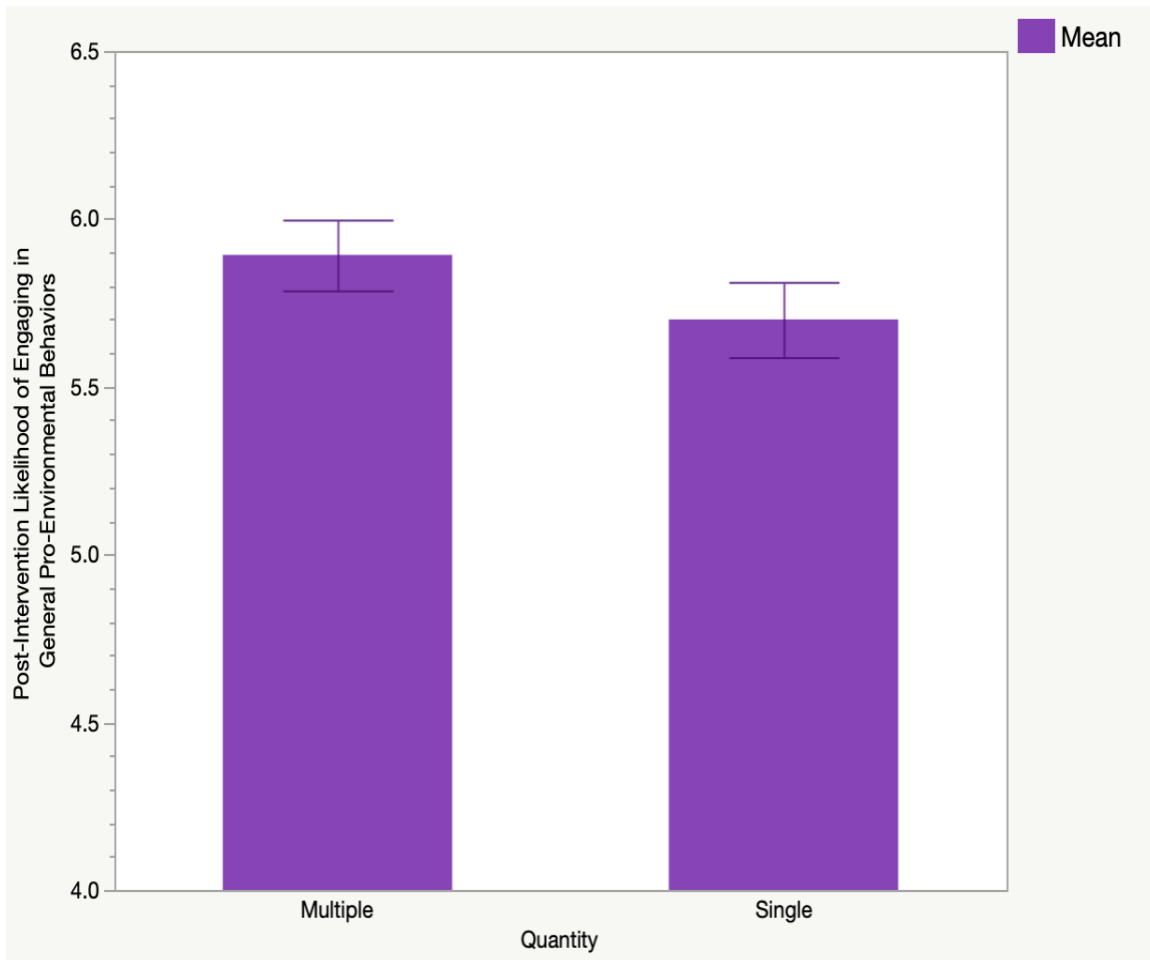
Please Note: Error bars were constructed using 1 Standard Error from the Mean

Figure 7. Main Effect of Solution Quantity Predicting Post-Intervention Likelihood of Engaging in General Pro-Environmental Behaviors "Over the Next Month" (Hypothesis 1b)

Finally, the third subset of each hypothesis projected future intention of engaging in clean electricity practices and products "*over the next month*," such that those in the *Single* Quantity (H1c) and *Legislator* Actor (H2c) message intervention conditions were expected to record higher post-intervention intention compared to the *Multiple* Quantity and *Self* Actor participants, respectively, while those in the *MultipleXSelf* condition (H3c) were expected to record the lowest intentions compared to the other three factorial message combinations. To test these hypotheses,

a third multiple regression analysis predicted squared post-intervention likelihood of engaging in clean electricity practices and products "*over the next month*" scores using a full factorial design of three main effects: condition assignment to Solution Quantity (*Single* versus *Multiple*), condition assignment to Solution Actor (*Self* versus *Legislators*), and the squared pre-intervention measure of the dependent variable. This model was significant, $F(7, 127) = 23.10$, $p < .001$, Adj. $R^2 = .488$ (see Table 4), accounting for nearly 49% of the variance in post-intervention likelihood. Regarding Hypothesis 1c, this model revealed a non-significant main effect of Solution Quantity, $B(SE) = -7.15(5.35)$, $t(127) = -1.34$, $p = .184$. For Hypothesis 2c, this model revealed a significant main effect of Solution Actor, $B(SE) = -18.31(5.03)$, $t(127) = -3.64$, $p < .001$; however, the difference between the two levels of this category was opposite of what was hypothesized, such that those in the *Self* Actor condition [$M(SD) = 32.6(1.12)$; square root back-transformed $M(SD) = 6.02(1.06)$] recorded a significantly higher likelihood of post-intervention behavior likelihood compared to the *Legislator* Actor condition [$M(SD) = 30.5(1.13)$; square root back-transformed $M(SD) = 5.52(1.06)$; see Figure 8]. Finally, regarding Hypothesis 3c, this model revealed a significant interaction effect of Solution Quantity and Solution Actor condition assignments, $B(SE) = 17.15(7.34)$, $t(127) = 2.32$, $p = .022$ (see Figure 9). However, post-hoc analysis of variance [ANOVA; $F(3, 131) = 1.30$, $p = .278$, $\eta^2 p = .03$] probing this interaction found no significant differences between the interaction levels. Accordingly, these results failed to support the third subset of each hypothesis, as commitment to clean electricity practices and products was most greatly affected when encouraging self-initiation of multiple behaviors rather than urging Legislator-initiation of these clean electricity-related policies.

Table 4. Multiple Regression Predicting Post-Intervention Likelihood of Committing to Clean Electricity Practices and Products "Over the Next Month" (Hypotheses 1c, 2c, and 3c)

	Estimate	*SE*	*t*	*p*
Intercept	22.44	3.74	5.99	$< .001$
Pre- Electricity Likely^2	0.42	0.11	3.68	$< .001$
Solution Quantity	-7.15	5.35	-1.34	.184
Solution Actor	-18.31	5.03	-3.64	$< .001$
Quantity^{X}Pre-Likely^2	0.14	0.17	0.87	.387
Actor^X Pre-Likely^2	0.51	0.16	3.24	.002
Quantity^{X}Actor	17.15	7.39	2.32	.022
Quantity^{X}Actor^X Pre-Likely^2	-0.47	0.24	-1.94	.054

Note: The *Multiple* Quantity and *Self* Actor levels were dummy coded as the reference levels.
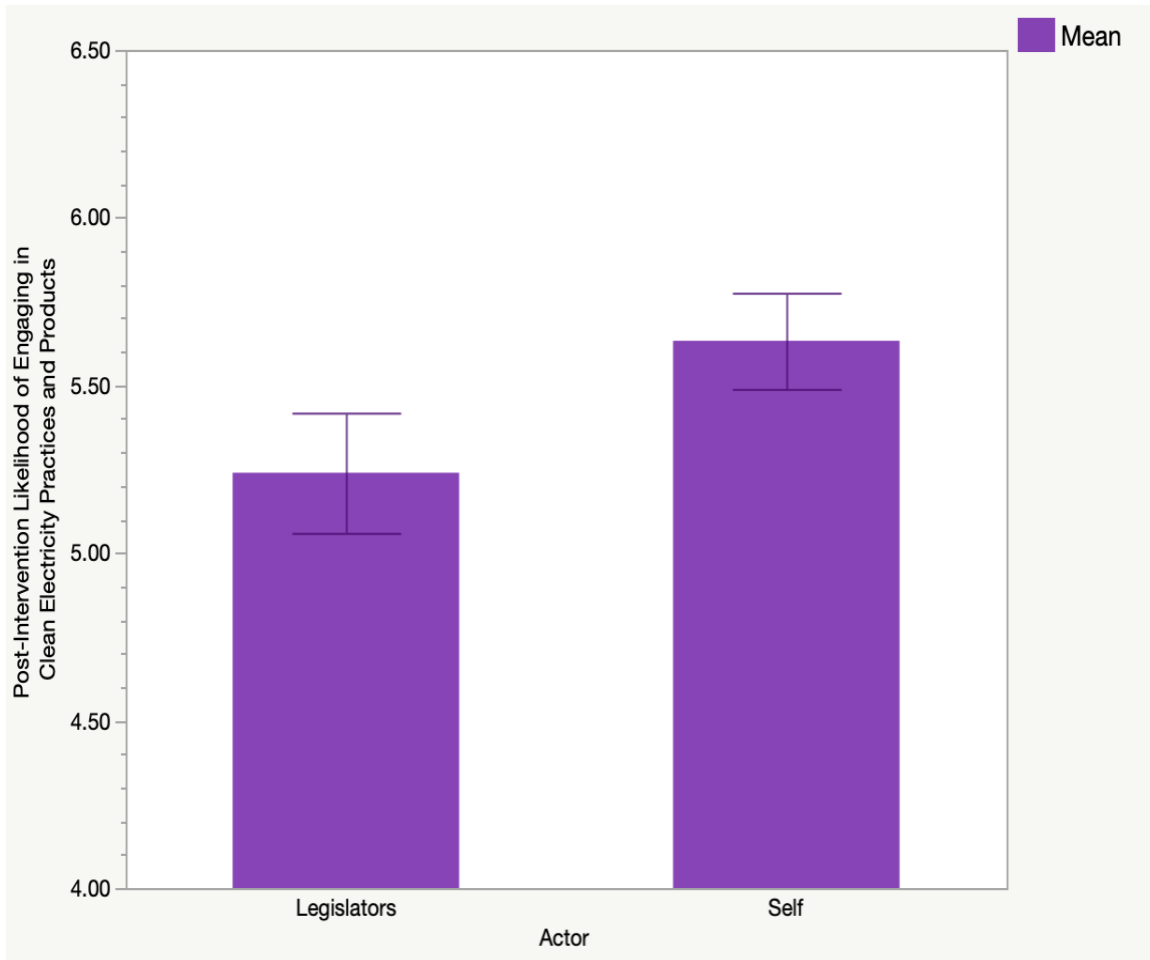
Please Note: Error bars were constructed using 1 Standard Error from the Mean

Figure 8. Main Effect of Solution Actor Predicting Post-Intervention Likelihood of Committing to Clean Electricity Practices and Products "Over the Next Month" (Hypothesis 2c)
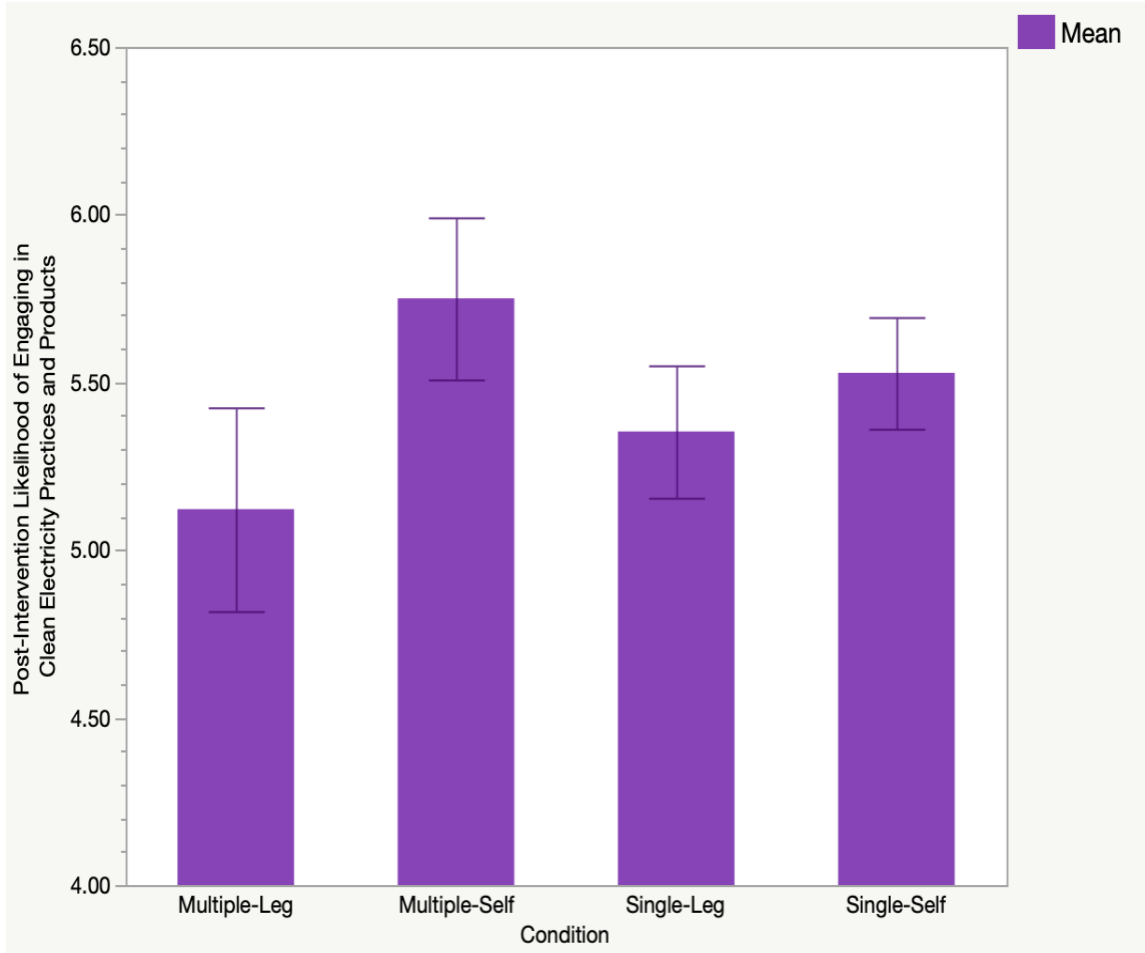
Please Note: Error bars were constructed using 1 Standard Error from the Mean

Figure 9. Interaction Effect of Solution Quantity and Actor Predicting Post-Intervention Likelihood of Committing to Clean Electricity Practices and Products "Over the Next Month" (Hypothesis 3c)

Exploratory and Ancillary Analyses

With a priori hypothesis testing, several exploratory analyses were conducted to better understand the Study 1 data (see Table 5 for the means of, ranges of, and bivariate correlations between Study 1's primary and demographic variables). Upon review, this sample of participants recorded higher-than-not pre-intervention perceptions of ease engaging in general pro-environmental behaviors ($M = 17.90$ out of 28, $SD = 4.41$), as well as higher-than-not pre-

intervention likelihood of both engaging in general pro-environmental behaviors (M = 5.71 out of 7, SD = 0.97) and in clean electricity products and practices (M = 5.09 out of 7, SD = 1.45). Additionally, as would be expected, participants' pre-intervention perceptions of ease engaging in pro-environmental behaviors was significantly correlated with both pre-intervention (r = .410, p = <.001) and post-intervention likelihood of engaging in general pro-environmental behaviors (r = .325, p = <.001), as well as post-intervention likelihood of engaging in clean electricity practices and products (r = .179, p = <.035); however, it was not significantly correlated with pre-intervention likelihood of engaging in clean electricity practices and products (r = .150, p = <.083). It is also important to note this sample was largely Liberal-leaning (M = 5.13 out of 7, SD = 1.73) and college-educated (M = 3.59 out of 4, SD = 0.65), with relatively moderate-income (M = 3.08 out of 5, SD = 1.47).

Table 5. Means, Ranges, and Bivariate Correlations of Study 1 Variables

	M(SD)	Range	1	2	3	4	5	6	7	8	9
1	17.90 (4.41)	4–28	–								
2	18.00 (4.44)	4–28	.777 ***	–							
3	5.71 (0.97)	1–7	.410 ***	.365 ***	–						
4	5.79 (0.90)	1–7	.325 ***	.356 ***	.548 ***	–					
5	5.09 (1.45)	1–7	.150	.273 ***	.278 ***	.260 **	–				
6	5.44 (1.34)	1–7	.179 *	.249 ***	.207 *	.398 ***	.684 ***	–			
7	40.70 (12.60)	20–71	-.005	-.012	-.008	.049	-.141	-.079	–		
8	5.13 (1.73)	1–7	.063	-.024	-.054	-.088	-.108	-.040	-.185 *	–	
9	3.59 (0.65)	1–4	-.058	-.101	.069	-.008	-.205 *	-.175 *	-.020	.014	–
10	3.08 (1.47)	1–5	.057	0.062	-.099	-.055	.056	.008	.057	-.180 *	.293 ***

Note: * *p* < .05, ** *p* < .01, *** *p* < .001
1. Pre-Intervention Pro-Environmental Perceptions of Ease Total Score
2. Post-Intervention Pro-Environmental Perceptions of Ease Total Score
3. Pre-Intervention Pro-Environmental Engagement Likelihood
4. Post- Intervention Pro-Environmental Engagement Likelihood
5. Pre-Intervention Clean Electricity Commitment Likelihood
6. Post-Intervention Clean Electricity Commitment Likelihood
7. Age (in whole number years)
8. Political Orientation (1. *Strongly Conservative* – 7. *Strongly Liberal*; 4. *Moderate*)
9. Education (1. *Less than high school* – 4. *Bachelor's degree or higher*)
10. Income (1. *Up to 24.9k* – 5. *85k or more*; increments of 15k)

Examining the relationships between the primary and demographic variables revealed only significant negative correlations between education and both the pre-intervention (r = -.205, p = .017) and post-intervention measures of commitment to clean electricity products and practices (r = -.175, p = .042). Independent samples t-tests also analyzed sex differences between male (n = 72) and female (n = 61) participants and race differences between white (n = 101) and non-white (n = 34) participants. However, analyses revealed neither sex [Post-Intervention Perceptions of Ease Engaging in General Pro-Environmental Behaviors: $t(131)$ = 0.75, p = .453; Post-Intervention Likelihood of Engaging in General Pro-Environmental Behaviors: $t(131)$ = 0.27, p = .787; Post-Intervention Likelihood of Committing to Clean Electricity Practices and Products: $t(131)$ = -0.21, p = .836] nor race differences [Post-Intervention Perceptions of Ease Engaging in General Pro-Environmental Behaviors: $t(131)$ = -0.46, p = .649; Post-Intervention Likelihood of Engaging in General Pro-Environmental Behaviors: $t(131)$ = 0.01, p = .991; Post-Intervention Likelihood of Committing to Clean Electricity Practices and Products: $t(131)$ = 0.51, p = .543] in either of the three dependent variables in Study 1.

Additional independent samples t-tests analyzed differences between *Alarmed* (n = 81) and *Concerned* participants (n = 54) in the primary Study 1 variables. These analyses showed no significant differences between the *Alarmed* and the *Concerned* in perceptions of ease engaging in general pro-environmental behaviors in both the pre-intervention [$t(133)$ = 1.64, p = .103, d = .29] and post-intervention scores [$t(131)$ = 0.79, p = .431, d = 14]. However, these analyses did reveal significant differences in the post-intervention likelihood of engaging in general pro-environmental behaviors [$t(133)$ = 2.98, p = .003, d = .52; $M(SD)$Alarmed = 5.98(0.91), $M(SD)$Concerned = 5.52(0.82)] but only marginally so in the pre-intervention scores [$t(133)$ = 1.90, p = .059, d = .34; $M(SD)$Alarmed = 5.84(1.04), $M(SD)$Concerned = 5.52(0.82)]. Finally,

analyses evaluating likelihood of engaging in clean electricity practices and products showed similar outcomes, such that they detected significant differences in the post-intervention scores [$t(133) = 3.19$, $p = .002$, $d = .56$; $M(SD)$Alarmed = 5.73(1.40), $M(SD)$Concerned = 5.00(1.13)] but only marginally so in the pre-intervention scores [$t(133) = 1.93$, $p = .056$, $d = .34$; $M(SD)$Alarmed = 5.28(1.52), $M(SD)$Concerned = 4.80(1.31)].

Study 1 Discussion

The purpose of Study 1 was to investigate the effectiveness of arguments encouraging pro-environmental behavior engagement when presented to Americans who care the most about the issue of climate change. Specifically, four messages varied by the quantity of proposed pro-environmental behaviors [a single behavior (i.e., commitment to clear energy practices and products) versus multiple (i.e., seven different types of behaviors, including commitment to clear energy practices and products)] and by the proposed actor of these behaviors [self-initiated (i.e., "bottom-up" behaviors) versus legislator-initiated (i.e., "top-down" behaviors). Only Americans with relatively high views and motivations related to the issue of climate change were recruited for participation. This was determined using the GWSA Six Americas Short SurveY (SASSY; Chryst et al., 2018), which admitted members of the two highest of six "segments" (i.e., the *Alarmed* and the *Concerned*; an estimated 51% of American adults). These individuals tend to hold the highest beliefs, largest concern, and most motivation regarding the issue of CC, and they tend to be the most open and willing to participate in pro-environmental behaviors (Maibach et al., 2011). Following study enrollment, participants recorded their recent likelihood (i.e., "*over the past month*") of and perceptions of ease associated with engaging in general pro-environmental behaviors and committing to clean electricity practices and products. They were then randomized within the Qualtrics survey platform to read one of four persuasive messages

[*Single* Quantity X *Self* Actor, *Single* Quantity X *Legislator* Actor, *Multiple* Quantity X *Self* Actor, or *Multiple* Quantity X *Legislator* Actor), before answering a similar set of questions as pre-intervention edited to reflect future (rather than past) likelihood of behavior engagement (i.e., "*over the next month*"). The highlighted behaviors were chosen for their high level of impact associated with the reduction of GHGs like CO_2, with the idea that participants would respond more positively to arguments highlighting only one set of behaviors versus multiple (i.e., seven). Furthermore, while each message accentuated the positive effects of either "Self-" initiated (bottom-up) or "Legislator-" initiated (top-down) pro-environmental behaviors, it was believed that participants would respond more positively to arguments that shifted the onus of these behaviors from them onto others that are generally perceived to have more direct access to initiating impactful changes.

These expectations were reflected within the Study 1 hypotheses, which predicted individuals in the *Single* Quantity and *Legislator* Actor message conditions would report the highest post-intervention perceptions of ease engaging in general pro-environmental behaviors (Hypotheses 1a, 2a, and 3a) and highest likelihood of engaging in general pro-environmental behaviors (Hypotheses 1b, 2b, and 3b) and committing to clean electricity practices and products (Hypotheses 1c, 2c, and 3c). Additionally, it was hypothesized that those in the *Multiple* Quantity and *Self* Actor conditions would score the lowest on these measures. To test these hypotheses, three multiple regression analyses predicted the post-intervention score of the three variables using a full-factorial model of the Solution Quantity (*Single* versus *Multiple*), Solution Actor (*Self* versus *Legislator*), and pre-intervention score main effects. While no significant differences were discovered between the levels of these conditions in the model predicting post-intervention perceptions of ease engaging in general pro-environmental behaviors (see Table 2),

65

surprising differences were found in the other two models. That is, the model predicting the post-intervention likelihood of engaging in general pro-environmental behaviors "*over the next month*" (Table 3) revealed significant main effects of both Solution Quantity (see Figure 6) and Solution Actor (see Figure 7), such that those in the *Multiple* Quantity and *Self* Actor conditions reported significantly higher likelihood than those in the *Single* Quantity and *Legislator* Actor conditions, respectively. Furthermore, the model predicting the post-intervention likelihood of committing to clean electricity practices and products "*over the next month*" (see Table 4) revealed a significant main effect of Solution Actor (see Figure 8), such that those in the *Self* Actor condition reported higher likelihood than those in the *Legislator* Actor condition, as well as a significant interaction effect between Solution Quantity and Actor, such that those in the *Multiple–Self* condition reported the highest post-intervention likelihood (see Figure 9).

Against expectations, these data suggest that *Alarmed* and *Concerned* Americans may, in fact, be more encouraged by messages encouraging the self-initiation of multiple different types of pro-environmental behaviors. Upon reflection, these findings could be due to several factors, related to these Americans' beliefs and to their perceptions of our political institutions. First, research shows that *Alarmed* and *Concerned* Americans are typically more aware of, worried about, and engaged in the issue of CC compared to other GWSA audience members (Maibach et al., 2011). Recent findings suggest that nearly half of Americans fall within these two groups (Leiserowitz et al., 2021), meaning that nearly half of Americans are much less aware of, worried about, and engaged in this issue. Accordingly, it may be *Alarmed* and *Concerned* Americans feel compelled to involve themselves in a wide range of GHG-reducing, pro-environmental activities. This is especially understandable when considering traditional approaches to pro-environmental persuasion, which tend to encourage a widespread,

comprehensive approach to tackling the issue of climate change. Given the gravity of climate change, *Alarmed* and *Concerned* Americans are the most likely to be receptive to pro-environmental persuasive efforts, regardless of the framing of those efforts. According to the psychology literature on influence and attitude formation, certain attitudes and behaviors can function as anchors to a social identity the individual holds (Katz, 1960; Smith et al., 1956). Evidence suggests this is true including pro-environmental attitudes as well (Milfont, 2009). Moreover, people tend to believe and behave in ways that are consistent with beliefs and behaviors expressed in previous situations (Cialdini, 1984; Diener & Larsen, 1984; Funder & Colvin, 1991), to avoid negative outcomes such as cognitive dissonance (Elliot & Devine, 1994; Festinger, 1957, 1962). Accordingly, to retain self-perceptions of consistency and to avoid any related dissonance, it may be that *Alarmed* and *Concerned* Americans take the "more is more" approach when it comes to committing themselves to pro-environmental behaviors.

Second, it is important to note the data for these two studies were collected in March of 2023 when sentiments towards the U.S. government and its effectiveness were considerably tenuous. For example, debates over the U.S. Federal Government defaulting on its debt for the first time in its history were common in the news media (e.g., Wilkie, 2023), while federal government inaction on other pressing issues such as gun control (e.g., Baker et al., 2023), bank regulation, (e.g., Schroeder & Lang, 2023) and even climate change (e.g., Elbien, 2023), also dominated media headlines. Additionally, it is important to note that these sentiments may or may not have extended from the progression of the COVID-19 pandemic, in which the U.S. Federal Government's handling of the crisis received notable criticism (e.g., Pezenik & Haslett, 2022) and mandates of vaccinations (e.g., Brumfiel, 2022) created intense discourse among the public. While perceptions of U.S. federal government trust and effectiveness were not measured

in this study, other data on Americans' views may help to elucidate the Study 1 findings. In fact, research published in 2022 illuminated Americans' general lack of trust in American politics and institutions, such that most sampled Americans disagreed that the U.S. government is helpful (55%) and listens to the public (65%), while also believing it negatively affects the country (53%; Hitlin & Shutava, 2022). With these findings in mind, it may be that at least some of these participants have very low positive expectations related to the functionality of the U.S. government. Accordingly, presenting them with messages encouraging reliance on the government–let alone to solve one of the most pressing issues we currently face–may not have inspired a significant increase in pro-environmental behavior intentions. Instead, Americans may have internalized their hopes for overcoming CC, expressing significantly higher intentions to engage in self-initiated and multiple GHG-reducing activities.

Study 1 Limitations

Of course, each study has limitations to consider in relation to its findings. First, upon review of the pre-intervention and post-intervention questionnaires, the wording of the items measuring perceptions of ease and behavior intention may have been unclear to participants. For example, while this study's survey measured perceived ease and intention of engaging, specifically, in clean electricity practices and products, "pro-environmental behaviors" were measured generally. That is, for example, the associated future behavior intention item was worded as, "*Over the next month, how likely are you to engage, generally, in pro-environmental behaviors*?" Although participants were provided a short, accurate definition of pro-environmental behaviors before these questions ("*Please note: 'Pro-environmental behaviors' can be defined as any behavior that does not contribute to harming the environment. This term is commonly interchangeable with 'green' behaviors*."), the inclusion of this definition may have

introduced undue error in their responses. In fact, data from the original GWSA report shows that when provided with the opportunity to ask one question to climate scientists, *Alarmed* and *Concerned* Americans are exceedingly most interested in asking about actions against CC (over evidence, causes, and consequences; Maibach et al., 2011), underscoring potential uncertainty around this important piece of the climate change issue. Thus, it could be that Study 1 participants may have benefitted from more guidance about these behaviors when asking these questions.

Second, it is important to note that these data were collected using the online marketplace platform, Connect by CloudResearch, rather than in person. On this and similar platforms, workers sign up on the website to complete online tasks (e.g., academic surveys) for compensation. This feature allows workers to complete these tasks on their own accord, under no supervision by the task host. The validity of Study 1's results relies on the assumption that participants honestly answered the survey's questions and effortfully processed the information presented within the persuasive message intervention. Thankfully, survey participation metadata provided by Qualtrics can help to identify and remove potentially erroneous survey responses, a practice supported by social science researchers (Cheung et al., 2017). As reported above, participants' data were examined using a combination of pre-screening items, attention checks, and Qualtrics measures; however, direct evidence of response quality remains unattainable through online marketplaces like this. Because of the novelty of the Connect platform, comprehensive data regarding the quality of task performance is limited; however, one recently published study shows positive signs of quality within Connect samples. That is, researchers found Connect participants provided higher quality data for the lowest price compared to samples from Amazon Mechanical Turk (MTurk), Qualtrics, and universities using college

students through SONA (Douglas et al., 2023). These findings are supported by other research on response quality from other online marketplaces (Cheung et al., 2017; Chmielewski & Kucker, 2020). Although the recent Connect findings are promising, further investigation into the quality of Connect workers' performance is necessary to evaluate this platform's utility.

Study 1 Future Directions

Considering Study 1's findings, a number of potential future research opportunities have been identified. First, future studies should seek to replicate and extend these findings while improving upon the methodological limitations discussed above. Because these participants unexpectedly reported higher intention of pro-environmental engagement following arguments for self-initiated (versus legislator-initiated) and multiple (versus one) actions, it is important to establish whether these findings generalize to other *Alarmed* and *Concerned* samples. These efforts may also benefit from incorporating more stringent quality control practices within the survey, including frequent attention checks, increased encouragement to effortfully engage in the online survey, and assessments of participants' perceptions of their data's quality. To extend these results, future research could expand measurement into a larger group of pro-environmental attitudes and behaviors. While this study measured perceptions of ease and likelihood of engaging in general pro-environmental behaviors and, specifically, clean electricity practices and products, other attitudes (e.g., perceptions of U.S. Federal Government trust and effectiveness, perceptions of pro-environmental behavior impactfulness, and willingness to adopt new pro-environmental behaviors, among others) and other GHG-reducing behaviors could help to elucidate the effectiveness of these arguments.

Alternatively, it may also be interesting to test the efficacy of these messages when presented to lower GWSA audience members, such as the *Cautious*. Study 1 originally sought to

test the Solution Quantity and Actor arguments with the most likely and willing individuals to engage in pro-environmental behaviors (i.e., the GSWA *Alarmed* and the *Concerned*). While research shows it is strategic to tailor persuasive communications to strongly held beliefs (Kreuter & Wray, 2003; Roser-Renouf et al., 2015), examination of the Study 1 data also reveals that these Americans report high levels of attitudes and behaviors even before the persuasive intervention (see Table 5). Accordingly, focusing these efforts on Americans with lower pre-intervention pro-environmental attitudes and behaviors–such as members of the *Cautious* GWSA audience–may help reveal if promoting specific, legislator-initiated is effective. In fact, the foundational GWSA data reveals support for this endeavor. First, *Cautious* Americans tend to be open to pro-environmental persuasion efforts, as they report being most willing to change their mind regarding CC. Second, they also tend to be the most politically diverse compared to the other five audiences, while also being less politically active than their *Alarmed* and *Concerned* counterparts; furthermore, compared to the average American, they tend to be less engaged with most types of news media (Maibach et al., 2011). Accordingly, while having a higher potential for improvement of pro-environmental attitudes and behaviors, they may also be more immune to the political apathy discussed above.

Chapter 3 - Study 2

Study 2 Overview & Hypotheses

Study 2 evaluated the efficacy of different appeals encouraging "opinion leadership" (i.e., the process of utilizing the familiarity and trust one holds with members of their social network to initiate dialogue and, ultimately, persuasion about specific topics; Nisbet & Kotcher, 2007) regarding the issue of CC, using the lens of the Five Factor Model of personality (Goldberg, 1981, 1990; McCrae & John, 1992). That is, using knowledge of the traits and behaviors–and barriers to behaviors–most strongly associated with the intrapersonal dimensions of (lower) Extraversion, (higher) Agreeableness, and (lower) Neuroticism (Goldberg, 1990; John & Srivastava, 1999; McCrae & Costa, 1990; McCrae & John, 1992), especially in situations involving initiating interpersonal communication (Frederickx & Hofmans, 2014), I sought to examine whether specific types of information can help overcome common barriers to opinion leadership. This examination followed the congruence principle highlighted across psychological theory (Festinger, 1957, 1962; Heider, 1958), which projects that people are inclined to engage in behaviors and situations that promote the behavioral manifestation of their personality (Ickes, Snyder, & Garcia, 1997; Emmons, Diener, & Larsen, 1986; Hampson, 2012). As such, Study 2 took an applied approach, utilizing psychological theories of personality and congruence to illuminate ways to overcome barriers to CC opinion leadership.

Specifically, participants completed a five-factor personality scale after being exposed to four messages explaining the benefits of opinion leadership and providing (or not) additional information to help this goal. While the "*Strategies*" message provided six tips on initiating conversations about difficult topics like CC, the "*Counterarguments*" message provided informational counters to six common arguments against the necessity of CC advocacy, and the

"*Posts*" message provided six examples of educational information that can be posted across social media platforms. Subsequently, these data were analyzed to examine whether individuals with certain personality traits find these interventions most effective, as was similarly examined in Hirsh and colleagues' 2012 report. As in Study 1, these messages were crafted to elicit central processing of the CC solution-related information (as suggested by Roser-Renouf's and colleagues' 2015 report on tailored communication strategies). Although GWSA researchers report opinion leadership is most suitable for members of the Alarmed GWSA audience (Roser-Renouf et al., 2015), Study 2 contributed to understanding how the *Alarmed* and the *Concerned* can be encouraged to engage with others. Thus, the following hypotheses were tested through the implementation of Study 2:

Hypothesis 2.1: Lower Extraversion will be uniquely linked to positive ratings of the *Posts* intervention.

Exploratorily, Study 2 also sought to test whether lower Extraversion scores were uniquely linked to positive ratings of the *Strategies* intervention.

Hypothesis 2.2: Higher Agreeableness will be uniquely linked to positive ratings of the *Counters* intervention.

Exploratorily, Study 2 also sought to test whether higher Agreeableness scores were uniquely linked to positive ratings of the *Posts* intervention.

Hypothesis 2.3: Higher Neuroticism will be uniquely linked to positive ratings of each of the three interventions (the *Strategies*, the *Counters*, and the *Posts*).

Hypotheses Rationale: Although not exact, the method and hypotheses of Study 2 were strongly related to Hirsh and colleagues' 2012 study on tailoring advertisements to personality. These researchers found that the effectiveness ratings of the product advertisements were

significantly or nearly significantly unique to the targeted personality trait. That is, for example, participants' effectiveness ratings of the Extraversion-based advertisement were distinctly related to higher scores in Extraversion, an effect that was unique to their report of that trait over the other four traits. Although the interventions in this Dissertation Study 2 are not directly tailored to traits of the Big Five dimensions, I sought to examine whether individuals with specific personality characteristics find additional, communication-encouraging tools most helpful for this pro-environmental opinion leadership. First, because those who are lower in Extraversion tend to be quiet and shy around others (i.e., not usually comfortable initiating conversations with other people; John & Srivastava, 1999), I predicted providing them with examples of ways to engage in opinion leadership online (as in the "Posts" condition) would be rated most positively by these individuals. Additionally, I explored whether providing strategies to initiate these conversations would also be helpful for those with lower Extraversion. Next, because individuals who are higher in Agreeableness tend to be non-confrontational and trusting (i.e., not effective at arguing with others about disagreements; John & Srivastava, 1999), I expected that providing sound counterarguments to these individuals (as is the case in the "Counters" condition) would be viewed as most helpful to these individuals. In addition, I explored whether providing examples of how to engage in online opinion leadership would also be helpful for those with higher Agreeableness. Finally, because individuals who are high in Neuroticism tend to be anxious and temperamental across all situations (i.e., can be anxious about connecting with others, especially regarding controversial topics; John & Srivastava, 1999), I anticipated providing suggestions of strategies, counterarguments, and social media posts will each be appealing to these individuals. Each of these three projections follows the congruence principle,

which posits individuals tend to seek out communication situations that are congruent with their personality (Cote & Moskowitz, 1998; Emmons et al., 1986; Hampson, 2012).

Study 2 Method

Study 2 Participants

A total of 97 participants [$M(SD)Age$ = 41.30(13.60) years, Male = 54%, White = 72%, at least "Somewhat Liberal" = 64%] were recruited for Study 2. This sample size was based on a power analysis using G*Power (Faul et al., 2007) with a suggested sample size of 85, using a multiple regression effect size level of 0.15, a power level of .80, and four predictors. All participants were recruited and compensated $0.50 via the CloudResearch marketplace to complete the online Qualtrics survey that included all study materials. The CloudResearch marketplace was chosen to recruit from a nationally representative sample.

Study 2 Design

Study 2 utilized a within-subjects intervention design. The message intervention condition was the manipulated factor, which has four levels: *Encouragement + Strategies* condition, *Encouragement + Counters* condition, *Encouragement + Posts* condition, and *Encouragement Control* condition. Additionally, this study also measured specific attitudes and behaviors regarding interpersonal communication about CC, their Five-Factor Model (John & Srivastava, 1999; McCrae & Costa, 1999) personality traits, and various demographic information. This study was conducted using an online Qualtrics survey.

Study 2 Materials

Participant Prescreening. The Study 2 survey required workers to complete a robot captcha and three prescreening items before being officially enrolled in the study. Next, the four-item GWSA's SASSY assessment determined which of the six audiences workers belong to

(Chryst et al., 2018). As in Study 1, only participants belonging to the highest two categories–the *Alarmed* and the *Concerned*–were permitted to continue the Study 2 survey. Then, workers self-reported their social media use by responding "*yes*" or "*no*" to the question, "*Are you a social media user who posts, at least, occasionally*?" Participants who responded "*yes*" were permitted to continue. Finally, workers were required to read a passage about turtles and answer a follow-up comprehension question. Those who met the above criteria were enrolled in Study 2, internally assigned a participant identification code, and were allowed to begin the survey. Those who did not meet these criteria were notified of their ineligibility to participate in this study and were thanked for their time. See Appendix A for Study 2 Pre-Screening items.

Demographics Questionnaire. The Study 1 survey measured participants' age, biological sex, race, and political ideology (see Appendix F). Specifically, participants entered their age as a whole number in a textbox and their political ideology using a seven-point Likert scale ranging from "*Strongly Conservative*" (1) to "*Strongly Liberal*" (7), with a midpoint of "*Moderate*" (4). Multiple choice items measured sex and race, in which participants recorded the response(s) to each that best describes them.

Intervention Messages. Participants read each of the four intervention messages, the order of which was block randomized to help prevent order effects (see Appendix G). To begin, participants were told the research team behind this study is seeking to test different types of appeals about climate change communication, and the participant was being recruited to help evaluate these appeals. Each message began with a base encouragement to initiate CC-related conversations with their friends and family. Specifically, this opening encouragement acknowledged that although it can be difficult to initiate CC-related conversations, evidence suggests they are great candidates for this important work. Three of these messages additionally

included either strategies for starting these conversations, counters to common denial and anti-CC claims, or educational information from webpages that can easily be posted on social media. The fourth message instead ended with an encouragement to "*do your part*" in overcoming CC (read more about these messages below). Accordingly, along with the additional condition-specific information, the encouragement opening for each message differed in two distinct ways, explained below. Participants were required to remain on the opening *Encouragement* page for a minimum of 30 seconds and on the intervention-specific message page for a minimum of 30 seconds to help encourage attention to and processing of the message.

   Encouragement Control Message. Whereas the other three messages included additional information, the *Control* message in this study only included an *Encouragement* to engage in CC-related conversations with others. Each opening *Encouragement* declared the importance of initiating CC conversations while also acknowledging the difficulty some have in doing so. This beginning used the following wording:

> *Climate change is a serious problem. Our ability to overcome its effects will require each and every one of us to act.*
>
> *While being greener and cleaner are important actions we should all focus on, there is another impactful–but much less promoted–action we should all increase: Creating dialog with friends & family members who may not be as passionate or knowledgeable about climate change.*
>
> *However, we know that, despite knowing its effects and caring deeply about it, climate change can be a difficult topic to discuss, for a number of reasons*.

Despite these difficulties, the *Encouragement* proclaimed that everyday individuals–rather than climate scientists–are some of the best candidates for this important work, due to the familiarity,

trust, and proximity they hold to those who could benefit from these conversations. Theoretical

justification was offered to support this claim before it concluded with a summary

encouragement sentence. Specifically, this portion of the message included the following

information:

Although difficulties exist, our research team strongly encourages you to rise to the

challenge of initiating these conversations.

In fact, you may be one of the best candidates for this impactful task!

How??

Well, theories like the Two-Step Flow model of communication and other multiple

findings from psychological research on influence show the 1) Familiarity, 2) Trust, and

3) Proximity you hold—coupled with your 4) Passion for and 5) Knowledge of

overcoming climate change—make you especially effective at having these important

conversations with your friends and family.

Lastly, the *Encouragement Control* concluded with a final, one-sentence summary of the

impact they can impart as climate communicators, which declared, "*Ultimately, talking with your*

friends and family about climate change is an important and effective way for you to do your

part in overcoming it" (see Appendix G).

Encouragement + Strategies Message. As mentioned, each message began with an

opening encouragement to initiate CC conversations. After declaring the importance of initiating

conversations about CC, the opening *Encouragement* of the *Strategies* message also

acknowledged the potential difficulty of initiating these conversations using the following

sentence: "*For some of us, the act of starting and holding a conversation about controversial*

and emotionally charged issues (such as climate change) can be especially difficult."

Additionally, at the end of the encouragement, this message informed participants, "*To help overcome some of the difficulties of initiating these conversations, our team has compiled 6 tips for creating dialog about climate change with friends and family. And we need your help!*" before instructing them to view the tips on the next page.

The six "Strategies" presented on the following page of the survey were presented in the following order:

"*1. Pick the best moment*,"

"*2. Actively listen by asking questions and finding connections*,"

"*3. Ask to share your journey in climate change understanding*,"

"*4. Don't try to lecture or win*,"

"*5. Focus on current events and solutions*," and

"*6. Thank them and ask to talk again another time*."

Each of these Strategies was sourced from various blogs and webpages and was compiled to cover a breadth of strategies. With each strategy, three statements of additional explanation and context were also provided to ensure each point was clearly communicated. For example, after the first "Strategy" (*Pick the best moment*), the following statement also included the following explanation, along with two others: "*Be sure to pick a time when the other person isn't busy, tired, or distressed. That will give you the best chance to have a proactive, open, and positive conversation. At the same time, make sure it's a good time for you too!*" (see Appendix G).

Encouragement + Counters Message. After declaring the importance of initiating conversations about CC, the opening *Encouragement* of the *Counters* message also acknowledged the potential difficulty of initiating these conversations using the following sentence: "*For some of us, knowing how to refute misinformation and climate change denial*

information in the moment of a conversation can be especially difficult." Additionally, at the end

of the encouragement, this message informed participants, "*To help overcome some of the*

difficulties of initiating these conversations, our team has compiled 6 common counterarguments

to climate change-denial claims that can be made if these claims come up in conversation. And

we need your help!" before instructing them to view the arguments and their *Counters* on the

next page. The six arguments were presented in the following order:

> "*1. There really isn't proof of climate change, and scientists aren't even sure about its*
> *seriousness. Why should I care?*";
>
> "*2. The climate has always been changing and probably always will. So, isn't climate*
> *change a natural phenomenon?*";
>
> "*3. Climate change is overexaggerated. I like the summer weather; I don't see what's so*
> *wrong with it being warmer.*";
>
> "*4. It's too late to do anything about climate change anyway. It's too big of a problem*
> *and it's too expensive to fix. Why bother?*";
>
> "*5. Other countries like China and India contribute to climate change, too. We shouldn't*
> *be the only one's doing anything to fix it.*"; and,
>
> "*6. Mitigating climate change is economically impractical. More of these climate*
> *regulations will only hurt US businesses and the economy.*"

Each of these "Counters" was sourced from multiple webpages found via internet searches and

was compiled to cover the breadth of anti-CC arguments that are commonly lobbied by skeptics

and deniers. Each argument was directly followed by a counterargument that includes specific

claims and points to relevant evidence that refutes that argument (see Appendix G). For example,

the counterargument for the first claim will include the following text:

Scientists don't "prove" theories and ideas; rather, they gather evidence that either supports or refutes them. 97% of scientists and every relevant climate change research group agree the evidence is clear: Climate change is a real issue that holds serious consequences for all of us on Earth. It is primarily caused and perpetuated by human activity. And we still have the time and capability to overcome the negative effects of climate change.

Encouragement + Posts Message. After declaring the importance of initiating conversations about CC, the opening *Encouragement* of the *Posts* message also acknowledged the potential difficulty of initiating these conversations using the following sentence: "*For some of us, the act of starting and holding a conversation about controversial issues (like climate change) in-person can be especially difficult.*" Additionally, at the end of the encouragement, this message informed participants, "*To help overcome some of the difficulties of having these conversations, our team has compiled 6 examples of social media posts that share links to information about climate change that can be easily posted across platforms. And we need your help!*" before instructing them to view the *Posts* on the next page.

The six posts were gathered from various webpages that can be easily found through an internet search, and they covered a wide range of educational information about CC. Before viewing these posts, participants were first asked to consider the following information: "*Please note: These posts were formatted such that they can be posted across any major social media network. Also, these are just sample posts of links from relatively familiar sources; feel free to use these as templates to share your own favorite links!*" Then, participants viewed the following titles of the pages and a video:

A) "*What is Climate Change?*",

B) "*How do we know Climate Change is real?*",

C) *5 stories of people impacted by Climate Change*,"

D) "*Start with these 10 actions!*",

E) *6 arguments to refute Climate Change denial*," and

F) "*Climate Change 101 with Bill Nye (YouTube)*."

Each of the six link titles was also accompanied by a brief text description introducing the topic and encouraging the (fictitious) reader to click on the post and link. For example, the "What is Climate Change?" link included, "*Curious what climate change actually is or in search of information to send to another potentially curious individual? Check out this link published by the advocacy group the Natural Resource Defense Council (NRDC) to learn more*" (see Appendix G).

Message Effectiveness Questionnaires. Following each message intervention, participants rated the previous information across several factors ultimately related to perceived effectiveness (see Appendix H). Specifically, participants answered six questions, including "*I find this information to be persuasive.*" and "*This is an effective message.*" Participants responded to these items using seven-point Likert scales ranging from "*Strongly Disagree*" to "*Strongly Agree*." Responses to these six items were summed to create composite effectiveness ratings for subsequent data analyses.

Big Five Inventory (BFI; John & Srivastava, 1999). The Big Five Inventory is a 44-item assessment of the five dimensions of personality: openness, conscientiousness, extraversion, agreeableness, and neuroticism (see Appendix C). Participants responded to these 44 statements of "*I see myself as someone who…*" using a five-point Likert scale that ranged from "*Disagree Strongly*" to "*Strongly Agree*." Fifteen of these items required reverse scoring. Example items

included "*Is talkative*" and "*Is reserved*" (measuring Extraversion), "*Tends to find fault with others*" and "*Is helpful and unselfish with others*" (measuring Agreeableness), "*Does a thorough job*" and "*Can be somewhat careless*" (measuring Conscientiousness), "*Is depressed, blue*" and "*Is relaxed, handles stress well*" (measuring Neuroticism), and "*Is original, comes up with new ideas*" and "*Prefers work that is routine*" (measuring Openness). Evidence shows the BFI has strong reliability with substantial convergent validity with other Five Factor Model assessments (John & Srivastava, 1999).

Attention and Manipulation Checks. To ensure participants were not distracted while completing this survey, it included multiple attention check items. That is, at the beginning of each ratings questionnaire (following each message intervention), participants were asked to confirm the message they were about to rate by selecting options from a multiple-choice item (see Appendix H). Specifically, they responded to the question "*Which of the following categories best describes the topic of information you just read, specifically, on the previous page*?" by choosing either, "*Strategies for initiating conversations about climate change*," "*Counterarguments to climate change denial claims*," "*Educational information that can be easily posted on social media*," or "*Encouragement to create dialogue about climate change*." Additionally, within the BFI, participants were explicitly asked to respond "*Slightly Agree*" to an additional item (see Appendix C).

Procedure

After completing each of the prescreening items, participants were enrolled in the study. To begin the survey, participants recorded their demographic characteristics of age, sex, race, and political ideology. Next, participants were told they were recruited to help evaluate specific appeals to climate change communication. Then, in block-randomized order, they were shown

each of the four message interventions. Following each intervention, participants were asked to identify and rate the information they just read. To conclude, participants completed the Big Five Inventory (John & Srivastava, 1999), before being debriefed, thanked for their time, and provided instructions to receive compensation for their participation.

Study 2 Results

Data Preparation

Using the CloudReserach® Connect marketplace, data were initially collected from 112 participants who passed each of the three prescreening tasks at the beginning of the survey. Specifically, after being screened as a member of either the *Alarmed* or the *Concerned* using the GWSA SASSY questionnaire, only participants who recorded being an active user of social media and those who passed the reading comprehension check (i.e., reading a passage about turtles and answering a multiple-choice comprehension question) were allowed to complete the survey. From this initial sample, 11 participants' data were removed before analyses under suspicion of careless or computer-generated responses, while three participants' data were removed for failing two or more of the three attention checks presented within the survey. In total, 98 participants' data were included for analysis. Study 2 data were analyzed using jamovi® statistical software (2022).

A priori Hypotheses Testing

Before hypothesis testing, the effectiveness scores for each of the four intervention conditions–calculated as a sum of six items using a seven-point Likert scale response–were evaluated. A review of the scores' Cronbach's α revealed each of the messages scores (*Strategies* Effectiveness Score Cronbach's α = .955; *Counters* Effectiveness Score Cronbach's α = .947; *Posts* Effectiveness Score Cronbach's α = .938; *Control* Effectiveness Score Cronbach's α =

.964) demonstrated adequate reliability. Study 2 analyses were inspired by the study by Hirsch and colleagues (2011) evaluating the congruence between personality scores and the effectiveness ratings of an advertised consumer product. First, the relationships between the four interventions' effectiveness ratings were evaluated, as strong correlations would suggest shared variance across the ratings. Correlations analyses revealed highly significant correlations between each set of ratings, with Pearson's *r* ranging from .510 to .666 (see Table 6). To control for this variance, four multiple regression analyses were conducted in which effectiveness ratings from three of the messages were regressed on the rating of the fourth message (see Tables 7–10). In turn, the residuals of these regressions–which captured the variance in the effectiveness ratings uniquely associated with each message intervention–were used to predict scores of the BFI's five dimension scores (see Tables 11–15).

The first hypothesis predicted a negative relationship between Extraversion and effectiveness ratings of the *Posts* intervention condition, such that those lower in Extraversion (i.e., those who tend to be shy, reserved, and solitary) will uniquely rate the *Posts* information as effective. Additionally, the potential for a negative relationship between Extraversion and the effectiveness ratings for the *Strategies* message was explored. To test these predictions, a multiple regression analysis was conducted to predict participants' Extraversion scores using the residuals gathered from the original set of multiple regressions, which captured the variance in the effectiveness ratings that are uniquely associated with each message intervention (see Table 11). While it is important to note the overall model was not significant [Adj. $R^2 = .005$, $F(4, 92) =1.12$, $p = .354$], it revealed a non-significant positive relationship between Extraversion and the *Posts* message effectiveness ratings ($t = 1.75$, $p = .083$) contrary to expectation; furthermore, also

contrary to predictions, this model revealed a marginally non-significant positive relationship between Extraversion and the *Strategies* message effectiveness ratings ($t = 1.94$, $p = .058$).

The second hypothesis predicted a positive relationship between level of Agreeableness and effectiveness ratings for the *Counters* intervention condition, such that those higher in Agreeableness (i.e., those who tend to be cooperative, soft-hearted, and conflict-averse) will uniquely rate the Counters information as effective. Additionally, the potential for a positive relationship between Agreeableness and the effectiveness ratings for the *Posts* message was explored. To test these predictions, a multiple regression was conducted to predict participants' Agreeableness scores using the residuals gathered from the original set of multiple regressions [Adj. $R^2 = .115$, $F(4, 92) = 4.11$, $p = .004$; see Table 12]. Although it was in the predicted direction, this model revealed a marginally non-significant positive relationship between Agreeableness and the *Counters* message's effectiveness ratings ($t = 1.87$, $p = .065$); however, it did identify a significant positive relationship between Agreeableness and the *Posts* message's effectiveness ratings ($t = 2.62$, $p = .010$). Finally, unexpectedly, this model also revealed a significant positive relationship between Agreeableness and the *Control* message's effectiveness ratings ($t = 3.90$, $p < .001$).

Finally, the third hypothesis predicted a positive relationship between levels of Neuroticism and effectiveness ratings for each of the three interventions (*Strategies*, *Posts*, and *Counters*), such that those with higher Neuroticism (i.e., those who tend to need reassurance across the board when it comes to interacting with others) will uniquely rate the three message interventions as effective. To test these predictions, a multiple regression was conducted to predict participants' Neuroticism scores using the residuals gathered from the original set of multiple regressions [Adj. $R^2 = .064$, $F(4, 92) = 2.64$, $p = .039$; see Table 13]. Contrary to

expectation, this model revealed a marginally non-significant negative relationship between Neuroticism and the *Strategies* message's effectiveness ratings ($t = -1.97$, $p = .058$). Also contrary to expectation, this model identified a non-significant negative relationship between Neuroticism and the *Counters* message effectiveness ratings ($t = -0.83$, $p = .119$). Lastly, while also contrary to expectation, this model identified a non-significant negative relationship between Neuroticism and the *Posts* message's effectiveness ratings ($t = -1.58$, $p = .083$; see Table 17 for a summary of multiple regression analyses establishing congruence between the Five Factor Model dimensions scores and the effectiveness ratings of the four messages).

Ancillary Analyses

In addition to *a priori* hypothesis testing, several additional analyses were conducted to better understand these Study 2 data (see Tables 6 and 16). Upon review of the relationships between the four message's effectiveness scores and the Study 2 demographic variables (see Table 6), only three significant relationships were identified by correlation analyses: a negative relationship between the *Strategies* message's effectiveness and participants political affiliation ($r = -.227$, $p = .030$), such that as liberalism decreased (conservatism increased), perceptions of effectiveness increased; two negative relationships between education and the *Counters* message's ratings ($r = -.258$, $p = .014$) and the *Posts* message's ratings ($r = -.217$, $p = .039$), such that those with lower formal education rated higher perceptions of effectiveness with the *Counters* and *Posts* messages.

Descriptive analyses revealed participants rated the *Counters* message as the most effective ($M = 35.80$, $SD = 4.96$), followed by the *Posts* ($M = 34.00$, $SD = 5.14$) and the *Strategies* message ($M = 33.90$, $SD = 5.50$), then the *Control* message ($M = 31.70$, $SD = 6.47$). To examine possible differences between the GWSA Alarmed and Concerned in the four

messages' effectiveness scores, a series of independent samples *t*-tests were conducted.

Subsequently, no differences between these two audiences were identified in any of the ratings, including the Strategies message's ratings [$t(95) = 1.34$, $p = .288$], the Counters message's ratings [$t(95) = 1.82$, $p = .389$], the Posts message's ratings [$t(95) = 1.79$, $p = .077$], and the Control message's ratings [$t(95) = 1.13$, $p = .242$].

Table 6. Bivariate Correlations between the Four Interventions' Effectiveness Ratings and the Sample's Demographic Data

	M(SD)	Range	1	2	3	4	5	6	7	8
1	33.90 (5.50)	20–42	--							
2	35.80 (4.96)	20–42	.529 ***	–						
3	34.00 (5.14)	22–42	.643 ***	.666 ***	–					
4	31.70 (6.74)	12–42	.660 ***	.510 ***	531 ***	–				
5	41.30 (13.6)	19–73	.029	.091	.153	.079	–			
6	5.01 (1.69)	1–7	-.227 *	.133	-.052	-.127	.012	–		
7	2.55 (0.65)	1–3	-.085	-.258 *	-.217 *	-.186	-.018	-.046	–	
8	3.07 (1.47)	1–5	-.-23	-.114	-.205	-.086	.013	-.134	.388 ***	–

Note: * p < .05, ** p < .01, *** p < .001
1.   Strategies Message's Effectiveness Ratings
2.   Counters Message's Effectiveness Ratings
3.   Posts Message's Effectiveness Ratings
4.   Control Message's Effectiveness Ratings
5.   Age
6.   Political Affiliation (1. *Strongly Conservative* – 7. *Strongly Liberal*)

7.   Education (1. *High School* –2. Some College – 3. *Bachelor's Degree or Higher*)
8.   Income (1. *Up to $24.9k* – 5. *$85k or more*; increments of $15k)

Table 7. Multiple Regression Analysis Predicting Effectiveness Ratings of the Strategies Message Intervention

	Estimate	*SE*	*t*	*p*
Intercept	6.84	2.92	2.34	.021
Counters Ratings	0.07	0.11	0.63	.530
Posts Ratings	0.40	0.10	3.86	<.001
Control Ratings	0.35	0.09	5.11	<.001

Note: adj. = .542, $F(3, 93) = 38.90$, $p < .001$

Table 8. Multiple Regression Analysis Predicting Effectiveness Ratings of the Counters Message Intervention

	Estimate	*SE*	*t*	*p*
Intercept	12.17	2.65	4.59	<.001
Strategies Ratings	0.06	0.10	0.63	.530
Posts Ratings	0.50	0.10	5.25	<.001
Control Ratings	0.14	0.08	1.84	.070

Note: adj. $R^2 = .463$, $F(3, 93) = 28.60$, $p < .001$

Table 9. Multiple Regression Analysis Predicting Effectiveness Ratings of the Counters Message Intervention

	Estimate	*SE*	*t*	*p*
Intercept	4.47	2.75	1.63	.107
Strategies Ratings	0.35	0.09	3.86	<.001
Posts Ratings	0.45	0.09	5.25	<.001
Control Ratings	0.05	0.07	0.69	.492

Note: adj. R^2 = .549, $F(3, 93)$ =40.00, $p < .001$

Table 10. Multiple Regression Analysis Predicting Effectiveness Ratings of the Control Message Intervention

	Estimate	*SE*	*t*	*p*
Intercept	-2.16	4.01	-0.54	.591
Strategies Ratings	0.63	0.12	5.11	<.001
Counters Ratings	0.26	0.14	1.84	.070
Posts Ratings	0.10	0.15	0.69	.492

Note: adj. R^2 = .457, $F(3, 93)$ =27.90, $p < .001$

Table 11. Multiple Regression Analysis Predicting Extraversion Scores

	Estimate	SE	t	p
Intercept	24.56	0.63	39.26	<.001
Strategies Residuals	0.50	0.23	1.94	.058
Counters Residuals	0.38	0.24	1.58	.119
Posts Residuals	0.49	0.28	1.75	.083
Control Residuals	0.30	0.18	1.69	.095

Note: adj. R^2 = .005, $F(4, 92)$ =1.12, p = .354

Table 12. Multiple Regression Analysis Predicting Agreeableness Scores

	Estimate	SE	t	p
Intercept	35.77	0.62	57.32	<.001
Strategies Residuals	0.83	0.26	3.21	.002
Counters Residuals	0.46	0.24	1.87	.065
Posts Residuals	0.73	0.28	2.62	.010
Control Residuals	0.69	0.18	3.90	<.001

Note: adj. R^2 = .115, $F(4, 92)$ =4.11, p = .004

Table 13. Multiple Regression Analysis Predicting Neuroticism Scores

	Estimate	*SE*	*t*	*p*
Intercept	19.97	0.86	23.14	<.001
Strategies Residuals	-0.67	0.36	-1.97	.058
Counters Residuals	-0.28	0.34	-0.83	.119
Posts Residuals	-0.61	0.39	-1.58	.083
Control Residuals	-0.76	0.25	-3.09	.095

Note: adj. R^2 = .064, $F(4, 92)$ =2.64, p = .039

Table 14. Multiple Regression Analysis Predicting Openness Scores

	Estimate	*SE*	*t*	*p*
Intercept	38.010	0.681	55.860	<.001
Strategies Residuals	0.424	0.280	1.510	.134
Counters Residuals	0.541	0.265	2.040	.044
Posts Residuals	0.345	0.305	1.130	.260
Control Residuals	0.599	0.193	3.100	.003

Note: adj. R^2 = .071, $F(4, 92)$ =2.84, p = .029

Table 15. Multiple Regression Analysis Predicting Conscientiousness Scores

	Estimate	SE	t	p
Intercept	37.546	0.727	51.680	<.001
Strategies Residuals	0.658	0.299	2.200	.030
Counters Residuals	0.538	0.283	1.900	.061
Posts Residuals	0.629	0.326	1.930	.056
Control Residuals	0.486	0.206	2.360	.020

Note: adj. $R^2 = .027$, $F(4, 92) = 1.67$, $p = .164$

Table 16. Bivariate Correlations between the Five Factor Model Dimension Scores and the Sample's Demographic Data

	M(SD)	Range	1	2	3	4	5	6	7	8
1	24.60 (6.17)	12–36	–							
2	35.80 (6.53)	19–45	.340 ***	–						
3	20.00 (8.78)	8–40	-.562 ***	-.571 ***	–					
4	38.00 (6.95)	15–50	.194	.359 ***	-.200 *	–				
5	37.5 (7.25)	14–45	.380 ***	.621 ***	-.693 ***	.259 *	–			
6	41.30 (13.6)	19–73	.087	.264 *	-.094	.173	.218 *	–		
7	5.01 (1.69)	1–7	-.164	.088	.219 *	.074	-.004	.012	–	
8	2.55 (0.65)	1–3	.100	.018	-.066	-.139	.101	-.018	-.046	–
9	3.07 (1.47)	1–5	.276 **	.091	-.170	-.068	.174	.013	-.134	.388 ***

Note: * p < .05, ** p < .01, *** p < .001
1. Extraversion Scores
2. Agreeableness Scores
3. Neuroticism Scores
4. Openness Scores
5. Conscientiousness Scores
6. Age
7. Political Affiliation (1. *Strongly Conservative* – 7. *Strongly Liberal*)
8. Education (1. *High School* –2. Some College – 3. *Bachelor's Degree or Higher*)
9. Income (1. *Up to $24.9k* – 5. $*85k or more*; increments of $15k)

Table 17. Summary of Multiple Regression Analyses Examining the Congruence Between the Five Factor Model Dimensions Scores and the Effectiveness Ratings for the Four Messages

	Extraversion Estimate(*p*)	Agreeableness Estimate(*p*)	Neuroticism Estimate(*p*)	Openness Estimate(*p*)	Conscientious. Estimate(*p*)
Strategies Ratings	0.500(.056) ✕	**0.825(.002)** ✕	-0.699(.052) ✕	0.424(.134)	**0.658(.030)**
Counters Ratings	0.384(.119)	0.455(.065)	-0.278(.411) ✕	**0.541(.044)**	0.538(.061)
Posts Ratings	0.492(.083) ✕	**0.733(.010)** ✓	-0.610(.118) ✕	0.345(.260)	0.629(.056)
Control Ratings	0.299(.095)	**0.691(<.001)**	**-0.757(.003)**	**0.599(.003)**	**0.486(.020)**

Note: Please see Tables 11–15 for full model output; significant Estimates are bolded; "✓" supported hypotheses; "✕" did not support hypotheses

Study 2 Discussion

The purpose of Study 2 was to examine the relationships between individuals' personality dimensions and their effectiveness ratings for specific messages encouraging CC opinion leadership. As in Study 1, participants with specifically high climate change attitudes–classified as the *Alarmed* and the *Concerned*–were recruited to participate using the GWSA SASSY assessment (Chryst et al., 2018). With their high CC-related attitudes and intentions in mind, GWSA researchers have suggested encouraging the *Alarmed* and *Concerned* to engage in opinion leadership (i.e., the process of utilizing the familiarity and trust one holds with members of their social network to initiate dialogue and, ultimately, persuasion about specific topics; Goldberg, 1981, 1990). However, opinion leadership requires the individual to engage in specific

and strategic methods of interpersonal interactions, which may be difficult for certain people for various reasons. Following enrollment, participants were asked to assist the research team in evaluating persuasive pro-environmental information. Specifically, while a base message heralded the reader's potential as a CC opinion leader and encouraged them to engage in communication initiation (i.e., the "Control" message), three other messages included additional information created to help overcome common barriers to opinion leadership. One message additionally provided six "Strategies" for initiating conversations about climate change, with ancillary explanations to provide context and clarity. Another message additionally provided six sound "Counterarguments" to common anti-CC and denial claims. Lastly, the third message additionally included information for six "Posts" the reader could share across their social media accounts. To conclude the study, participants completed the Big Five Inventory (John & Srivastava, 1999), which measured participants' propensity for each of the five major personality dimensions.

Three hypotheses were tested in this study, which were based on knowledge of the Five Factor Model of personality (Goldberg, 1981, 1990; McCrae & John, 1992) and common behavioral barriers related to opinion leadership and initiating difficult conversations (like about the issue of CC). Specifically, this study sought to investigate the relationships between the three "interpersonal" personality dimensions of Extraversion, Agreeableness, and Neuroticism (Costa & McCrae, 2011; Frederickx & Hofmans, 2014). While those who are higher in Extraversion tend to be outspoken, enthusiastic, and sociable, those who are lower in this trait (i.e., "introverted") tend to be shy, reserved, and solitary (John & Srivastava, 1999). Accordingly, those lower in Extraversion may find information that encourages online opinion leadership of CC–and information providing specific strategies for initiating in-person opinion leadership–as

most effective. With this understanding, the first hypothesis tested through Study 2 predicted the relationship between Extraversion and the effectiveness ratings of the intervention messages, such that it was hypothesized that those lower in Extraversion would rate the *Posts* message–and, exploratorily, the *Strategies* message–as most uniquely effective. Next, while those higher in Agreeableness tend to be cooperative, soft-hearted, and conflict-averse, those lower in this trait tend to be more strongly willed and indifferent to conflict (John & Srivastava, 1999). As such, those higher in Agreeableness may find information providing sensible counters to common CC misinformation and denial–and information that encourages online CC opinion leadership–as most effective. With this understanding, the second hypothesis predicted those higher in Agreeableness would rate the *Counters* Messages–and, exploratorily, the *Posts* message–as most uniquely effective. Finally, while those who are lower in Neuroticism tend to be stable, calm, and content, those who are higher in this trait tend to be anxious, temperamental, and self-punishing (John & Srivastava, 1999). Consequently, the third hypothesis predicted participants higher in Neuroticism would rate each of the three intervention messages (i.e., the *Strategies*, *Counters*, and *Posts*) as highly effective, as they typically struggle with difficult interpersonal interaction across the board.

Data analysis was inspired by Hirsch and colleagues' investigation into the congruence between personality traits and effectiveness ratings of advertisements tailored to these traits (2011). To analyze this data, shared variance between participants' effectiveness ratings of the four messages was captured and then regressed on the five personality trait response scores. These analyses revealed unique connections between the personality dimensions and the intervention messages (see Table 17). As proposed exploratorily, the data suggested those higher in Agreeableness would rate the *Posts* message as uniquely effective. Agreeableness was also

uniquely associated with effectiveness ratings of the *Strategies* message, one of several unexpected unique relationships identified within this data. Notably, effectiveness ratings for the control message were uniquely related to four (i.e., two interpersonal dimensions of Agreeableness and Neuroticism, and the additional dimensions of Openness and Conscientiousness) of the five dimensions. Additionally, although none of the relationships between levels of Neuroticism and effectiveness ratings of the *Strategies*, *Counters*, and *Posts* message, were significant, each relation manifested in the opposite (negative) direction than what was hypothesized. Lastly, the relationships between Extraversion and the Strategies' and Posts' effectiveness ratings were not significant, nor were they in the hypothesized (negative) direction.

One possible explanation for Study 2's findings may involve the degree to which the interventions were tailored to the targeted personality dimensions. Hirsch and colleagues' (2011) study–from which these methods and analyses were inspired–examined effectiveness ratings of five different products that were advertised to improve some aspect of the consumer's life related to the Five Factor Model personality dimensions. For example, the (high) Extraversion-fashioned message included information like "*With XPhone, you'll always be where the excitement is*" (Hirsh et al., 2011, p. 579). Accordingly, these researchers found the effectiveness ratings were related to their connected personality traits as was hypothesized. Although the 2011 study provided a useful framework to examine Study 2's interventions, differences in focus and form exist between them. Instead of directly tailoring the Study 2 messages to the traits most strongly associated with Extraversion, Agreeableness, and Neuroticism, Study 2's messages were tailored to aid individuals to overcome significant barriers related to these personality traits. Thus, within this context, the conceptual link between the Five Factor Model of personality and the encouragement of CC opinion leadership may be less straightforward.

On the other hand, other distinctions about the messages and, ultimately, their requests to the readers, may help to explain these results. Although these interventions were created to help overcome the behavioral barriers associated with lower Extraversion, higher Agreeableness, and higher Neuroticism, they could have been tailored differently or more strongly to these personality traits. Alternatively, the barriers associated with these traits may have functioned counteractively as deterrents to positive perceptions of these tools. That is, directly encouraging those lower in Extraversion (i.e., those who tend to be shy, reserved, and solitary; John & Srivastava, 1999) to engage in potentially difficult interactions about CC may not be strategic, as these individuals are not generally apt to engage in such activities. Similarly, with those who are higher Neuroticism (i.e., those who tend to be anxious, temperamental, and self-punishing; John & Srivastava, 1999), asking these individuals to engage in opinion leadership may not be a strategic avenue of encouragement, as they tend to struggle in interpersonal interactions as it is. These messages may have cued these participants to self-evaluate their perceived ability to engage in these behaviors, priming thoughts of conflict, skepticism, and avoidance related to CC opinion leadership. Alternatively, those lower in Extraversion and those higher in Neuroticism may be more receptive to messages urging engagement in other aspects of pro-environmentalism with which they are more comfortable. Just as this study sought to specifically recruit members of the *Alarmed* and *Concerned* GWSA segments–to tailor these interventions to their positive CC beliefs–future persuasive efforts should continue considering the utility and versatility of tailored messages.

Findings captured by the Study 2 Ancillary Analyses are also worth elaboration. As discussed, correlation analyses between the messages' effectiveness ratings and the study's demographic variables first revealed positive relationships between conservatism and the

Strategies message's effectiveness ratings. Upon reflection, it could be that Conservatives are most receptive to this information, as they find it most valuable when contemplating opinion leadership over their peers. Rather than arguing with their peers or engaging online, those higher in conservatism may believe the most influential opinion leadership tools encourage proper, positive conversations about CC issues. Second, these analyses also revealed negative relationships between education and the *Counters* and *Posts* messages' effectiveness ratings, suggesting those who are lower in formal education fund providing counterarguments and online opinion leadership content as most effective. These findings make sense, as those who are less educated may be less aware of the science and realities of CC. Thus, they may perceive messages providing them with facts they can use to combat misinformation or share online with their social network as most useful.

Study 2 Limitations

As in Study 1, certain limitations may have affected the outcomes of Study 2. First, the scope of items utilized in this survey may have restricted comprehensive analysis of the four messages' effectiveness. Specifically, while the six items measuring the messages' effectiveness were crafted to reliably measure these beliefs–being heavily inspired by Hirsch and colleagues' (2011) study–an item directly measuring their effectiveness in helping participants overcome behavioral barriers related to CC opinion leadership was not included. Items measuring this facet of perceived effectiveness could have been fashioned in various ways, and they would have allowed for a more direct examination of how to help members of the *Alarmed* and *Concerned* engage in CC opinion leadership.

Like Study 1, this study may also have suffered from vulnerabilities related to unsupervised online data collection. Although this study also specifically recruited individuals

with high beliefs and motivations regarding CC, scientists' ability to assess the validity of the responses from online marketplaces is limited. Study 2 is uniquely vulnerable, as it is relying on participants' systematic processing of four distinct messages, as well as their robust ability to provide accurate responses to the different questions throughout the survey. Requiring participants to attend to this quantity and scale of information can become tricky when the information is presented using an online medium. Instead, recruiting participants to participate in person may help to ensure response validity through the strengthening of experimenter control. As in Study 2, a variety of prescreening, data cleaning, and quality evaluation tools were included in Study 2's methodology; furthermore, recent positive trends were identified in Connect participants' response quality. However, further investigation into the Connect workers' performance quality is necessary to evaluate this platform's utility.

Study 2 Future Directions

When considering future directions of research, a variety of avenues can be explored. First, while expanding the current pool of survey items measuring perceptions of the intervention messages, future research could also work to establish the messages' effectiveness in helping to overcome the behavioral barriers to CC opinion leadership. While studying the perceived effectiveness of an intervention is a logical first step to take in this context, this research program would benefit from collecting behavioral data and data representing their perceptions about these behaviors. For example, is the *Strategies* message effective at helping decrease negative anticipation of engaging in CC dialogue, and do people exposed to this information more likely to engage in CC opinion leadership than those who are not? These additional lines of investigation can help more thoroughly uncover the utility–or not–of these different forms of information.

Study 2 took the approach of strengthening weaknesses–rather than highlighting strengths–when encouraging CC opinion leadership; however, as discussed above, taking this approach may have counteractively worked to make the personal realities of these barriers salient. Thus, future research could alternatively investigate the effectiveness of tailoring these interventions to the strengths–rather than barriers–associated with these traits. Working to highlight and utilize individuals' strengths has become a popular trend in the research literature, especially within workplace contexts (e.g., Lavy & Littman-Ovadia, 2017; Peláez et al., 2020). This notion of orienting toward strengths and tendencies is also supported by the theory of regulatory fit (Higgins, 2000), which posits individuals engage in activities that reflect their motivational nature. The potential effectiveness of tailoring persuasive messages to personality-related strengths is also supported by other theories of behavior change like the Theory of Planned Behavior (Ajzen, 1991), which highlights the importance of perceptions of behavioral control (i.e., one's perceived ability to successfully achieve a goal).

Chapter 4 - General Discussion

Climate change (CC) is one of the most pressing issues humanity faces. Despite warnings about the negative consequences we are already facing–which are projected to intensify going forward, under the status quo–differences in Americans' beliefs and involvement continue to persist. One way of classifying these views is through the use of the Global Warming's Six Americas framework, which uses measures of CC-related attitudinal valence (i.e., the inclination to accept or reject climate change science) and issue involvement (i.e., individuals' engagement with the issue of climate) to categorize Americans into one of six "audiences," listed from highest to lowest beliefs: the *Alarmed*, the *Concerned*, the *Cautious*, the *Disengaged*, the *Doubtful*, and the *Dismissive* (Maibach et al., 2011). Because the *Alarmed* and the *Concerned* hold the highest CC-related beliefs and are the most motivated to help solve the issue of CC, these Americans may be the best candidates for CC and pro-environmental persuasion efforts. Accordingly, both studies in this dissertation utilized methods [via the GWSA Six America's Short SurveY (SASSY; Chryst et al., 2018)] to specifically recruit these Americans for participation.

Using this framework and other aspects of psychological theory, prudent methods of increasing pro-environmental engagement can be created, as was the case in these two studies. For instance, one topic crucial to both Study 1 and Study 2 was tailoring (i.e., the act of incorporating information specific to the target individual as a way of creating a personal connection to the behavior of interest; Kreuter & Wray, 2003), a persuasion technique common within the health modification literature. Tailoring was especially relevant in recruiting *Alarmed* and *Concerned* Americans for these studies, with inspiration from a specific GWSA report on communications strategies tailored to each audience. Specifically, based on the attitudes and

tendencies of the *Alarmed* and the *Concerned*, these researchers suggested the use of arguments that elicit central (i.e., effortful) processing by the target individual and the inclusion of information that build perceptions of self-efficacy for success within the target individual (Roser-Renouf et al., 2015). These suggestions–especially the latter two–are closely aligned with theories related to the psychological antecedents of behaviors and goal setting. For example, models like the Theory of Planned Behavior (Azjen, 1991) propose the fortification of behavioral antecedents like behavioral control beliefs (i.e., the individual's perceptions of the target behavior's ease or difficulty) and subjective norms (i.e., the belief other people will approve or disapprove of the target behavior) to help individuals more easily achieve the desired level of behavior modification. Relatedly, research shows goals individuals make must–at least initially–be perceived as worthy, but also attainable, for them to considered in the first place (Lunenburg, 2011).

Study 1 General Discussion

The focus of Study 1 was to test the efficacy of different appeals encouraging engagement in specific pro-environmental behaviors. That is, participants were randomized to read one of four messages that varied by the "quantity" of behaviors proposed (one versus seven) and which "actor" would be responsible for the initiation of these behaviors (the participant themself or their elected government officials). More specifically, these messages highlighted either one impactful behavior (i.e., committing to clean electricity practices and products) or a group of seven impactful behaviors (including committing to clean electricity practices and products), as well as either proposed the advantages of self-initiated, "bottom-up" pro-environmental efforts or proposed the advantages of government-initiated, "top-down" pro-environmental efforts. While public pro-environmental appeals tend to underscore the necessity

for the self-initiation of multiple pro-environmental behaviors, psychological theory [i.e., the Theory of Planned Behavior (Azjen, 1991) and goal-setting theory (Lunenburg, 2011)] suggests individuals could be most encouraged by messages emphasizing fewer behaviors and those initiated by those with the power to affect the necessary change, being Legislators within the United States Government. Accordingly, Study 1 sought to test the extent to which these messages led to differences in perceptions of ease engaging in general pro-environmental behaviors and the likelihood of engaging in both general pro-environmental behaviors and clean electricity practices and products.

Interestingly, Study 1 data provided evidence contrary to the hypothesized differences inspired by psychological literature. That is, while no significant differences between the *Quantity* and *Actor* messages were revealed within multiple regression analyses when predicting post-intervention perceptions of ease engaging in general pro-environmental behaviors (see Table 2), the data suggested providing the "Multiple" (over "Single") Quantity and "Self" (over "Legislator") Actor messages led to significantly higher post-intervention likelihood of engaging in general pro-environmental behaviors (see Table 3, Figure 6, and Figure 7). Furthermore, these trends persisted in multiple regression analyses predicting post-intervention likelihood of engaging in clean electricity practices and products, as the "Multiple–Self" message led to significantly higher post-intervention scores compared to the other messages (see Table 4 and Figure 9). Although these findings defy expectations from related psychological theory, they can potentially be explained by factors relevant to the targeted individuals and the general foci of the messages. First, with arguably the highest level of awareness about the gravity of CC–coupled with understanding of the lack of CC-related progress accomplished thus far–it could be *Alarmed* and *Concerned* Americans may feel most comfortable with and encouraged by suggestions of

multiple and self-initiated efforts. Given the gravity of the situation, it may be that these

Americans expect to be encouraged to engage in widespread, immediate contributions to

overcoming CC. Second, at the time of data collection, perceptions of the U.S. Federal

government's effectiveness in passing novel but necessary legislation were largely in question,

especially following a series of national and international events (e.g., the COVID-19 pandemic,

gun violence, and natural disasters) that may have emboldened such sentiments across the

country. Thus, *Alarmed* and *Concerned* Americans may not be willing to wait for government

intervention in this crisis; instead, they may be operating under the motivation they need to be

initiators of change regarding the issue of CC.

Study 2 General Discussion

Following Study 1, the focus of Study 2 was to establish effective ways of encouraging

Alarmed and *Concerned* Americans to engage in a specific kind of CC communication called CC

"opinion leadership." This is the process of utilizing the familiarity and trust one holds with

members of their social network to initiate dialogue and, ultimately, persuasion about a specific

topic; Nisbet & Kotcher, 2007). Within the GWSA report on tailored communications strategies,

these researchers specifically identified CC opinion leadership as a task of utmost relevance to

the high-involvement *Alarmed* and *Concerned* Americans, as these individuals tend to hold the

highest knowledge about the issue of CC and are most motivated to shift others' lower CC

beliefs (Roser-Renouf et al., 2015). Encouraging opinion leadership–even in those who may be

most equipped to do so–is not always a straightforward request, however, as psychological

theory also helps elucidate potential behavioral barriers to this kind of request. For example,

theories of personality like the Five Factor Model (Goldberg, 1981, 1990; McCrae & John, 1992)

reveal each of the five personality dimensions can be represented by both positive and negative

traits which correspond with a lower or higher endorsement of that dimension. Specifically, communication-related barriers can be associated with different levels of each of the three "interpersonal" personality traits of (lower) Extraversion, (higher) Agreeableness, and (higher) Neuroticism (Costa & McCrae, 2011). That is, theory would suggest that those lower in Extraversion (characterized by being shy, quiet, and generally not comfortable initiating conversations with other people), higher in Agreeableness (characterized by being non-confrontational, trusting, and generally not effective at arguing with others about disagreements), and higher in Neuroticism (characterized by being nervous, temperamental across all situations, and generally anxious about connecting with others, especially regarding controversial topics; John & Srivastava, 1999), may naturally struggle with this task. Because of these and other barriers, initiating conversations and attempting to persuade others' beliefs about the issue of CC can be difficult, even unattainable. These notions are supported by psychological theories like the congruence principle, which posits individuals tend to seek out communication-related situations congruent with their personality profile (Cote & Moskowitz, 1998; Emmons et al., 1986; Hampson, 2012).

As such, Study 2 participants were presented and asked to rate four messages encouraging CC option leadership that varied by additional information that was included (or not). Specifically, after encouraging CC opinion leadership at the beginning, these messages additionally included either six "strategies" for initiating conversations about CC, six "counterarguments" to common CC misinformation and denial claims, or six "posts" of educational CC content that can be easily shared across social media platforms. Furthermore, the fourth "control" message only included the initial opinion leadership encouragement, followed by a call to action to inspire these participants toward activation. Participants also completed the

Big Five Inventory (John & Srivastava, 1999) to assess their personality profile, based on the Five Factor Model of personality (Goldberg, 1981, 1990; McCrae & John, 1992). Given the understanding of these traits, Study 2 examined whether those with lower Extraversion would find the *Posts* message (hypothesized *a priori*) and the *Strategies* message (analyzed exploratorily) most effective. Next, Study 2 examined whether those with higher Agreeableness would find the *Counters* message (hypothesized *a priori*) and the *Posts* message (analyzed exploratorily) most effective. Finally, Study 2 hypothesized participants with higher Neuroticism would rate each of the three interventions as effective (each hypothesized *a priori*).

Study 2 analyses–inspired by Hirsch and colleagues (2011)–suggested unique but unexpected relationships between the "Big Five" personality traits and effectiveness ratings of the intervention messages (see Table 17). To achieve these findings, Each of the four intervention's effectiveness ratings was regressed using the other three intervention's ratings to save the models' residuals (see Tables 7–10). These residuals–which captured the unique variance in effectiveness ratings for each intervention–were then used to predict participants' personality scores (see Tables 11–15). In turn, the estimates of these models represented the unique relationships between the personality dimensions and the intervention's effectiveness ratings. Although it was expected lower Extraversion would be uniquely related to positive effectiveness ratings of the Posts and Strategies messages, the data suggested that these relationships were neither significant nor in the expected (negative) direction (see Table 11). These trends were also apparent in the relationships between higher Neuroticism and the effectiveness scores of each of the three messages, as these relationships were neither significant nor in the hypothesized (positive) direction (see Table 13). However, expectations regarding higher Agreeableness were partially met, as Agreeableness was positively related to effective

108

ratings of the Posts message but not the Counters message, as originally hypothesized (see Table 12).

Although Study 2 revealed unexpected outcomes, reflection on psychological theory may help to provide some clarity. One explanation may reside in how the messages were specifically tailored to the opinion leadership- and personality-related behavior barriers, especially compared to Hirsch and colleagues' (2011) initial study. That is, while the appeals tested in the initial 2011 study were more directly tailored to the strengths associated with each personality dimension (e.g., part of the Extraversion-tailored product advertisement read "*With XPhone, you'll always be where the excitement is*"), Study 2 tailored the interventions to negative aspects of these personality dimensions (i.e., overcoming difficulties related to dialog initiation about a difficult topic). While these messages were created to help individuals build beliefs they could overcome these barriers, the messages may have, instead, primed negative thoughts about having to overcome these barriers. Alternatively, knowing the barriers associated with these traits– especially lower Extraversion and higher Neuroticism–it may, simply, be more strategic to encourage such individuals to engage in other pro-environmental behaviors (i.e., besides CC opinion leadership–that are less reliant on interpersonal skills and interactions).

Dissertation Limitations and Future Directions

Of course, certain limitations to both Study 1 and Study 2 were identified, and future research is needed to replicate and extend these results. First, the construction of Study 1 pre- and post-intervention items may have been unclear to some participants, consequently affecting the validity and reliability of their responses and these findings. This is especially relevant with the items measuring perceived ease and likelihood of engaging in "general" pro-environmental behaviors. Although a brief definition of pro-environmental behaviors (i.e., "*Please note: 'Pro-*

environmental behaviors' can be defined as any behavior that does not contribute to harming the environment. This term is commonly interchangeable with 'green' behaviors.") was provided before each set of questions, this explanation may have unexpectedly caused undue error in participants' responses to these items. Additionally, the online delivery of this study's survey– using the Connect by CloudResearch marketplace–may have also affected the quality of participants' responses, as experimental control becomes notably compromised when using these kinds of recruitment methods. Because participants were able to complete the survey on their own time and setting, researchers must rely on attention checks and survey metadata (as was the case in Study 1) to ensure participants remained attentive and honest during their participation. This limitation provides an opportunity for future research investigating how the Study 1 messages affect actual engagement in specific pro-environmental behaviors, especially clean electricity practices and products. Future research could also expand the participant recruitment to include the next lower GWSA audience of the *Cautious*. While these Americans tend not to be as passionate about or motivated by the issue of CC, research shows they are the most willing to change their mind about the issue of CC, while also being less connected to news media compared to other Americans (Maibach et al., 2011). Holding more malleable views and being more insulated from negative perceptions of the U.S. Federal Government's effectiveness, these Americans may also be good candidates for certain pro-environmental efforts.

As in Study 1, certain limitations and future directions were identified related to the methodology of Study 2. Although the Study 2 survey included multiple (i.e., six) items measuring participants' perceptions of each intervention's effectiveness, it did not include direct measurement of the intervention's ability to overcome specific barriers to CC opinion leadership. That is, the Study 2 survey was, in a sense, limited in its ability to determine whether the

presented "Strategies," "Counters," and "Posts" were effective at helping to overcome the interpersonal barriers most strongly related to lower Extraversion, higher Agreeableness, and higher Neuroticism. Accordingly, future directions could expand this measurement, while also testing different methods of tailoring to the three interpersonal personality traits. Tailoring interventions both to help overcome personality-related behavioral barriers and accentuate the personality-based skills most relevant to successful CC option leadership may help elucidate when either type of tailoring is most strategic. Similarly to Study 1, future directions could explore these interventions' efficacy to increase actual CC opinion leadership by taking a longitudinal and behavioral approach to data collection.

Conclusion

While *Alarmed* and *Concerned* Americans tend to hold the highest beliefs about and involvement in the issue of CC, attention must be given to the persuasive appeals and approaches to encourage them. Specifically, researchers can–and should–utilize psychological theory to formulate ways to encourage these Americans' engagement in overcoming CC. Such was the case in these two dissertation studies, which collectively relied on the identification of differences in CC-related attitudes and behaviors (through the use of the GWSA framework; Maibach et al., 2011), the utilization of persuasive tailoring (Kreuter & Wray, 2003), and the understanding of psychological antecedents of behavior (Azjen, 1991; Lunenburg, 2011), personality (John & Srivastava, 1999), and the principle of congruence (Cote & Moskowitz, 1998; Emmons et al., 1986; Hampson, 2012) to identify strategic ways of increasing pro-environmentalism. Specifically, when deciding the scope of pro-environmental behavior engagement being encouraged, Study 1 suggests *Alarmed* and *Concerned* Americans are most encouraged by messages that highlight multiple (versus one) behaviors and self-initiation (versus

legislator-initiated) engagement. Although against expectation, these results align with current trends in public CC advocacy efforts, which tend to underscore the necessity for the self-initiation of multiple pro-environmental behaviors. Furthermore, when establishing the effectiveness of messages encouraging CC opinion leadership, tailoring to their personality-related strengths–rather than weaknesses and barriers–may be advantageous to these advocacy efforts. At the same time, knowing the barriers related to the interpersonal personality traits of lower Extraversion, higher Agreeableness, and higher Neuroticism, it may be most advantageous to encourage individuals with these traits to engage in other aspects of pro-environmental efforts. Regardless of the pro-environmental effort, researchers should continue to utilize psychological theory and empirical evidence when crafting persuasive messages, even when targeting *Alarmed* and *Concerned* Americans. In all, significant action toward overcoming the negative effects of CC must still be achieved; thus, maximal efforts to identify strategic methods of pro-environmental persuasion must continue to be made.

References

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2007). The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents. *Journal of Environmental Psychology, 27*, 265-276.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.

Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics*, *95*(9-10), 1082-1095.

Allen, D. E., Singh, B. P., & Dalal, R. C. (2011). Soil health indicators under climate change: a review of current knowledge. *Soil Health and Climate Change*, 25-45.

Alló, M., & Loureiro, M. L. (2014). The role of social norms on preferences towards climate change policies: A meta-analysis. *Energy Policy*, *73*, 563-574.

Altemeyer, B. (1998). The other "authoritarian personality". In *Advances in experimental social psychology* (Vol. 30, pp. 47-92). Academic Press.

Amann, M., Klimont, Z., & Wagner, F. (2013). Regional and global emissions of air pollutants: recent trends and future scenarios. *Annual Review of Environment and Resources*, *38*, 31-55.

Amirkhan, J. H., Risinger, R. T., & Swickert, R. J. (1995). Extraversion: A "hidden" personality

    factor in coping?. *Journal of Personality*, *63*(2), 189-212.

Anderson, C. J. (2003). The psychology of doing nothing: forms of decision avoidance result

    from reason and emotion. *Psychological Bulletin*, *129*(1), 139.

Andersson, M., & von Borgstede, C. (2010). Differentiation of determinants of low-cost and

    high-cost recycling. *Journal of Environmental Psychology*, *30*(4), 402-408.

Arias, P., Bellouin, N., Coppola, E., Jones, R., Krinner, G., Marotzke, J., ... & Zickfeld, K.

    (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working

    Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate

    Change; Technical Summary.

Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the

    HEXACO model of personality structure. *Personality and Social Psychology Review*,

    11(2), 150-166.

Ashton, M. C., & Lee, K. (2009). The HEXACO–60: A short measure of the major dimensions

    of personality. *Journal of Personality Assessment*, *91*(4), 340-345.

Baker, M., Kovaleski, S. F., & Thrush, G. (2023, March 30). *After mass shootings, Republicans expand access to guns*. After Mass Shootings, Republicans Expand Access to Guns. Retrieved April 1, 2023, from https://www.nytimes.com/2023/03/29/us/nashville-gun-laws.html

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1), 14-25.

Bandura, A. (1986). Social foundations of thought and action. *Englewood Cliffs, NJ*, *1986*(23-28).

Bang, G. (2010). Energy security and climate change concerns: Triggers for energy policy change in the United States?. *Energy Policy*, *38*(4), 1645-1653.

Beus, J. M., Dhanani, L. Y., & McCord, M. A. (2015). A meta-analysis of personality and workplace safety: addressing unanswered questions. *Journal of Applied Psychology*, *100*(2), 481.

Bogg, T., & Roberts, B. W. (2004). Conscientiousness and health-related behaviors: a meta-analysis of the leading behavioral contributors to mortality. *Psychological Bulletin*, *130*(6), 887.

Borick, C. P., & Rabe, B. G. (2017). Personal experience, extreme weather events, and

    perceptions of climate change. In *Oxford Research Encyclopedia of Climate Science*.

Boykoff, M. T., & Roberts, J. T. (2007). Media coverage of climate change: Current trends,

    strengths, weaknesses. *Human Development Report*, *2008*(3), 1-53.

Bradley, B. H., Baur, J. E., Banford, C. G., & Postlethwaite, B. E. (2013). Team players and

    collective performance: How agreeableness affects team performance over time. *Small*

    Group Research, *44*(6), 680-711.

Brick, C., & Lewis, G. J. (2016). Unearthing the "green" personality: Core traits predict

    environmentally friendly behavior. *Environment and Behavior*, *48*(5), 635-658.

Brown, S. D., Lent, R. W., Telander, K., & Tramayne, S. (2011). Social cognitive career theory,

    conscientiousness, and work performance: A meta-analytic path analysis. *Journal of*

    Vocational Behavior, *79*(1), 81-90.

Brulle, R. J., Carmichael, J., & Jenkins, J. C. (2012). Shifting public opinion on climate change:

    an empirical assessment of factors influencing concern over climate change in the US,

    2002–2010. *Climatic Change*, *114*(2), 169-188.

Brumfiel, G. (2022, November 2). Vaccines used to be apolitical. now they're a campaign issue. Retrieved April 1, 2023, from https://www.npr.org/sections/health-shots/2022/11/02/1133097215/vaccines-election-campaign-midterms

Burger, J. M. (1999). The foot-in-the-door compliance procedure: A multiple-process analysis and review. *Personality and Social Psychology Review*, *3*(4), 303-325.

Burke, M., Craxton, M., Kolstad, C. D., Onda, C., Allcott, H., Baker, E., ... & Tol, R. S. (2016). Opportunities for advances in climate change economics. *Science*, *352*(6283), 292-293.

Burton, I., Lim, B., Spanger-Siegfried, E., Malone, E. L., & Huq, S. (2005). *Adaptation Policy Frameworks for Climate Change*. Cambridge University Press.

Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N., & Upham, P. (2015). International trends in public perceptions of climate change over the past quarter century. *Wiley Interdisciplinary Reviews: Climate Change*, *6*(1), 35-61.

Carrico, A. R., & Riemer, M. (2011). Motivating energy conservation in the workplace: An evaluation of the use of group-level feedback and peer education. *Journal of Environmental Psychology*, *31*(1), 1-13.

Cesario, J., Grant, H., & Higgins, E. T. (2004). Regulatory fit and persuasion: Transfer from" feeling right.". *Journal of Personality and Social Psychology*, *86*(3), 388.

Chamorro-Premuzic, T., & Furnham, A. (2009). Mainly Openness: The relationship between the

    Big Five personality traits and learning approaches. *Learning and Individual Differences*,

    19(4), 524-529.

Chapman, A. J., McLellan, B. C., & Tezuka, T. (2018). Prioritizing mitigation efforts

    considering co-benefits, equity and energy justice: Fossil fuel to renewable energy

    transition pathways. *Applied Energy*, *219*, 187-198.

Chaudhary, A., & Clark, A. (2022, September 1). *Melting Himalayan Glaciers Are Making*

    Pakistan's Floods Worse. Bloomberg. https://www.bloomberg.com/news/articles/2022-

    09-01/pakistan-floods-worsened-as-global-warming-melts-himalayan-glaciers

Cheung, J. H., Burns, D. K., Sinclair, R. R., Sliter, M., (2017). Amazon Mechanical Turk in

    Organizational Psychology: An Evaluation and Practical Recommendations. *Journal of*

    Business Psychology, *32*, 347-361.

Cheung, S. F., Chan, D. K. S., & Wong, Z. S. Y. (1999). Reexamining the theory of planned

    behavior in understanding wastepaper recycling. *Environment and Behavior*, *31*(5), 587-

    612.

Chiang, Y. H., Hsu, C. C., & Shih, H. A. (2017). Extroversion personality, domain knowledge,

    and the creativity of new product development engineers. *Creativity Research Journal*,

    29(4), 387-396.

Chmielewski, M., & Kucker, S. C. (2020). An MTurk crisis? Shifts in data quality and the

impact on study results. *Social Psychological and Personality Science*, *11*(4), 464-473.

Chryst, B., Marlon, J., van der Linden, S., Leiserowitz, A., Maibach, E., & Roser-Renouf, C.

(2018). Global warming's "Six Americas Short Survey": Audience segmentation of

climate change views using a four question instrument. *Environmental Communication*,

12(8), 1109-1122.

Cialdini, R. B. (1984). *Influence: The new psychology of modern persuasion*. Morrow.

Cobb-Clark, D. A., & Schurer, S. (2012). The stability of big-five personality traits. *Economics

Letters*, *115*(1), 11-15.

Conte, B., Hahnel, U. J., & Brosch, T. (2021). The dynamics of humanistic and biospheric

altruism in conflicting choice environments. *Personality and Individual Differences*, *173*,

110599.

Corner, A., Markowitz, E., & Pidgeon, N. (2014). Public engagement with climate change: the

role of human values. *Wiley Interdisciplinary Reviews: Climate Change*, *5*(3), 411-422.

Costa, D. L., & Kahn, M. E. (2013). Energy conservation "nudges" and environmentalist

ideology: Evidence from a randomized residential electricity field experiment. *Journal of

the European Economic Association*, *11*(3), 680-702.

Costa Jr, P. T., & McCrae, R. R. (2011). The five-factor model, five-factor theory, and

    interpersonal psychology. *Handbook of interpersonal psychology: Theory, Research,*

    Assessment, and Therapeutic Interventions, 91-104.

Côté, S., & Moskowitz, D. S. (1998). On the dynamic covariation between interpersonal

    behavior and affect: prediction from neuroticism, extraversion, and agreeableness.

    Journal of Personality and Social Psychology, *75*(4), 1032.

Crowley, T. J., & Berner, R. A. (2001). CO2 and climate change. *Science*, *292*(5518), 870-872.

Dalton, A. N., & Spiller, S. A. (2012). Too much of a good thing: The benefits of

    implementation intentions depend on the number of goals. *Journal of Consumer*

    Research, *39*(3), 600-614.

Danovaro, R., Corinaldesi, C., Dell'Anno, A., Fuhrman, J. A., Middelburg, J. J., Noble, R. T., &

    Suttle, C. A. (2011). Marine viruses and global climate change. *FEMS Microbiology*

    Reviews, *35*(6), 993-1034.

Davidson, M. D. (2008). Wrongful harm to future generations: The case of climate change.

    Environmental Values, *17*(4), 471-488.

De Groot, J. I., & Steg, L. (2008). Value orientations to explain beliefs related to environmental significant behavior: How to measure egoistic, altruistic, and biospheric value orientations. *Environment and Behavior*, *40*(3), 330-354.

De Groot, J. I., & Steg, L. (2009). Mean or green: which values can promote stable pro–environmental behavior?. *Conservation Letters*, *2*(2), 61-66.

De Leeuw, A., Valois, P., Ajzen, I., & Schmidt, P. (2015). Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions. *Journal of Environmental Psychology*, *42*, 128-138.

DeConto, R. M., & Pollard, D. (2016). Contribution of Antarctica to past and future sea-level rise. *Nature*, *531*(7596), 591-597.

DeConto, R. M., Pollard, D., Alley, R. B., Velicogna, I., Gasson, E., Gomez, N., ... & Dutton, A. (2021). The Paris Climate Agreement and future sea-level rise from Antarctica. *Nature*, *593*(7857), 83-89.

DiClemente, C. C., Marinilli, A. S., Singh, M., & Bellino, L. E. (2001). The role of feedback in the process of health behavior change. *American Journal of Health Behavior*, 25(3), 217-227.

Diener, E., & Larsen, R. J. (1984). Temporal stability and cross-situational consistency of affective, behavioral, and cognitive responses. *Journal of personality and social psychology*, *47*(4), 871.

Dietz, T., Fitzgerald, A., & Shwom, R. (2005). Environmental values. *Annual Review of Environment and Resources*, *30*, 335.

Do, M. H., & Minbashian, A. (2014). A meta-analytic examination of the effects of the agentic and affiliative aspects of extraversion on leadership outcomes. *The Leadership Quarterly*, *25*(5), 1040-1053.

Douglas, B. D., Ewell, P. J., & Brauer, M. (2023). Data quality in online human-subjects research: Comparisons between MTurk, Prolific, CloudResearch, Qualtrics, and SONA. *Plos one*, *18*(3), e0279720.

El-Sayed, A., & Kamel, M. (2020). Climatic changes and their role in emergence and re-emergence of diseases. *Environmental Science and Pollution Research*, *27*(18), 22336-22352.

Elbein, S. (2023, February 1). *Society isn't changing fast enough to stop climate change: Study*. Retrieved April 1, 2023, from https://thehill.com/policy/energy-environment/3839348-society-isnt-changing-fast-enough-to-stop-climate-change-study/

Elliot, A. J., & Devine, P. G. (1994). On the motivational nature of cognitive dissonance: Dissonance as psychological discomfort. *Journal of personality and social psychology*, *67*(3), 382.

Emmons, R. A., Diener, E. D., & Larsen, R. J. (1986). Choice and avoidance of everyday situations and affect congruence: Two models of reciprocal interactionism. *Journal of Personality and Social Psychology*, *51*(4), 815.

Ewart, C. K. (1991). Social action theory for a public health psychology. *American Psychologist*, *46*(9), 931.

Eyring, V., Bony, S., Meehl, G. A., Senior, C. A., Stevens, B., Stouffer, R. J., & Taylor, K. E. (2016). Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization. *Geoscientific Model Development*, *9*(5), 1937-1958.

Fahad, S., Hasanuzzaman, M., Alam, M., Ullah, H., Saeed, M., Khan, I. A., & Adnan, M. (Eds.). (2020). *Environment, Climate, Plant and Vegetation Growth*. Springer International Publishing.

Farrow, K., Grolleau, G., & Ibanez, L. (2017). Social norms and pro-environmental behavior: A review of the evidence. *Ecological Economics*, *140*, 1-13.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical

    power analysis program for the social, behavioral, and biomedical sciences. *Behavior*

    Research Methods, 39, 175–191.

Festinger, L. (1957). A Theory of Cognitive Dissonance. Evanston, IL: Row Peterson, 1957.

Festinger, L. (1962). *A theory of cognitive dissonance* (Vol. 2). Stanford university press.

Fiske, S. T., & Dupree, C. (2014). Gaining trust as well as respect in communicating to

    motivated audiences about science topics. *Proceedings of the National Academy of*

    Sciences, *111*(supplement_4), 13593-13597.

Flatt, V. B. (2007). Taking the Legislative Temperature: Which Federal Climate Change

    Legislative Proposal Is Best. *Nw. L. Rev. Colloquy*, *102*, 123.

Frederickx, S., & Hofmans, J. (2014). The role of personality in the initiation of communication

    situations. *Journal of Individual Differences*.

Freedman, J. L., & Fraser, S. C. (1966). Compliance without pressure: the foot-in-the-door

    technique. *Journal of Personality and Social Psychology*, *4*(2), 195.

Funder, D. C., & Colvin, C. R. (1991). Explorations in behavioral consistency: properties of persons, situations, and behaviors. *Journal of personality and social psychology*, *60*(5), 773.

Füssel, H. M. (2007). Adaptation planning for climate change: concepts, assessment approaches, and key lessons. *Sustainability Science*, *2*(2), 265-275.

Gallivan, N. P., & Brannon, L. A. (2022). Specialty coffee consumption intervention illustrates the utility of behavior feedback messages. *Eating Behaviors*, *45*, 101630.

Gifford, R. (2011). The dragons of inaction: psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, *66*(4), 290.

Goldberg, L. R. (1981). Language and individual differences: The search for universals in personality lexicons. *Review of Personality and Social Psychology*, *2*(1), 141-165.

Goldberg, L. R. (1990). An alternative" description of personality": the big-five factor structure. *Journal of Personality and Social Psychology*, *59*(6), 1216.

Gowdy, J. M. (2008). Behavioral economics and climate change policy. *Journal of Economic Behavior & Organization*, *68*(3-4), 632-644.

Grasso, M. (2007). A normative ethical framework in climate change. *Climatic Change*, *81*(3), 223-246.

Graziano, W. G., Habashi, M. M., Sheese, B. E., & Tobin, R. M. (2007). Agreeableness, empathy, and helping: a person× situation perspective. *Journal of Personality and Social Psychology*, *93*(4), 583.

Griffith, S. (2022). *Electrify: an optimist's playbook for our clean energy future*. MIT Press.

Gustafson, A., Marlon, J. R., Goldberg, M. H., Wang, X., Ballew, M. T., Rosenthal, S. A., & Leiserowitz, A. (2020). Blame where blame is due: many Americans support suing fossil fuel companies for global warming damages. *Environment: Science and Policy for Sustainable Development*, *62*(2), 30-35.

Haidt, J. (2001). The emotional dog and its rational tail: a social intuitionist approach to moral judgment. *Psychological Review*, *108*(4), 814.

Haidt, J. (2008). Morality. *Perspectives on Psychological Science*. 3(1), 65-72.

Hallegatte, S., Lecocq, F., & De Perthuis, C. (2011). Designing climate change adaptation policies: an economic framework. *World Bank Policy Research Working Paper*, (5568).

Hampson, S. E. (2012). Personality processes: Mechanisms by which personality traits "get outside the skin". *Annual Review of Psychology*, *63*, 315.

Hansen, B. B., Grøtan, V., Herfindal, I., & Lee, A. M. (2020). The Moran effect revisited: spatial population synchrony under global warming. *Ecography*, *43*(11), 1591-1602.

Hart, P. S., & Nisbet, E. C. (2012). Boomerang effects in science communication: How motivated reasoning and identity cues amplify opinion polarization about climate mitigation policies. *Communication Research*, *39*(6), 701-723.

Head, B. W. (2008). Wicked Problems in Public Policy. *Public Policy*, *3*(2), 101-118.

Heider, F. (1958) *The Psychology of Interpersonal Relations*. New York: Wiley.

Herring (2020). *What can we do to slow or stop global warming?* National Oceanic and Atmospheric Administration. Retrieved from https://www.climate.gov/news-features/climate-qa/what-can-we-do-slow-or-stop-global-warming

Higgins, E. T. (2000). Making a Good Decision: value from fit. *American Psychologist*, *55*(11), 1217.

Higgins, E. T., Idson, L. C., Freitas, A. L., Spiegel, S., & Molden, D. C. (2003). Transfer of value from fit. *Journal of Personality and Social Psychology*, *84*(6), 1140.

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on

    responsible environmental behavior: A meta-analysis. *The Journal of Environmental*

    Education, *18*(2), 1-8.

Hirsh, J. B. (2010). Personality and environmental concern. *Journal of Environmental*

    Psychology, *30*(2), 245-248.

Hirsh, J. B. (2014). Environmental sustainability and national personality. *Journal of*

    Environmental Psychology, *38*, 233-240.

Hirsh, J. B., & Dolderman, D. (2007). Personality predictors of consumerism and

    environmentalism: A preliminary study. *Personality and Individual Differences*, *43*(6),

    1583-1593.

Hirsh, J. B., Kang, S. K., & Bodenhausen, G. V. (2012). Personalized persuasion: Tailoring

    persuasive appeals to recipients' personality traits. *Psychological Science*, *23*(6), 578-

    581.

Hitlin, P., & Shutava, N. (2022, March 23). Trust in Government: A Close Look at Public

    Perceptions of the Federal Government and Its Employees. Published by Freedman

    Consulting, LLC.

Hock, R. (2005). Glacier melt: a review of processes and their modelling. *Progress in Physical Geography*, *29*(3), 362-391.

Hock, R., G. Rasul, C. Adler, B. Cáceres, S. Gruber, Y. Hirabayashi, … & H. Steltzer, 2019: High Mountain Areas. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 131–202. https://doi.org/10.1017/9781009157964.004.

Hofmann, W., Baumeister, R. F., Förster, G., & Vohs, K. D. (2012). Everyday temptations: an experience sampling study of desire, conflict, and self-control. *Journal of Personality and Social Psychology*, *102*(6), 1318.

Howe, P. D., Marlon, J. R., Mildenberger, M., & Shield, B. S. (2019). How will climate change shape climate opinion?. *Environmental Research Letters*, *14*(11), 113001.

Hruby, D. (2022, October 5). *These melting mountain peaks could kill thousands. Can science help?* Environment. Retrieved from https://www.nationalgeographic.com/environment/article/these-melting-mountain-peaks-could-kill-thousands-can-science-help

Hu, J., Zhang, Z., Jiang, K., & Chen, W. (2019). Getting ahead, getting along, and getting

    prosocial: Examining extraversion facets, peer reactions, and leadership emergence.

    Journal of Applied Psychology, *104*(11), 1369.

Huang, C. (2019). Social network site use and Big Five personality traits: A meta-analysis.

    Computers in Human Behavior, *97*, 280-290.

Hudson, N. W., & Fraley, R. C. (2016). Do people's desires to change their personality traits

    vary with age? An examination of trait change goals across adulthood. *Social*

    Psychological and Personality Science, *7*(8), 847-856.

Hudson, N. W., & Roberts, B. W. (2014). Goals to change personality traits: Concurrent links

    between personality traits, daily behavior, and goals to change oneself. *Journal of*

    Research in Personality, *53*, 68-83.

Hungate, B. A., Dukes, J. S., Shaw, M. R., Luo, Y., & Field, C. B. (2003). Nitrogen and climate

    change. *Science*, *302*(5650), 1512-1513.

Hurst, M., Dittmar, H., Bond, R., & Kasser, T. (2013). The relationship between materialistic

    values and environmental attitudes and behaviors: A meta-analysis. *Journal of*

    Environmental Psychology, *36*, 257-269.

Ickes, W., Snyder, M., & Garcia, S. (1997). Personality influences on the choice of situations. In R. Hogan, J. Johnson, & S. Briggs (Eds.), *Handbook of personality psychology* (pp. 165–195). San Diego, CA: Academic Press.

Incropera, F. P. (2016). *Climate change: a wicked problem: complexity and uncertainty at the intersection of science, economics, politics, and human behavior*. Cambridge University Press.

IPCC, 2001: Climate Change 2001: Synthesis Report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Watson, R.T. and the Core Writing Team (eds.)]. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA, 398 pp.

IPCC, 2005: IPCC Special Report on Carbon Dioxide Capture and Storage. Prepared by Working Group III of the Intergovernmental Panel on Climate Change [Metz, B., O. Davidson, H. C. de Coninck, M. Loos, and L. A. Meyer (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 442 pp.

IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

IPCC, 2019: Technical Summary [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, E. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.- O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 39–69. https://doi.org/10.1017/9781009157964.002

IPCC, 2021: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC, 2022a: *Climate Change 2022: Impacts, Adaptation, and Vulnerability.* Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K.

Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

IPCC, 2022b*: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926

IPCC, 2022c: *Summary for Policymakers*. In: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001.

Jaccard, M. (2020). *The citizen's guide to climate success: Overcoming myths that hinder progress*. Cambridge University Press.

John, O. P., & Srivastava, S. (1999). *The Big-Five trait taxonomy: History, measurement, and theoretical perspectives*. In L. A. Pervin & O. P. John (Eds.), *Handbook of Personality: Theory and research* (Vol. 2, pp. 102–138). New York: Guilford Press.

Kaiser, F. G., Hübner, G., & Bogner, F. X. (2005). Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior 1. *Journal of Applied Social Psychology*, *35*(10), 2150-2170.

Kaplan, S., Bradley, J. C., Luchman, J. N., & Haynes, D. (2009). On the role of positive and negative affectivity in job performance: a meta-analytic investigation. *Journal of Applied Psychology*, *94*(1), 162.

Karau, S. J., & Williams, K. D. (1993). Social loafing: A meta-analytic review and theoretical integration. *Journal of Personality and Social Psychology*, *65*(4), 681.

Karlin, B., Zinger, J. F., & Ford, R. (2015). The effects of feedback on energy conservation: A meta-analysis. *Psychological Bulletin*, *141*(6), 1205.

Kasulis, J. J., Huettner, D. A., & Dikeman, N. J. (1981). The feasibility of changing electricity consumption patterns. *Journal of Consumer Research*, *8*(3), 279-290.

Katz, D. (1960). The functional approach to the study of attitudes. *Public opinion quarterly*, *24*(2), 163-204.

Kircaburun, K., Alhabash, S., Tosuntaş, Ş. B., & Griffiths, M. D. (2020). Uses and gratifications
of problematic social media use among university students: A simultaneous examination
of the Big Five of personality traits, social media platforms, and social media use
motives. *International Journal of Mental Health and Addiction*, *18*, 525-547.

Kleine, J., Wagner, N., & Weller, T. (2016). Openness endangers your wealth: Noise trading and
the big five. *Finance Research Letters*, *16*, 239-247.

Klöckner, C. A. (2013). A comprehensive model of the psychology of environmental
behaviour—A meta-analysis. *Global Environmental Change*, *23*(5), 1028-1038.

Knez, I. (2016). Is climate change a moral issue? Effects of egoism and altruism on pro-
environmental behavior. *Current Urban Studies*, *4*(2), 157-174.

Koenig, W. D. (2002). Global patterns of environmental synchrony and the Moran effect.
Ecography, *25*(3), 283-288.

Krebs, P., Prochaska, J. O., & Rossi, J. S. (2010). A meta-analysis of computer-tailored
interventions for health behavior change. *Preventive Medicine*, *51*(3-4), 214–221.
doi:10.1016/j.ypmed.2010.06.004

Kreuter, M. W., Strecher, V. J., & Glassman, B. (1999). One size does not fit all: the case for
tailoring print materials. *Annals of Behavioral Medicine*, *21*(4), 276.

Kreuter, M. W., & Wray, R. J. (2003). Tailored and targeted health communication: strategies

    for enhancing information relevance. *American Journal of Health Behavior*, *27*(1), S227-

    S232.

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*(1), 7-43.

Lahey, B. B. (2009). Public health significance of neuroticism. *American Psychologist*, *64*(4),

    241.

Lavy, S., & Littman-Ovadia, H. (2017). My better self: Using strengths at work and work

    productivity, organizational citizenship behavior, and satisfaction. *Journal of Career*

    Development, *44*(2), 95-109.

Lee, A. Y., & Aaker, J. L. (2004). Bringing the frame into focus: the influence of regulatory fit

    on processing fluency and persuasion. *Journal of Personality and Social Psychology*,

    86(2), 205.

Lee, D. K. (2020). Data transformation: a focus on the interpretation. *Korean journal of*

    anesthesiology, *73*(6), 503-508.

Lee, J. Y., Marotzke, J., Bala, G., Cao, L., Corti, S., Dunne, J. P., ... & Zappa, G. (2021). Future global climate: scenario-based projections and near-term information. IPCC.

Leiserowitz, A. (2007). International public opinion, perception, and understanding of global climate change. *Human Development Report*, *2008*, 1-40.

Leiserowitz, A., Roser-Renouf, C., Marlon, J., & Maibach, E. (2021). Global Warming's Six Americas: A review and recommendations for climate change communication. *Current Opinion in Behavioral Sciences*, *42*, 97-103.

Locke, E. A. (1996). Motivation through conscious goal setting. *Applied and Preventive Psychology*, *5*(2), 117-124.

Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting & task performance*. Prentice-Hall, Inc.

Lorenzoni, I., & Pidgeon, N. F. (2006). Public views on climate change: European and USA perspectives. *Climatic Change*, *77*(1), 73-95.

Lui, L., & Standing, L. (1989). Communicator credibility: Trustworthiness defeats expertness. *Social Behavior & Personality: An international journal*, *17*(2).

Lunenburg, F. C. (2011). Goal-setting theory of motivation. *International Journal of Management, Business, and Administration*, *15*(1), 1-6.

Lustria, M. L. A., Cortese, J., Gerend, M. A., Schmitt, K., Kung, Y. M., & McLaughlin, C. (2016). A model of tailoring effects: a randomized controlled trial examining the mechanisms of tailoring in a web-based STD screening intervention. *Health Psychology*, 35(11), 1214.

Luttrell, A., Petty, R. E., Briñol, P., & Wagner, B. C. (2016). Making it moral: Merely labeling an attitude as moral increases its strength. *Journal of Experimental Social Psychology*, *65*, 82-93.

Lynch Jr, J. G., Netemeyer, R. G., Spiller, S. A., & Zammit, A. (2010). A generalizable scale of propensity to plan: The long and the short of planning for time and for money. *Journal of Consumer Research*, *37*(1), 108-128.

Maibach, E. W., Leiserowitz, A., Roser-Renouf, C., & Mertz, C. K. (2011). Identifying like-minded audiences for global warming public engagement campaigns: An audience segmentation analysis and tool development. *PloS one*, *6*(3), e17571.

Malhi, G. S., Kaur, M., & Kaushik, P. (2021). Impact of climate change on agriculture and its mitigation strategies: A review. *Sustainability*, *13*(3), 1318.

Markowitz, E. M. (2012). Is climate change an ethical issue? Examining young adults' beliefs about climate and morality. *Climatic Change*, *114*(3), 479-495.

Markowitz, E. M., Goldberg, L. R., Ashton, M. C., & Lee, K. (2012). Profiling the "pro-environmental individual": A personality perspective. *Journal of Personality*, *80*(1), 81-111.

Marshall, G. (2015). *Don't even think about it: Why our brains are wired to ignore climate change*. Bloomsbury Publishing USA.

Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 553–672, doi:10.1017/9781009157896.006.

McCarty, J. P. (2001). Ecological consequences of recent climate change. *Conservation Biology*, *15*(2), 320-331.

McCollum, D., Krey, V., Kolp, P., Nagai, Y., & Riahi, K. (2014). Transport electrification: A key element for energy system transformation and climate stabilization. *Climatic Change*, *123*(3), 651-664.

McCrae, R. R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of Personality and Social Psychology*, *52*(6), 1258.

McCrae R. R., & Costa, Jr, P. T. (1990). Personality in adulthood. New York: Guilford.

McCrae, R. R., & Costa Jr, P. T. (1997). Conceptions and correlates of openness to experience. In *Handbook of Personality Psychology* (pp. 825-847). Academic Press.

McCrae, R. R., & Costa, P. T., Jr. (2008). The five-factor theory of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of Personality: Theory and Research* (pp. 159–181). The Guilford Press.

McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality*, *60*(2), 175-215.

McGuire, W. J. (1964). Inducing resistance to persuasion. Some contemporary approaches. *CC Haaland and WO Kaelber (Eds.), Self and Society. An Anthology of Readings, Lexington, Mass.(Ginn Custom Publishing) 1981, pp. 192-230.*

Milfont, T. L. (2009). A functional approach to the study of environmental attitudes. *Medio ambiente y comportamiento humano*, *10*(3), 235-252.

Milfont, T. L., & Sibley, C. G. (2012). The big five personality traits and environmental engagement: Associations at the individual and societal level. *Journal of Environmental Psychology*, *32*(2), 187-195.

Molloy, G. J., O'carroll, R. E., & Ferguson, E. (2014). Conscientiousness and medication adherence: a meta-analysis. *Annals of Behavioral Medicine*, *47*(1), 92-101.

Montzka, S. A., Dlugokencky, E. J., & Butler, J. H. (2011). Non-CO2 greenhouse gasses and climate change. *Nature*, *476*(7358), 43-50.

Moser, S. C. (2010). Communicating climate change: history, challenges, process and future directions. *Wiley Interdisciplinary Reviews: Climate Change*, *1*(1), 31-53.

National Academy of Sciences. (2020). *Climate change: Evidence and causes: Update 2020*. The National Academies Press, Washington, DC, p. B-2.

Nisbet, M. C., & Kotcher, J. E. (2009). A two-step flow of influence? Opinion-leader campaigns on climate change. *Science Communication*, *30*(3), 328-354.

Nießen, D., Schmidt, I., Groskurth, K., Rammstedt, B., & Lechner, C. M. (2022). The Internal–External Locus of Control Short Scale–4 (IE-4): a comprehensive validation of the English-language adaptation. *PLoS One*, *17*(7), e0271289.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*, *41*(5), 715-740.

Noar, S. M., Benac, C. N., & Harris, M. S. (2007). Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychological Bulletin*, *133*(4), 673.

Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2008). Normative social influence is underdetected. *Personality and Social Psychology Bulletin*, *34*(7), 913-923.

O'Neill, B. C., Tebaldi, C., Van Vuuren, D. P., Eyring, V., Friedlingstein, P., Hurtt, G., ... & Sanderson, B. M. (2016). The scenario model intercomparison project (ScenarioMIP) for CMIP6. *Geoscientific Model Development*, *9*(9), 3461-3482.

Oerlemans, J. (2001). *Glaciers and climate change*. CRC Press.

Oreg, S., & Sverdlik, N. (2014). Source personality and persuasiveness: Big Five predispositions to being persuasive and the role of message involvement. *Journal of Personality*, *82*(3), 250-264.

Peláez, M. J., Coo, C., & Salanova, M. (2020). Facilitating work engagement and performance through strengths-based micro-coaching: a controlled trial study. *Journal of Happiness Studies*, *21*(4), 1265-1284.

Petty, R. E., Brinol, P., & Priester, J. R. (2009). Mass media attitude change: Implications of the elaboration likelihood model of persuasion. In *Media Effects* (pp. 141-180). Routledge.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In *Communication and persuasion* (pp. 1-24). Springer, New York, NY.

Pezenik, S. P., & Haslett, C. (2022, August 17). Review finds CDC mishandled COVID-19 pandemic response. Retrieved April 1, 2023, from https://abcnews.go.com/Politics/cdc-covid-guidance-confusing-overwhelming-organization-overhaul/story?id=88502792

Rao, S., Klimont, Z., Smith, S. J., Van Dingenen, R., Dentener, F., Bouwman, L., ... & Tavoni, M. (2017). Future air pollution in the Shared Socio-economic Pathways. *Global Environmental Change*, *42*, 346-358.

Renn, O., & Levine, D. (1991). Credibility and trust in risk communication. In *Communicating Risks to the Public* (pp. 175-217). Springer, Dordrecht.

Reno, R. R., Cialdini, R. B., & Kallgren, C. A. (1993). The transsituational influence of social norms. *Journal of Personality and Social Psychology*, *64*(1), 104.

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155-169.

Roberts, B. W., & Mroczek, D. (2008). Personality trait change in adulthood. *Current Directions in Psychological Science*, *17*(1), 31-35.

Roberts, S. G., Wilson, R., Fedurek, P., & Dunbar, R. I. (2008). Individual differences and personal social network size and structure. *Personality and Individual Differences*, *44*(4), 954-964.

Rosen, P. A., & Kluemper, D. H. (2008). The impact of the big five personality traits on the acceptance of social networking websites. *AMCIS 2008 proceedings*, 274.

Roser-Renouf, C., Stenhouse, N., Rolfe-Redding, J., Maibach, E., & Leiserowitz, A. (2015). Engaging diverse audiences with climate change: Message strategies for global warming's six Americas. In *The Routledge Handbook of Environment and Communication* (pp. 388-406). Routledge.

Sandifer, P. A., & Scott, G. I. (2021). Coastlines, Coastal Cities, and Climate Change: A Perspective on Urgent Research Needs in the United States. *Frontiers in Marine Science*, *8*, 631986.

Sandstrom, G. M., & Boothby, E. J. (2021). Why do people avoid talking to strangers? A mini meta-analysis of predicted fears and actual experiences talking to a stranger. *Self and Identity*, *20*(1), 47-71.

Sarmiento, J. L., Hughes, T., Stouffer, R. J., & Manabe, S. (1998). Simulated response of the

    ocean carbon cycle to anthropogenic climate warming. *Nature*, *393*(6682), 245-249.

Schäfer, M. S., & Schlichting, I. (2014). Media representations of climate change: A meta-

    analysis of the research field. *Environmental Communication*, *8*(2), 142-160.

Schroeder, P., & Lang, H. (2023, March 28). *US regulator CITES 'terrible' risk management for*

    Silicon Valley Bank failure. US regulator cites 'terrible' risk management for Silicon

    Valley Bank failure. Retrieved April 1, 2023, from

    https://www.reuters.com/markets/us/us-regulators-face-sharp-questions-congress-over-

    bank-collapses-2023-03-28/

Schultz, P. W. (1999). Changing behavior with normative feedback interventions: A field

    experiment on curbside recycling. *Basic and Applied Social Psychology*, *21*(1), 25-36.

Sharma, L., Markon, K. E., & Clark, L. A. (2014). Toward a theory of distinct types of

    "impulsive" behaviors: a meta-analysis of self-report and behavioral measures.

    Psychological Bulletin, *140*(2), 374.

Shaw, B. R., Radler, B., Chenoweth, R., Heiberger, P., & Dearlove, P. (2011). Predicting intent

    to install a rain garden to protect a local lake: An application of the theory of planned

    behavior. *Journal of Extension*, *49*(4), 4FEA6.

Shin, F., & Preston, J. L. (2021). Green as the gospel: The power of stewardship messages to

    improve climate change attitudes. *Psychology of Religion and Spirituality*, *13*(4), 437.

Shum, R. Y. (2012). Effects of economic recession and local weather on climate change

    attitudes. *Climate Policy*, *12*(1), 38-49.

Sidanius, J., & Pratto, F. (2001). *Social dominance: An Intergroup Theory of Social Hierarchy*

    and Oppression. Cambridge University Press.

Sisco, M. R. (2021). The effects of weather experiences on climate change attitudes and

    behaviors. *Current Opinion in Environmental Sustainability*, *52*, 111-117.

Smith, M. B., Bruner, J. S., & White, R. W. (1956). Opinions and personality.

Sniehotta, F. F., Nagy, G., Scholz, U., & Schwarzer, R. (2006). The role of action control in

    implementing intentions during the first weeks of behaviour change. *British Journal of*

    Social Psychology, *45*(1), 87-106.

Soliño, M., & Farizo, B. A. (2014). Personal traits underlying environmental preferences: A

    discrete choice experiment. *PloS one*, *9*(2), e89603.

Soutter, A. R. B., Bates, T. C., & Mõttus, R. (2020). Big Five and HEXACO personality traits, proenvironmental attitudes, and behaviors: A meta-analysis. *Perspectives on Psychological Science*, *15*(4), 913-941.

Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with" green consumerism". *Social Psychology Quarterly*, 388-399.

Spence, A., Poortinga, W., Butler, C., & Pidgeon, N. F. (2011). Perceptions of climate change and willingness to save energy related to flood experience. *Nature Climate Change*, *1*(1), 46-49.

Srivastava, S., John, O. P., Gosling, S. D., & Potter, J. (2003). Development of personality in early and middle adulthood: Set like plaster or persistent change?. *Journal of Personality and Social Psychology*, *84*(5), 1041.

Stanley, S. K., & Wilson, M. S. (2019). Meta-analysing the association between social dominance orientation, authoritarianism, and attitudes on the environment and climate change. *Journal of Environmental Psychology*, *61*, 46-56.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309-317.

Stenseth, N. C., Mysterud, A., Ottersen, G., Hurrell, J. W., Chan, K. S., & Lima, M. (2002). Ecological effects of climate fluctuations. *Science*, *297*(5585), 1292-1296.

Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*(3), 407-424.

Stern, P. C., Kalof, L., Dietz, T., & Guagnano, G. A. (1995). Values, beliefs, and proenvironmental action: Attitude formation toward emergent attitude objects 1. *Journal of Applied Social Psychology*, *25*(18), 1611-1636.

Sugiyama, M. (2012). Climate change mitigation and electrification. *Energy Policy*, *44*, 464-468.

Taylor, S., & Todd, P. (1995). An integrated model of waste management behavior: A test of household recycling and composting intentions. *Environment and Behavior*, *27*(5), 603-630.

Termeer, C., Dewulf, A., & Breeman, G. (2013). Governance of wicked climate adaptation problems. In *Climate Change Governance* (pp. 27-39). Springer, Berlin, Heidelberg.

The jamovi project (2022). *jamovi* (Version 2.3) [Computer Software]. Retrieved from https://www.jamovi.org

Trumbo, W., Garrett, J., & O'Keefe, C., (2001). Intention to conserve water: Environmental

   values, planned behavior, and information effects. A comparison of three communities

   sharing a watershed. *Society & Natural Resources*, *14*(10), 889-899.

Union of Concerned Scientists (n.d.). *Take Action*. Retrieved from https://www.ucsusa.org/take-

   action

United Nations (n.d.). *Start with these ten actions!* Retrieved from

   https://www.un.org/en/actnow/ten-actions

United States Environmental Protection Agency (2022a). *What You Can Do About Climate

   Change*. Retrieved from https://www.epa.gov/climate-change/what-you-can-do-about-

   climate-change

United States Environmental Protection Agency (2022b). *What You Can Do About Climate

   Change — Energy*. Retrieved from https://www.epa.gov/climate-change/what-you-can-

   do-about-climate-change-energy

United States Environmental Protection Agency (n.d.). *Sources of Greenhouse Gas Emissions*.

   Retrieved from https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

Van der Linden, S., Leiserowitz, A., Rosenthal, S., & Maibach, E. (2017). Inoculating the public

   against misinformation about climate change. *Global challenges*, *1*(2), 1600008.

Valois, P., Talbot, D., Bouchard, D., Renaud, J. S., Caron, M., Canuel, M., & Arrambourg, N. (2020). Using the theory of planned behavior to identify key beliefs underlying heat adaptation behaviors in elderly populations. *Population and Environment*, *41*(4), 480-506.

Vassileva, I., Dahlquist, E., Wallin, F., & Campillo, J. (2013). Energy consumption feedback devices' impact evaluation on domestic energy use. *Applied Energy*, *106*, 314-320.

Vedel, A. (2014). The Big Five and tertiary academic performance: A systematic review and meta-analysis. *Personality and Individual Differences*, *71*, 66-76.

Vichi, M., Manzini, E., Fogli, P. G., Alessandri, A., Patara, L., Scoccimarro, E., ... & Navarra, A. (2011). Global and regional ocean carbon uptake and climate change: sensitivity to a substantial mitigation scenario. *Climate Dynamics*, *37*(9), 1929-1947.

Wang, X. (2017). Risk perceptions, moral attitudes, and anticipated guilt in US consumers' climate change behavioral intentions. *Journal of Risk Research*, *20*(12), 1554-1567.

Weber, E. U. (2010). What shapes perceptions of climate change?. *Wiley Interdisciplinary Reviews: Climate Change*, *1*(3), 332-342.

Weber, E. U. (2016). What shapes perceptions of climate change? New research since 2010. *Wiley Interdisciplinary Reviews: Climate Change*, *7*(1), 125-134.

Wheeler, T., & Von Braun, J. (2013). Climate change impacts on global food security. *Science*, *341*(6145), 508-513.

Wilkie, C. (2023, February 16). U.S. will default this summer unless Congress raises debt limit, CBO warns. Retrieved April 1, 2023, from https://www.cnbc.com/2023/02/15/debt-ceiling-us-is-projected-to-default-between-july-and-september-if-congress-doesnt-raise-limits-cbo-says.html

Wilkinson, K. (2021). *The Climate Crisis Is a Call to Action. These 5 Steps Helped Me Figure Out How to Be of Use*. Time. https://time.com/6071765/what-can-i-do-to-fight-climate-change/

Williams, P. G., Rau, H. K., Cribbet, M. R., & Gunn, H. E. (2009). Openness to experience and stress regulation. *Journal of Research in Personality*, *43*(5), 777-784.

Wolsko, C., Ariceaga, H., & Seiden, J. (2016). Red, white, and blue enough to be green: Effects of moral framing on climate change attitudes and conservation behaviors. *Journal of Experimental Social Psychology*, *65*, 7-19.

Wullenkord, M. C., & Reese, G. (2021). Avoidance, rationalization, and denial: defensive self-protection in the face of climate change negatively predicts pro-environmental behavior. *Journal of Environmental Psychology*, *77*, 101683.

Yadoo, A., & Cruickshank, H. (2012). The role for low carbon electrification technologies in poverty reduction and climate change strategies: A focus on renewable energy mini-grids with case studies in Nepal, Peru and Kenya. *Energy Policy*, *42*, 591-602.

Zellars, K. L., & Perrewé, P. L. (2001). Affective personality and the content of emotional social support: coping in organizations. *Journal of Applied Psychology*, *86*(3), 459.

Zerega Jr, W. D., Tseng, M. S., & Greever, K. B. (1976). Stability and concurrent validity of the Rotter internal-external locus of control scale. *Educational and Psychological Measurement*, *36*(2), 473-475.

Zhang, F., Baranova, A., Zhou, C., Cao, H., Chen, J., Zhang, X., & Xu, M. (2021). Causal influences of neuroticism on mental health and cardiovascular disease. *Human Genetics*, *140*(9), 1267-1281.

Zhang, R., & Fujimori, S. (2020). The role of transport electrification in global climate change mitigation scenarios. *Environmental Research Letters*, *15*(3), 034019.

Appendix A - Studies 1 & 2 Prescreening Materials

GWSA's Six America's Short SurveY (SASSY):

(Chryst, Marlon, van der Linden, Leiserowitz, Maibach, & Roser-Renouf, 2018)

1. *How important is the issue of global warming to you personally*?
    a. Extremely important
    b. Very important
    c. Somewhat important
    d. Not too important
    e. Not at all Important
2. *How worried are you about global warming*?
    a. Very worried
    b. Somewhat worried
    c. Not very worried
    d. Not at all worried
3. *How much do you think global warming will harm you personally*?
    a. A great deal
    b. A moderate amount
    c. Only a little
    d. Not at all
    e. Don't know
4. *How much do you think global warming will harm future generations*?
    a. A great deal
    b. A moderate amount
    c. Only a little
    d. Not at all
    e. Don't know

Voting History:

Have you voted in a government election over the past 3 years?

1. No
2. **Yes**

(*This Pre-Screening Item is unique to Study 1)

Reading Comprehension:

Please read the passage and then choose the best answer to the question below.

Turtles have been around for more than 200 million years. Covered by their shells, turtles are walking houses. Scientists think they are the most ancient of all reptiles. Turtles live in many places on land and in water. Like all reptiles, they are cold-blooded. Turtles that live where winters are cold usually hibernate. Turtles eat insects, fish, and frogs. They also munch on plants, including fruit and flowers. The largest turtle is the leatherback, which can weigh more than 2,000 pounds! That's one huge reptile!

The title that best summarizes this passage is…
  A. Places Where Turtles Live
  B. Interesting Facts About Turtles
  C. My Best Friend, Turtle
  D. Why Turtles Need Protection

Appendix B - Study 1 Pre- and Post-Intervention Questionnaire

Perceptions of Pro-Environmental Behaviors:

I believe engaging in pro-environmental behaviors, in general, is _____.

(*Pre- and Post-Intervention)

- Easy
- Demanding
- Attainable
- Difficult
    - 1. Strongly Disagree – 7. Strongly Agree

I believe committing to clean electricity practices and products in my life is _____.

(*Pre- and Post-Intervention)

- Easy
- Demanding
- Attainable
- Difficult
    - 1. Strongly Disagree – 7. Strongly Agree

Inclination toward Pro-Environmental Behaviors:

Over the past month, how likely were you to engage, generally, in pro-environmental behaviors?

(*Pre-Intervention)

- 1. Extremely Unlikely – 7. Extremely Likely

Over the next month, how likely are you to engage, generally, in pro-environmental behaviors?

(*Post-Intervention)

- 1. Extremely Unlikely – 7. Extremely Likely

Over the past month, how likely were you to use clean electricity practices and products?

(*Pre-Intervention)

- 1. Extremely Unlikely – 7. Extremely Likely

Over the next month, how likely were you to use clean electricity practices and products?

(*Post-Intervention)

- 1. Extremely Unlikely – 7. Extremely Likely

Appendix C - Big Five Inventory (John & Srivastava, 1999)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

Disagree strongly (1) – Disagree a little (2) – Neither agree nor disagree (3)
Agree a little (4) – Agree Strongly (5)

I see myself as someone who...

____1. Is talkative

____2. Tends to find fault with others

____3. Does a thorough job

____4. Is depressed, blue

____5. Is original, comes up with new ideas

____6. Is reserved

____7. Is helpful and unselfish with others

____8. Can be somewhat careless

____9. Is relaxed, handles stress well

____10. Is curious about many different things

____11. Is full of energy

____12. Starts quarrels with others

____13. Is a reliable worker

____14. Can be tense

____15. Is ingenious, a deep thinker

____16. Generates a lot of enthusiasm

____17. Has a forgiving nature

____18. Tends to be disorganized

____19. Worries a lot

____20. Has an active imagination

____21. Tends to be quiet

_____22. Is generally trusting

_____23. Tends to be lazy

_____24. Is emotionally stable, not easily upset

_____25. Is inventive

_____26. Select "slightly agree" here

_____27. Has an assertive personality

_____28. Can be cold and aloof

_____29. Perseveres until the task is finished

_____30. Can be moody

_____31. Values artistic, aesthetic experiences

_____32. Is sometimes shy, inhibited

_____33. Is considerate and kind to almost everyone

_____34. Does things efficiently

_____35. Remains calm in tense situations

_____36. Prefers work that is routine

_____37. Is outgoing, sociable

_____38. Is sometimes rude to others

_____39. Makes plans and follows through with them

_____40. Gets nervous easily

_____41. Likes to reflect, play with ideas

_____42. Has few artistic interests

_____43. Likes to cooperate with others

_____44. Is easily distracted

_____45. Is sophisticated in art, music, or literature

Extraversion: 1, 6R, 11, 16, 21R, 26, 31R, 36

Agreeableness: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42

Conscientiousness: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R

Neuroticism: 4, 9R, 14, 19, 24R, 29, 34R, 39

Openness: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

("R" denotes reverse-scored item)

Appendix D - Study 1 Message Interventions

*Please Note: Differences in wording between the messages are highlighted in purple.

<div align="right"><u>*1) Multiple–Self* message</u>:</div>

Climate change is an extremely serious problem. Our ability to overcome its effects will require each and every one of us to act.

Thankfully, there are **many different types of actions you can take** to ensure we are successful.

For example, **here are the 7 most effective behavior-based solutions to climate change we all should be engaging in**:

- **Commit to Clean Electricity Practices & Products** (for example, switching to efficient electric appliances and rechargeable products & utilizing electric means of transportation whenever possible)
- **Conserve Energy** (for example, unplugging products and appliances that are not commonly used & installing smart thermostats to strategically cool/heat your residence)
- **Reduce Food & Water Waste** (for example, practicing at-home composting of food scraps & refraining from lengthy showers)
- **Buy Eco-Friendly Products** (for example, purchasing recyclable or compostable products & prioritizing eco-conscious brands and companies)
- **Help to Protect Your Local Ecosystems** (for example, growing native wildflowers in your home garden & picking up littered trash in public spaces)
- **Avoid Single-Use Goods** (for example, obtaining reusable everyday products & abstaining from buying goods in single-use plastic containers)
- **Eat More Plants** (for example, implementing "meatless" days into your week & purchasing produce at local/farmers' markets)

Taking the initiative of engaging in these behaviors–**rather than waiting on others**–is arguably one of **our best paths forward**.

Not only will you help **combat climate change from multiple angles**, but you will also be **setting an example** of working from the bottom-up (at the individual level) to affect necessary change.

So, what new actions can you start taking today?

Climate change is an extremely serious problem. Our ability to overcome its effects will require each and every one of us to act.

Thankfully, there is **one specific type of action you can take** to ensure we are successful.

That is, **here is the most effective behavior-based solutions to climate change we all should be engaging in**:

- **Commit to Clean Electricity Practices & Products** (for example, switching to efficient electric appliances and rechargeable products & utilizing electric means of transportation whenever possible)

Taking the initiative of engaging in these behaviors–**rather than waiting on others**–is arguably one of **our best paths forward**.

Not only will you help **combat climate change from multiple angles**, but you will also be **setting an example** of working from the bottom-up (at the individual level) to affect necessary change.

So, what new actions can you start taking today?

Climate change is an extremely serious problem. Our ability to overcome its effects will require each and every one of us to act.

Thankfully, there are **many different types of actions you can encourage Legislators to prioritize** to ensure we are successful.

For example, **here are the 7 most effective behavior-based solutions to climate change Legislators should help make it easier for use to engage in**:

- **Commit to Clean Electricity Practices & Products** (for example, switching to efficient electric appliances and rechargeable products & utilizing electric means of transportation whenever possible)
- **Conserve Energy** (for example, unplugging products and appliances that are not commonly used & installing smart thermostats to strategically cool/heat your residence)
- **Reduce Food & Water Waste** (for example, practicing at-home composting of food scraps & refraining from lengthy showers)
- **Buy Eco-Friendly Products** (for example, purchasing recyclable or compostable products & prioritizing eco-conscious brands and companies)
- **Help to Protect Your Local Ecosystems** (for example, growing native wildflowers in your home garden & picking up littered trash in public spaces)
- **Avoid Single-Use Goods** (for example, obtaining reusable everyday products & abstaining from buying goods in single-use plastic containers)
- **Eat More Plants** (for example, implementing "meatless" days into your week & purchasing produce at local/farmers' markets)

Passing legislation making it easier to engage in these behaviors–rather than relying on individuals to take different actions themselves– is arguably one of **our best paths forward**.

Not only will you help **combat climate change from multiple angles**, but you will also be **setting an example** of working from the top-down (at the legislative level) to affect necessary change.

So, what new legislation can you start advocating for today?

Climate change is an extremely serious problem. Our ability to overcome its effects will require each and every one of us to act.

Thankfully, there are **<u>many different types of actions you can encourage Legislators to prioritize</u>** to ensure we are successful.

For example, **here is the most effective behavior-based solutions to climate change Legislators should help make it easier for us to engage in**:

- **<u>Commit to Clean Electricity Practices & Products</u>** (for example, switching to efficient electric appliances and rechargeable products & utilizing electric means of transportation whenever possible)

Passing legislation making it easier to engage in these behaviors–rather than relying on individuals to take different actions themselves– is arguably one of **our best paths forward**.

Not only will you help **combat climate change from multiple angles**, but you will also be **setting an example** of working from the top-down (at the legislative level) to affect necessary change.

So, what new legislation can you start advocating for today?

Appendix E - Rotter's Locus of Control Scale (1966)

For each question select the statement that you agree with the most.

1. a. Children get into trouble because their parents punish them too much.

b. The trouble with most children nowadays is that their parents are too easy with them.

2. a. Many of the unhappy things in people's lives are partly due to bad luck.

b. People's misfortunes result from the mistakes they make.

3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.

b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world

b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries

5. a. The idea that teachers are unfair to students is nonsense.

b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6. a. Without the right breaks one cannot be an effective leader.

b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try, some people just don't like you.

b. People who can't get others to like them don't understand how to get along with others.

8. a. Heredity plays the major role in determining one's personality

b. It is one's experiences in life which determine what they're like.

9. a. I have often found that what is going to happen will happen.

b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.

b. Many times exam questions tend to be so unrelated to course work that studying in really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.

b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.

b. This world is run by the few people in power, and there is not much the little guy can do about it.

13. a. When I make plans, I am almost certain that I can make them work.

b. It is not always wise to plan too far ahead because many things turn out to- be a matter of good or bad fortune anyhow.

14. a. There are certain people who are just no good.

b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.

b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.

b. Getting people to do the right thing depends upon ability. Luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.

b. By taking an active part in political and social affairs the people can control world events.

18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.

b. There really is no such thing as "luck."

19. a. One should always be willing to admit mistakes.

b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.

b. How many friends you have depends upon how nice a person you are.

21. a. In the long run the bad things that happen to us are balanced by the good ones.

b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a. With enough effort we can wipe out political corruption.

b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give.

b. There is a direct connection between how hard 1 study and the grades I get.

24. a. A good leader expects people to decide for themselves what they should do.

b. A good leader makes it clear to everybody what their jobs are.

25. a. Many times I feel that I have little influence over the things that happen to me.

b. It is impossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.

b. There's not much use in trying too hard to please people, if they like you, they like you.

27. a. There is too much emphasis on athletics in high school.

b. Team sports are an excellent way to build character.

28. a. What happens to me is my own doing.

b. Sometimes I feel that I don't have enough control over the direction my life is taking.

29. a. Most of the time I can't understand why politicians behave the way they do.

b. In the long run the people are responsible for bad government on a national as well as on a local level.

Appendix F - Studies 1 & 2 Demographic Questionnaires' Items

Age:

Please enter your current age as a whole number (i.e., "37") in the text box below.

Biological Sex:

Please enter the sex that you were assigned at birth.

- Female
- Male
- Intersex
- Other

Race:

Please select the identity that best describes you.

- Asian or Pacific Islander
- Black or African American
- Hispanic, Latinx, or Spanish Origin
- Native American or Alaska Native
- White or Caucasian
- Biracial or Multiracial
- A race/ethnicity not shown here

Political Ideology:

Please rate the extent to which you identify ideologically as Conservative/Liberal.

1. Strongly Conservative
2. Conservative
3. Leaning Conservative
4. Moderate
5. Leaning Liberal
6. Liberal
7. Strongly Liberal

<u>Study 1 Recall Item</u>:

Which of the following behavior groups did you see previously in the survey?

    A. Avoiding Aviation Travel
    B. Protest Against Environmental Offenders
    C. Investing in Green Companies and Industries
    D. Committing to Clean Electricity Practices and Products

<u>Study 2 Recall Item</u>:

Which of the following themes of information was not presented earlier in the survey?

    A. Strategies for initiating conversations about climate change
    B. Solutions to climate change that more people should know about
    C. Counter-information to combat specific climate-denial arguments
    D. Educational information about climate change that can be easily shared on social media

Appendix G - Study 2 Message Interventions

*Please Note: Differences in wording between the messages are highlighted in yellow.

<div align="right"><u>*Preface & Instructions*</u>:</div>

Hello, and thank you for participating in our research study!

For this survey, our research team is specifically searching for **<u>individuals like you</u>** who take the issue of Climate Change seriously and are committed to solving it. **We need your help**!

We value the opinions and experiences of everyday individuals like you, and **<u>we greatly appreciate your contribution here to the Climate Change advocacy movement</u>**.

Across the next part of the survey, you will be shown four sets of information. **After you read each set of information, you will then rate that information across a number of characteristics on the following page**.

Within these questionnaires, **<u>we greatly appreciate your honesty</u>**. Please remember that no personally identifiable information is gathered by our research team in this study; thus, **your ratings will remain anonymous**.

After reading this information, please indicate which of the following actions you would like to take:
- **I no longer wish to participate in this study and would like to exit now.**
- **I agree to read each of the following four sets of information and I agree to rate them honestly**.

Climate change is a serious problem. Our ability to overcome its effects will require every one of us to act.

While being greener and cleaner are important actions we should all focus on, there is another impactful–but much less promoted–action we should all increase:

- **Creating dialog about climate change with friends & family members who may not be as passionate or knowledgeable**

However, for some of us, **the act of <u>starting and holding a conversation</u> about difficult topics (such as climate change) can be especially difficult**.

Although these difficulties exist, **<u>you are one of the best candidates for this impactful task!</u>**

How??

Well, **theories** like the ***<u>Two-Step Flow model of communication</u>*** & other findings from **psychological research on Influence** show the

   1) Familiarity, **2) Trust**, & **3) Proximity** you hold, coupled with your

   4) Knowledge of & **5) Passion** for overcoming climate change,

<u>**make you especially effective**</u> at having these important conversations with your friends and family.

To help overcome some of the difficulties of having these conversations, **our team has compiled 6 "strategies" for initiating dialog about climate change with friends and family**. And we need your help!

On the next page, you will be shown these six strategies and some context behind them.

Please read each of them carefully, then proceed to the following page to answer a few questions about them. **<u>We greatly appreciate your time and honesty!</u>**

- I acknowledge that I will be required to stay on each page for a certain amount of time, I agree to read the information carefully, and I am ready to proceed to the next page.

6 Strategies for Initiating Conversations about Climate Change:

1. **Pick the best moment**.
   a. Be sure to pick a good time for you both; ask to speak another time if needed
   b. Maintain a friendly, casual demeanor, and try your best not to be too overbearing
   c. Use your knowledge of that person to your advantage; back off when needed

2. **Actively listen by asking questions & finding connections**.
   a. Starting with guilting and "shoulds" can off-putting; don't risk your opportunity
   b. Instead, start by asking them a question (what they already know/if they have Qs)
   c. Search for commonalities between your knowledge and beliefs to build comradery

3. **Ask to share your journey of climate change understanding**.
   a. Ask for permission before sharing your climate change advocacy journey
   b. Don't just flood the listener with potentially boring/off-putting science information
   c. Connect your story to the questions and uncertainties they expressed, if possible

4. **Don't try to lecture or win**.
   a. Don't jeopardize your trust/rapport by appearing to have entered in bad faith
   b. Remember, we simply hope to encourage dialog around the realities of this issue
   c. If the conversation turns: 1) remain calm, 3) stay respectful, & 3) and back off

5. **Focus on current events & solutions**.
   a. Use current events help to highlight the often overlooked "here and now" realities
   b. Avoid negativity and information that can be perceived as irrelevant
   c. Focus on positives like solutions and the opportunities that lie within adaptation

6. **Thank them & ask to talk again another time**.
   a. Difficult conversations require courage and humility; express your thanks
   b. Encourage them to look out for climate-related current events, especially locally
   c. Gauging their openness to talk again in the future and be sure to follow up!

After the timer permits, please proceed to the next page to rate the information you just read.

Please note, you will not be able to return to this page after proceeding.

Climate change is a serious problem. Our ability to overcome its effects will require every one of us to act.

While being greener and cleaner are important actions we should all focus on, there is another impactful–but much less promoted–action we should all increase:

- **Creating dialog about climate change with friends & family members who may not be as passionate or knowledgeable**

However, for some of us, **knowing how to refute misinformation and climate change denials in-the-moment of a conversation can be especially difficult**.

Although these difficulties exist, **you are one of the best candidates for this impactful task!**

How??

Well, **theories** like the ***Two-Step Flow model of communication*** & other findings from **psychological research on Influence** show the
      1) Familiarity, **2) Trust**, & **3) Proximity** you hold, coupled with your
      4) Knowledge of & **5) Passion** for overcoming climate change,
make you especially effective at having these important conversations with your friends and family.

To help overcome some of the difficulties of having these conversations, **our team has compiled 6 "counters" to common climate change-denial claims that might come up in conversation**. And we need your help!

On the next page, you will be shown these six counters and some context behind them.

Please read each of them carefully, then proceed to the following page to answer a few questions about them. **We greatly appreciate your time and honesty!**

- I acknowledge that I will be required to stay on each page for a certain amount of time, I agree to read the information carefully, and I am ready to proceed to the next page.

6 Climate Change Denial Claims & Counterarguments:

Climate Change Denial Claim #1:
- **There really isn't proof of climate change, and scientists aren't even sure about its seriousness. Why should I care?**

Counters to #1:
A. Scientists don't "prove" things; rather, they gather evidence, which supports or refutes
B. 97% of scientists & every relevant climate research group agree the evidence is clear
C. Climate change is a real issue that holds serious consequences for everyone on Earth

Climate Change Denial Claim #2:
- **The climate has always been changing and probably always will. So, isn't climate change a natural phenomenon?**

Counters to #2:
A. Yes, evidence shows Earth's climate has varied in the past, for many different reasons
B. Since the Industrial Revolution, human activity has produced unnaturally high CO_2
C. In turn, we have drastically disrupted the ecological balance of nature across the globe

Climate Change Denial Claim #3:
- **Climate change is over-exaggerated. I like the summer weather; I don't see what's so wrong with it being warmer**.

Counters to #3:
A. The issue is not that temperatures are rising, but rather how fast and turbulent it is
B. Humans, animals, and ecosystems are suited to particular weather patterns and sea levels
C. Additionally, rapid climate change is the prime suspect in most mass extinction events (like the "The Great Dying," when nearly 90% of all life went extinct, ~250M years ago)

Climate Change Denial Claim #4:
- **It's too late to do anything about climate change anyway. It's too big of a problem and it's too expensive to fix. Why bother**?

Counters to #4:
A. That's exactly what the fossil fuel industry wants you to think, but it's never too late
B. The more we act now, the more we will be able to slow it down & get it under control
C. Scientists have already discovered simple, impactful changes that can be made now

Climate Change Denial Claim #5:

- **Other countries contribute to climate change, too. We shouldn't be the only one's doing anything to fix it**.

Counters to #5:

A. China, the US, & India contribute over half of all greenhouse gas (GHG) emissions; however, the US has been industrialized for over twice as long comparatively
B. Regardless of how much we think other countries are responsible, we still need to act.
C. Climate change will only continue to worsen, and there are economic opportunities involved with adaptation and mitigation

Climate Change Denial Claim #6:

- **Mitigating climate change is economically impractical. More of these climate regulations will only hurt US businesses and the economy**.

Counters to #6:

A. Combating these real, growing dangers will require systemic change in how we operate
B. Although it may be expensive in the short-term, it will certainly pay off in the long-term
C. That is, making these changes sooner will be more cost-effective, profitable, and safe

After the timer permits, please proceed to the next page to rate the information you just read.

Please note, you will not be able to return to this page after proceeding.

Climate change is a serious problem. Our ability to overcome its effects will require every one of us to act.

While being greener and cleaner are important actions we should all focus on, there is another impactful–but much less promoted–action we should all increase:

- **Creating dialog about climate change with friends & family members who may not be as passionate or knowledgeable**

However, for some of us, **starting and holding a conversation about controversial issues (like climate change), especially in-person,** can be especially difficult.

Although these difficulties exist, **you are one of the best candidates for this impactful task!**

How??

Well, **theories** like the ***Two-Step Flow model of communication*** & other findings from **psychological research on Influence** show the
      1) Familiarity, **2) Trust**, & **3) Proximity** you hold, coupled with your
      4) Knowledge of & **5) Passion** for overcoming climate change,
make you especially effective at having these important conversations with your friends and family.

To help overcome some of the difficulties of having these conversations, **our team has compiled 6 examples of social media posts that share links to information about climate change that can be easily posted across platforms**.

And we need your help!

On the next page, you will be shown these six posts and some context behind them.

Please read each of them carefully, then proceed to the following page to answer a few questions about them. **We greatly appreciate your time and honesty!**

- I acknowledge that I will be required to stay on each page for a certain amount of time, I agree to read the information carefully, and I am ready to proceed to the next page.

6 Social Media Posts of Links to Climate Change Information:

Please note:
**1) These posts were formatted so that
they can be posted across any major social media network.**

**2) Also, these are just sample posts of links from relatively familiar sources;
feel free to use these as templates to share your own favorite links/info!**

**3) These links are not currently live,
but you will have access to them at the end of the study.**

What exactly is "climate change"?
- Curious what climate change actually is or in search of information to send to another potentially curious individual? Check out this link published by the advocacy group the Natural Resource Defense Council (NRDC) to learn more.

How do we know climate change is real?
- Climate change is an issue that is highly complex but has also been highly researched over the recent decades. Check out this link on NASA's website that summarizes the evidence scientists have collected so far.

Stories of 5 people impacted by climate change
- Despite what I would like to think, climate change is an issue that is negatively affecting us, here and now. Here are stories of 5 people who have been affected by climate change… and are inspired to take action.

Start with these 10 actions to help fight climate change!
- Climate change is arguably the most pressing issue we face as a species. Interested in learning more about the ways you can contribute to overcoming the issues of climate change? Check out this United Nations webpage to learn more.

Here are 6 arguments to refute climate change denial
- Despite the seriousness of climate change, denial is still much more common than it should be. Check out this link to the Earth Day website to read 6 counterarguments you can use to refute common denial claims.

Climate Change 101 with Bill Nye! (YouTube)
- Climate change is a complex topic that can get a bit confusing to discuss sometimes. Who better than Bill Nye in a video by National Geographic to deliver the most relevant information in an extremely digestible way.

After the timer permits, please proceed to the next page to rate the information you just read.

<u>Please note</u>, you will not be able to return to this page after proceeding.

<div align="right">4) *<u>Encouragement Control</u>* <u>message</u>:</div>

Climate change is a serious problem. Our ability to overcome its effects will require every one of us to act.

While being greener and cleaner are important actions we should all focus on, there is another impactful–but much less promoted–action we should all increase:

- **Creating dialog about climate change with friends & family members who may not be as passionate or knowledgeable**

However, we know that, **despite knowing its effects and caring deeply about it, climate change can be a difficult topic to discuss**, for a number of reasons.

Although these difficulties exist, **<u>you are one of the best candidates for this impactful task!</u>**

How??

Well, **theories** like the ***<u>Two-Step Flow model of communication</u>*** & other findings from **psychological research on Influence** show the
       1) Familiarity, **2) Trust**, & **3) Proximity** you hold, coupled with your
       4) Knowledge of & **5) Passion** for overcoming climate change,
<u>make you especially effective</u> at having these important conversations with your friends and family.

Ultimately, talking with your friends and family about climate change is an important and effective way for you to do your part in overcoming it.

Please proceed to the next page to rate the information you just read.

<u>Please note</u>, you will not be able to return to this page after proceeding.

176

Appendix H - Study 2 Message Effectiveness Questionnaires

Which of the following categories best describes the topic of information you just read, specifically, on the previous page?

    A. **Strategies** for initiating conversations about climate change
    B. **Counterarguments** to climate change denial claims
    C. Educational information that can be easily shared as **Posts** on social media
    D. **Encouragement** to create dialogue about climate change (only)

I found this information to be persuasive.

- 1 Strongly Disagree – 7 Strongly Agree

That was effective information.

- 1 Strongly Disagree – 7 Strongly Agree

I would use this information going forward.

- 1 Strongly Disagree – 7 Strongly Agree

This information has made me more interested in the issue of climate change.

- 1 Strongly Disagree – 7 Strongly Agree

Overall, I liked this information.

- 1 Strongly Disagree – 7 Strongly Agree

This information makes me feel encouraged to initiate communication about climate change.

- 1 Strongly Disagree – 7 Strongly Agree