Cultural Perspectives on Climate Change: Examining Differences among College Students in Climate Change Threat Perception, Knowledge, and Behaviors

Hanna R. Hecht

Cultural Perspectives on Climate Change: Examining Differences among College Students in Climate Change Threat Perception, Knowledge, and Behaviors

Cover Page Footnote

Hanna R. Hecht received her BA, Communications and Sustainability, in 2020 from George Washington University.

Cultural Perspectives on Climate Change:
Examining Differences among College Students in Climate Change Threat Perception, Knowledge, and Behaviors

Climate change is one of the most pressing issues facing our planet. Over the past several decades—and especially in recent years—the world has seen this problem grow and has observed the devastating impacts that it has had on local communities and the global community at large: Weather patterns have shifted, threatening food supply and production; sea levels have risen, increasing the risk of catastrophic flooding; global average temperatures have climbed, jeopardizing public health and biodiversity.[1] Thus, if local, state, and federal governments, as well as businesses, communities, and individuals continue with a "business as usual" approach to climate change, these calamitous effects will only worsen and broaden in scope of impact. According to the 2018 Special Report released by the International Panel on Climate Change (IPCC), the global average temperature will likely increase 1.5-2.0℃ by 2030 if climate change remains unabated, exacerbating current climate-related risks and impacts for both human and natural systems.[2]

To thoroughly address this pressing issue, one must be able to effectively communicate its severity to the public in a manner that will incite action and inspire change. However, given the multifaceted diversity of our global community, it is inevitable that public knowledge and attitudes regarding the climate crisis will vary among and within countries and their respective cultures. Therefore, it is very important to be able to gauge cultural perspectives on this issue to be able to more effectively tailor our climate change communication to meet these various baseline measures and overcome certain cultural differences that may serve as an advantage or disadvantage in engendering climate action. Furthermore, assessing the climate-related thoughts and opinions of younger generations—particularly college students—is vital to achieving

effective climate change communication, as today's youth will comprise the next generation of thought leaders, policy makers, and catalysts.

Literature Review

Given its ubiquitous effects and increasing media attention, there is a growing and diverse body of research on climate change as it relates to the public's awareness, understanding, and attitudes. This section reviews relevant research on climate change threat perception, knowledge, and behavior; greenhouse gas emissions; college students; cultural worldview; and the Cultural Theory of Risk. Throughout this paper, the term "climate change" rather than "global warming" will be used, except when referencing studies in which the latter is employed as a stimulus term. While these two terms are often used interchangeably, they are not synonymous, as "global warming" strictly refers to increases in temperature resulting from rising atmospheric greenhouse gas emissions.[3] The more scientifically correct term, "climate change," thus accounts for the more varied changes in the climactic system—such as alterations in precipitation distribution and intensity—in addition to rising temperatures, that result from increasing greenhouse gas emissions.[4]

Climate Change Threat Perception, Knowledge, & Behavior

Research on cross-national public threat perception, knowledge, and behavior regarding climate change dates back to the early 1990s, when the George H. Gallup International Institute conducted their "Health of the Planet" (HOP) survey, which was the largest environmental opinion survey to ever be administered at the time.[5] The HOP study surveyed twenty-four nations of varying levels of economic development and political stability. Overall, results suggested a high level of concern for environmental issues among a majority of citizens in both industrialized and developing countries.[6]

This international survey laid the groundwork for three pioneering studies in the field of climate change communication. Two studies released in 1998 both found a universal awareness yet vague understanding of climate change among respondents in cross-national surveys on environmental attitudes.[7] Findings from these studies also suggested limited perceived threat of climate change impacts, as respondents indicated greater concern for other environmental and social issues.[8] However, these analyses and findings were largely skewed towards the Western world (i.e. the United States, Canada, Western Europe, Mexico, and Brazil). In 2003, Brechin obtained data from a more diverse sample of countries: While he found a slight increase in global understanding of climate change and its anthropogenic (i.e. man-made or human-induced) causes, he identified a consistent lack of knowledge regarding the overall problem.[9] Additionally, in concurrence with the two previous studies and the 1992 HOP Gallup poll, Brechin found no statistically significant difference in climate change knowledge between "developed" and "developing' nations."[10]

Since these four foundational studies were published, research on global public attitudes regarding climate change has boomed and researchers have collected data from an increasing number of countries around the world. As a result, more recent studies have identified widespread patterns and long-term trends in the lay public's climate change-related threat perception, knowledge, and behaviors, greatly improving our understanding of the issue.[11]

"Threat perception" refers to one's interpretation of risk and corresponding level of concern based on his or her beliefs or understanding of danger.[12] These public threat perceptions are shaped by a wide variety of factors, including social and psychological variables, as well as technical and scientific definitions of danger.[13] With regard to climate change, more recent studies have found wide discrepancies among countries in public threat perception and level of

concern for the issue: While climate change concern tends to be high among citizens in developing nations, the issue is perceived as a distant, non-personal threat by those in more developed countries.[14] For instance, the 2009 Pew Global Attitudes Project surveyed twenty-five countries and found that, when asked if global warming is a "very serious problem," 67 percent of respondents in India agreed with the statement as compared to only 44 percent of respondents in the United States and 30 percent of respondents in China.[15] These findings clearly contradict past findings that have suggested a universally high level of concern and perceived threat of climate change, prompting the need for further research on the topic.[16]

Trends in the global public's climate change knowledge—which refers to the factually correct climate change-related information acquired and employed by an individual—have also been identified in recent studies. While past studies have reported consistent levels of climate change awareness and knowledge across the global population, more recent findings suggest the contrary. Similar to the aforementioned studies on threat perception, those that have examined climate change-related knowledge have also discovered large differences among developed and developing countries.[17] For instance, when Lee et al. surveyed a representative sample of the world's adult population from 199 countries, they found that approximately 40 percent of adults worldwide have never heard of climate change.[18] Moreover, while over 90 percent of the public in developed regions, like North America, Europe, and Japan, were aware of climate change, more than 65 percent of adults in developing countries, such as Egypt, Bangladesh, and India, were generally unaware of the issue.[19] This finding has been replicated and supported in other studies, such as Pugliese and Ray's Gallup report, which identified that only about 61 percent of the world's population knew "something" about global climate change.[20] Therefore, while this body of research provides great insight into worldwide awareness and knowledge levels

regarding climate change, further research is, again, necessary to explore the conflicting findings that exist on the topic.

"Climate change mitigation behavior" refers to any human intervention that aims to "reduce emissions or enhance the sinks of greenhouse gases."[21] These behaviors span across all major economic sectors (e.g. food, agriculture and land management, and transportation) and include individual actions such as recycling; walking, biking, or using public transportation to commute rather than driving a car; and reducing consumption of single-use and disposable items.[22] Despite the importance that these individual-level behaviors serve in allaying the impacts and consequences of climate change, little research exists on the topic. To date, most of the literature on climate change mitigation behavior focuses on the various personal and psychological factors that predict one's likelihood of engaging in these pro-environmental behaviors.[23] As such, many studies have specifically focused on the role that an individual's climate change threat perception and knowledge play in influencing corresponding mitigation behaviors.[24] While some studies have found that different types of climate change knowledge (e.g. casual, action-related, result-related, etc.) have varying effects on climate change threat perception and willingness to engage in mitigation behaviors, most findings support the general conclusion that higher levels of climate change knowledge and concern positively correlate with likelihood of pro-environmental behavior change.[25]

Some researchers have also examined the way in which certain cognitive styles and habitual thought patterns can serve as barriers to individual and collective climate action.[26] In one such study, O'Riordan and Stoll-Kleemann used Kahneman's concepts of "fast" and "slow" thinking to explain why it is often more difficult for people to make sustainable dietary shifts (e.g. transitioning to a more plant-based diet) as compared to engaging in other pro-

environmental behaviors (e.g. walking instead of driving).[27] The authors note that people's eating behaviors are often habitual and thus a product of "fast" thinking: Since these behaviors are "repetitive, routine, reliable, reinforcing, and rewarding," they decrease cognitive burden and uncertainty and, in effect, enable people to bypass the "slow" thinking processes that would encourage them to deliberate issues of morality and social responsibility.[28] Olsen elaborated on this research by proposing several cognitive biases that are employed by the "fast" thinking system and further impede pro-environmental behavior change, such as "short-term bias," in which people display greater sensitivity towards short-term rather than long-term risk and are consequently reluctant to make short-term sacrifices.[29]

While this research highlights the influence that personal and psychological factors like, climate change-related concern and cognitive processes, can have in shaping one's likelihood of engaging in mitigation behavior, it still remains unclear how other cultural variables or influences, such as worldview, may play into this relationship.

Greenhouse Gas Emissions Distribution & Contribution

"Greenhouse gases" (GHGs) are gases in the Earth's atmosphere that trap outgoing energy from the sun and use this energy to heat the Earth's surface. This process is commonly referred to as the "greenhouse effect" and suggests the crucial role that these gases play in maintaining a habitable global average temperature. Over the past 150 years, human activity has caused a spike in atmospheric concentration levels of GHGs, particularly carbon dioxide (76 percent), methane (16 percent), nitrous oxide (6 percent), and fluorinated gases (2 percent), such as chlorofluorocarbons (CFCs).[30] Globally, the most prominent sources of these anthropogenic GHG emissions are the burning of fossil fuels for electricity, heat production, and transportation; agriculture, forestry, and other land-use change; and industry.[31] Given the heat-trapping

capability of these gases, this increase in GHG concentration has consequently led to a rise in global average temperatures, resulting in a domino effect of large and small-scale climatic shifts. This human-induced increase in atmospheric GHG concentrations is a contributing factor of climate change.

Much of the research regarding rising GHG concentrations and climate change has focused on emissions contributions between and within economic sectors, as well as among countries and geographic regions. Many studies have particularly examined the differences among "developed" and "developing" nations in their GHG emission contributions, highlighting the shifts that have occurred since the turn of the century.[32] For example, in assessing the share of developing countries in global CO_2 emissions in the late 1900s, Ravindranath and Sathaye found that, despite the developing world accounting for 73 percent of the global population by 2000, it was only responsible for 37 percent of the cumulative global CO_2 emissions, which came primarily from fossil fuel combustion and land-use change.[33] This finding has been strongly supported by several other studies that have demonstrated the developing world's historically small GHG emission contribution prior to the twenty-first century.[34] However, more recent research points to a shift in these patterns: While North America and Europe are still the largest GHG emitters, the greatest increases in cumulative global emissions growth is coming from the developing world as a result of advancing economic development among these countries.[35] In fact, developing nations and the least developed economies accounted for 73 percent of the global GHG emissions growth in 2004.[36]

This research is helpful in establishing a better understanding of the global distribution of greenhouse gases and patterns in emissions contributions; however, there has been limited

investigation into how these country and region-specific contribution patterns may relate to the respective public's attitudes and perceptions of climate change.

College Students' Climate Change Attitudes

At present, there is limited research on college students' climate change-related threat perception, knowledge, or behaviors, as a vast majority of past studies have focused on measuring these variables among primary and secondary school students.[37] The literature that does exist on this population still provides useful insight into university students' conceptions and misconceptions regarding climate change. Among these studies, there is a consensus reporting a general pattern of confusion about the causes and consequences of climate change.[38] For example, in Bozdoğan's meta-analysis of studies conducted in the education discipline on the topic of climate change, he found that over 50 percent of students at the university level held the misconception that "the increase in the temperature due to greenhouse effect / global warming [would] lead to skin cancer."[39] Additionally, Bozdoğan points out that many of the commonly held misconceptions observed in studies of primary and secondary school students were also found in those studying university-level students.[40] This finding is concerning considering that today's college students will soon be faced with making important climate change policy decisions and assume the responsibility of shaping the way in which our world addresses this pressing issue. Further research is therefore necessary to gain a better understanding of how these misconceptions relate to university students' climate change concern, knowledge, and behaviors.

Cultural Worldview & Climate Change Attitudes

Cultural worldview refers to the "shared mental representations, values and general social, cultural and political attitudes held by a group of individuals."[41] People tend to cultivate

worldviews, or cultural identities, that are consistent with the values held by the people they are surrounded by or the groups they belong to.[42] These worldviews, in effect, serve as "orienting positions" that guide one's thoughts and actions in a myriad of social situations.[43] As such, an individual's stance on contemporary and controversial topics, like global climate change, becomes ingrained in his or her cultural identity and consequently plays a large role in framing threat perceptions, knowledge, and reactive behaviors.[44]

A number of studies have examined the impact of both worldview and knowledge in shaping one's climate change threat perception, resulting in mixed findings. While some researchers have found that the effects of worldview on threat perception are independent from climate change knowledge level, others have found a significant correlation between worldview and knowledge.[45] For instance, in studying a representative sample of U.S. adults, Kahan et al. found that, while controlling for science knowledge and literacy, cultural worldview significantly affected individuals' climate change concern.[46] However, these findings were not replicated in Stevenson et al. 's study that examined the influence of cultural worldview and climate change knowledge on adolescents' acceptance of anthropogenic climate change and risk perception.[47] More specifically, they found that adolescents holding individualistic worldviews and median to low climate change knowledge levels were less likely to accept anthropogenic climate change and its associated risk than similarly knowledgeable students holding communitarian worldviews.[48] However, there was no statistically significant difference between students holding individualistic worldviews and those with communitarian worldviews at high climate change knowledge levels.[49] Nonetheless, despite these varied findings, both of these studies, along with others, have found support for the claim that individualistic and hierarchical worldviews correspond with lower levels of climate change concern and threat perception.[50]

Therefore, while there is substantial research and scientific consensus on the correlation between worldview and climate change concern, it remains unclear to what extent pre-obtained knowledge may affect this relationship. Moreover, additional research is needed to explore how worldview may affect climate change knowledge levels, independent of threat perception.

There is also a limited yet growing body of research concerning cultural worldview as it relates to individuals' climate change mitigation behaviors. Thus far, findings from these studies suggest that people holding individualistic and hierarchical worldviews are less likely to engage in behaviors directed towards mitigating the impacts of climate change than those holding egalitarian and communitarian worldviews.[51] Shi et al.'s study has been widely cited within this particular body of climate change research.[52] After surveying 1,065 adults in the German-speaking region of Switzerland, the researchers concluded that both individualistic and hierarchical worldviews were negatively correlated with willingness to adopt climate change mitigation behaviors.[53] Even more, they found that worldview *directly* influenced mitigation behavior, as compared to other studies that have suggested the presence of intervening variables, such as level of concern and climate-related.[54] However, as noted by the authors, these findings may lack generalizability outside of the Swiss population, since the study was only conducted among that particular demographic. Nonetheless, this study has undoubtedly provided useful insight into the interrelationship between worldview and climate change mitigation behaviors. Further research is now necessary to determine whether these findings are generalizable to more diverse populations.

Cultural Theory of Risk

Cultural Theory of Risk (CTR) proposes that individuals' risk perceptions and interpretations are largely influenced by social learning and cultural adherence.[55] In other words,

risk and threat perception are socially constructed. More specifically, the theory is based on Douglas's grid-group typology: "Grid" refers to the degree of regulation and restriction that a society imposes on an individual's behaviors through social prescriptions and proscriptions, while 'group' refers to an individual's level of identification with and involvement in particular bonded social units or groups.[56] A "low" grid orientation therefore corresponds to an egalitarian social structure and approach to life, where all people are equal and deserving of equal rights and opportunities, and few to no restrictions are placed on individuals' participation in social roles. In contrast, a "high" grid orientation correlates with a more hierarchical social structure dominated by stratified role differentiation and the maintenance of these "rank-based constraints."[57] A "low" group orientation is typical of an individualistic society, in which competition, autonomy, and self-reliance are prioritized. Conversely, a "high" group orientation indicates an inclination towards a more collectivist way of life, where values of solidarity, self-sacrifice, harmony, and a sense of duty are upheld.

Therefore, when these grid-group dimensions are placed on a two-axis system, ranging from low to high, four typologies result: egalitarian (high group, low grid), hierarchical (high group, high grid), individualistic (low group, low grid), and fatalistic (low group, high grid). These typologies represent four different kinds of social environments and, accordingly, four different worldviews. CTR postulates that individuals and cultural groups can typically be classified into one of these four categories: They will either be more group-oriented or individual-oriented and will similarly either believe in the necessity of social rules and regulations to control behavior or not.

These differing preferences for how society should function consequently shape the way in which individuals in each of the four typologies identify and perceive risk. Through these

categorized differences, CTR is believed to "predict and explain what kind of people will perceive which potential hazards to be how dangerous."[58] However, based on the premise that culture and nature are synergistic, mutually constitutive systems, CTR underwent an important development in the mid-1980s: Four "myths of nature," or socially constructed models of the environment, were mapped onto the original four worldviews, thus broadening the understanding of the relationship between culture and nature and establishing a more systematic means of predicting culturally-driven environmental risk perception.[59]

Accordingly, CTR proposes the following threat perception and nature-orientation characterizations for each of the four worldviews: Archetypal *individualists* perceive extreme threat in anything that impedes their autonomy and agency. Additionally, they adhere to the "dominant social paradigm," seeing nature as self-preserving and limitless, especially when being exploited in favor of technological and research advances.[60] On the other hand, the archetypal *hierarchist* fears social deviance, disruption of the existing power structure, and defers to expert knowledge when in the face of potential risk.[61] Like individualists, hierarchists also view nature as self-preserving, however, within strict limits, that—if crossed—can result in dire consequences.[62] Following, quintessential *egalitarians* express greater concern over social injustices and power hierarchies. Unlike hierarchists, egalitarians are accepting of social deviance yet skeptical of expert knowledge.[63] Moreover, they view nature as fragile and highly susceptible to human impacts.[64] Lastly, *fatalists* are often socially disengaged and marginalized, as they feel "tied and regulated by social groups they do not belong to."[65] Therefore, these individuals are often indifferent to risk, assuming that they have little influence over neither their social setting nor the environment.[66]

At present, a majority of the research surrounding CTR has focused on the aforementioned dimension of environmental risk perception, such as how people differ in their perceived threat of nuclear power generation or deforestation impacts, and a few studies have even focused more specifically on climate change.[67] These studies have employed various "short-form" versions of Kahan's original cultural cognition index, which measures cultural worldview with two continuous scales—one assessing an individual's degree of "hierarchy-egalitarianism" and the other assessing that of "individualism-communitarianism," excluding fatalism.[68] With regard to the body of research that has examined climate change perceptions in light of CTR, findings suggest that people who score higher on both the individualistic and hierarchical dimensions tend to be skeptical of environmental risks, as compared to those scoring higher on the egalitarian and communitarian dimensions, who generally acknowledge that climate change is largely caused by humans.[69] Additionally, while the high individualistic-hierarchical individuals believe that there is uncertainty and dissent among scientists regarding the existence of climate change, high egalitarian-communitarian individuals feel that there is a scientific consensus that climate change is happening.[70] These findings therefore exemplify how Douglas and Wildavksy's Cultural Theory of Risk can be applied to investigate climate change threat perception and subsequently provide foundational insight into why particular people or groups hold certain attitudes towards the issue. However, further research is now necessary to strengthen the empirical support for CTR.

Present Study

The present study aims to build upon this research and fill the aforementioned gaps by examining the association between cultural worldview and college students' climate change threat perceptions, knowledge levels, and mitigation behaviors. Additionally, this study will

investigate the possibility of a relationship between the GHG emissions level of a college

student's home country and his or her climate change threat perception. Accordingly, the present

study proposes the following research questions:

- ➢ *RQ₁: Does perceived threat of climate change vary between college students holding different cultural worldviews?*
- ➢ *RQ₂: Does climate change knowledge vary between college students holding different cultural worldviews?*
- ➢ *RQ₃: Is there a relationship between a college student's cultural worldview and his/her likelihood of engaging in climate change mitigation behaviors?*
- ➢ *RQ₄: Do college students from countries with low greenhouse gas (GHG) emissions perceive climate change as more or less of a threat than those from countries with relatively higher GHG emissions?*

Methods

In order to efficiently obtain the diverse and large sampling of participants necessary to

properly address the aforementioned research questions, survey methodology was employed in

this study. More specifically, a web-based survey was used to further aid in obtaining access to a

large number of diverse respondents within a short timeframe and enable these individuals to

anonymously record their responses. The following sections will detail information regarding the

participants, procedures, and measures used in the present study.

Participants

A total of 191 individuals responded to the survey. Nine of the original 191 respondents

indicated non-student status and were immediately redirected to exit the survey. Additionally,

thirty respondents did not complete the survey, and so their data was omitted from analysis. The

remaining sample (n = 152) was 42.1 percent male (n = 64), 52.7 percent female (n = 87), and

one participant identified as "other." Regarding classification in college/university, a majority of

respondents identified as "Senior" (35.5 percent, n = 54), followed by "Graduate student" (29.6

percent, n = 45), "Junior" (16.4 percent, n = 25), "Sophomore" (13.2 percent, n = 20), and lastly

"Freshman/First-year" (5.3 percent, n = 8). Among the seven educational discipline categories provided, most participants indicated that their major, or anticipated major, fell within the "Literature, Language, & Social Science" field (29.6 percent, n = 45) or the "Engineering & Technology" field (22.4 percent, n = 34). Fewer participants selected the "Business" (12.5 percent, n = 19), "Science & Math" (11.2 percent, n = 17), "Arts" (9.9 percent, n = 15), "Other" (6.6 percent, n = 10), and "Environment" (5.9 percent, n = 9) fields, respectively. Three respondents did not specify a field of study. Furthermore, of the sample, 54.6 percent (n = 83) identified their political views as "Liberal," with 19.7 percent (n = 30) identifying as "Conservative" and 21.1 percent (n = 32) as "Moderate." Seven respondents selected "Other" and identified the following political ideologies through text entry: "Leftist," "Socialist," "Progressive," "Radical," "Spiral Dynamics yellow stage perspective," and "Independent." In terms of the primary region in which respondents grew up, the modal response was North America (59.9 percent, n = 91), followed by Asia (24.3 percent, n = 37), South America (5.3 percent, n = 8), and the European Union (4.6 percent, n = 7). Of the remaining participants, four (2.6 percent) selected "Central America," three (2.0 percent) indicated the "Middle East," and "Africa" and "Eastern Europe" were each chosen by one participant. Similarly, a majority of respondents reported that their home country was either the United States (68.4 percent, n = 104), India (18.4 percent, n = 28), or Brazil (2.6 percent, n = 4). Each of the following countries was chosen by one respondent: Argentina, Australia, Canada, China, Finland, France, South Korea, Lebanon, Mexico, Nepal, Nigeria, Switzerland, Thailand, Turkey, and the United Kingdom.

Procedure

The present study used an anonymous web-based questionnaire constructed through Qualtrics, an online research and business insights platform. Since the study involved the use of survey procedures through which the subjects could not be identified, either directly or indirectly, through identifiers linked to the individuals, and any disclosure of the subjects' responses outside of the study would not cause damage to the subjects in any way, the present study was exempted from the George Washington University's IRB review. The survey was conducted over a fourteen-day span, from January 6, 2020 through January 19, 2020. Participants were recruited via nonprobability sampling methods, namely availability/convenience sampling, as the survey was distributed through public posts in university-affiliated Facebook pages, class email lists, and SMS group chats. These participants were not compensated. Additionally, forty participants were recruited through Amazon Mechanical Turk, an Amazon Web Services crowdsourcing platform, and compensated $0.50 for completing the survey.[71] Interested participants accessed the survey through an anonymous link provided by Qualtrics. Upon clicking on the survey link, all participants were presented with an informed consent form. They were provided the option to print the form for future reference and then clicked "next" to indicate consent and proceed to the rest of the survey. In order to ensure that all respondents were university students, participants were first asked to specify their "classification in college/university," ranging from freshman/first year student to graduate student. Those who selected the option, "I'm not a student," were redirected to the end-of-survey page. All remaining participants were then guided through a series of fifteen closed-ended and demographic questions detailed in the next section and subsequently thanked for their

participation upon completion of the survey. The order of items was the same for all participants and the survey took approximately ten minutes to complete.

Measures

After obtaining informed consent and ensuring that participants were of student status, the survey prompted respondents with two demographic questions, one asking for the respondent's gender and the other concerning the respondent's field of study or anticipated field of study. Participants then proceeded to complete several measures used to assess the present study's research questions. See Appendix A for all survey measures. Additionally, the final survey question asked respondents to identify whether their political views tended to lean liberal, conservative, or moderate. Respondents were also given the option to select "other" and write in a more applicable self-descriptor. This demographic question was reserved for the end of the survey in order to avoid priming responses based on political affiliations and their stereotypically associated social views.

Due to time constraints, an extensive pretest was not conducted in preparing for the present study. Therefore, to ensure measurement reliability and validity, several questions and indexes were adapted from previously published and widely tested surveys measuring the same concepts. Slight modifications were made to a few of the measures to ensure their contemporary relevance to the present study, such as updating predicted reference years for climate change impacts and including more recently popularized and demographically relevant climate change mitigation behaviors (e.g. reducing the use of single-use plastics and adopting a more plant-rich diet). Additionally, the present study's final questionnaire received external feedback and approval from peers within the target demographic and an expert researcher.

Climate change threat perception

Respondents completed four successive measures that assessed the degree to which they perceive climate change as a threat. The first question, adapted from Howe et al., provided respondents with a definition of "climate change" then asked them to indicate their level of concern regarding the general topic on a five-point labeled unipolar scale (M = 3.97, SD = 0.99). Response options ranged from "Not concerned at all" (coded 1) to "Extremely concerned" (coded 5).[72]

The second measure evaluated respondents' level of concern about experiencing personal harm from global climate change during their lifetimes using a question from Stokes et al.[73] Again, respondents indicated their level of concern on a five-point labeled unipolar scale ranging from "Not concerned at all" (coded 1) to "Extremely concerned" (coded 5) (M = 3.74, SD = 1.08).

The following two questions were based on Leiserowitz's Risk Perception index, with wording modified for the context of the present study.[74] The first of the two measures was a six-item scale that addressed some of the possible effects of climate change. More specifically, the index measured respondents' belief in the likelihood of climate change causing decreased standards of living, water shortages, and increased rates of infectious disease over the next thirty years, both worldwide and in their personal lives. For example, participants were asked, "How likely do you think it is that… Increased rates of serious disease will occur worldwide?" Participants recorded their responses on a seven-point bipolar Likert scale, with response options ranging from "Extremely unlikely" (coded 1) to "Extremely likely" (coded 7) (M = 5.41, SD = 1.07). The six items were condensed into a single composite measure, which was internally consistent (α = 0.88). The second question measured the degree to which respondents perceived

climate change to be a serious threat to non-human nature (i.e., wildlife and "wild space" away from human populations) and provided five unipolar Likert-type response options ranging from "Not serious at all" (coded 1) to "Extremely serious" (coded 5) (M = 4.28, SD = 1.07).

Climate change knowledge

Respondents' climate change knowledge was operationalized using a scale (α = 0.69) compiled from Tobler et al.'s causal and result-related knowledge indexes.[75] Ten items from the original indexes were used and, again, wording was modified to better fit the context of the present study. The final knowledge scale consisted of both true (five items) and false (five items) statements that addressed a wide range of climate change-related knowledge, such as "The last century's global increase in temperature was the largest it's been in the past 1,000 years," (correct) and "Over the next few decades, the climate will change evenly all over the world," (incorrect). Respondents answered each item with "true" (coded 1), "false" (coded 0), or "don't know" (coded 0). The latter response option was included to discourage respondents from guessing.

Climate change mitigation behaviors

Respondents' willingness to engage in climate change mitigation behaviors was measured using a modified six-item scale (α = 0.74) from Shi et al.[76] Three items were taken directly from the original scale and three items were new to account for more contemporarily and demographically relevant climate change mitigation behaviors. Participants were asked to select the statement that best described them with regard to their willingness to adopt each of the six climate change mitigation behaviors. Response options were presented on a five-point Likert scale ranging from "I am not willing to do this at all" (coded 1) to "I am already doing this" (coded 5). The scale included a wide range of activities commonly associated with mitigating

climate change, such as "Reducing consumption of disposable or single-use items (e.g. plastic bags, paper towels, packaged foods, etc.)" and "Walking, cycling, or taking public transportation instead of driving cars."

Cultural worldview

Cultural worldview was measured using Kahan et al.'s twelve-item version of Kahan's original cultural cognition index.[77] The scale consisted of two successive subscales, one measuring hierarchy-egalitarianism (six items) and the other measuring individualism-communitarianism (six items). The hierarchy-egalitarianism subscale ($\alpha = 0.83$) contained six statements that reflected attitudes towards social stratification and social equality (e.g., "Our society would be better off if the distribution of wealth was more equal"). Similarly, the individualism-communitarianism subscale ($\alpha = 0.67$) contained six statements that reflected attitudes towards the role of government regulation in societal functioning (e.g., "Sometimes the government needs to make laws that keep people from hurting themselves"). Respondents were asked to indicate their level of agreement or disagreement with each of the twelve items on a seven-point Likert scale ranging from "Strongly disagree" (coded 1) to "Strongly agree" (coded 7) (Individualism scale: $M = 3.47$, $SD = 1.05$; Hierarchy scale: $M = 2.49$, $SD = 1.35$).

Low versus high GHG countries

In order to obtain the data necessary to answer the present study's fourth research question regarding the correlation between a country's GHG emissions level and an individual's climate change threat perception, respondents were prompted with two more demographic questions. The first question asked participants to select the region that they primarily grew up in (North America, Africa, Eastern Europe, etc.), and the second question prompted participants to identify their home country. This information was then compared to 2018 data obtained by the

Global Carbon Project, specifying the historical and most recent GHG emissions level of each country and global region.[78]

Results

All four research questions were assessed using SPSS data analysis software (v. 25). As previously mentioned, thirty of the original 191 respondents did not complete the survey or left missing items, and so their data was entirely omitted from analysis. Accordingly, preliminary analyses were run for each variable (climate change threat perception, knowledge, mitigation behavior, and cultural worldview) in which certain answers were reverse-coded and measures of inter-item reliability and central tendency were obtained. Separate Pearson's correlation tests were then run to answer the first three research questions and an independent samples t-test was run for the fourth research question. The following sections detail the findings for each of the four questions.

Cultural Worldview & Climate Change Threat Perception (RQ₁)

RQ₁ questioned whether climate change threat perception would vary among college students holding different cultural worldviews. Before any inferential analyses were conducted, the four measures used to assess respondents' climate change threat perception were condensed into a single variable ($\alpha = 0.74$). Descriptive statistics on this variable indicated a relatively high level of perceived threat among respondents ($M = 4.35$, $SD = 0.79$). Additionally, certain answers from the worldview scales were reverse coded (Individualism items 2, 5, 6; Hierarchy items 2, 3, 4) such that higher average scores on the individualism-communitarianism scale correlated with a higher degree of individualism and higher scores on the hierarchy-egalitarianism scale corresponded with a higher degree of hierarchy. These reverse-coded scales were also used in the primary analyses for research questions two and three. On average,

respondents appeared to hold moderate individualistic and hierarchical worldviews, as responses on the two worldview subscales were normally distributed (Individualism scale: $M = 3.49$, $SD = 1.05$; Hierarchy scale: $M = 2.49$, $SD = 1.35$).

To examine the relationship between threat perception and worldview, two subsequent Pearson's correlation tests were conducted: One between respondents' average scores on perceived threat of climate change and individualism-communitarianism, and another between respondents' average scores on perceived threat of climate change and hierarchy-egalitarianism. The first test found a significant yet weak negative relationship between climate change threat perception and individualism ($r(152) = -0.279$, $p = 0.001$), meaning that as individualistic worldview increased, level of perceived threat of climate change decreased. The second test revealed a statistically significant and moderate negative relationship between climate change threat perception and hierarchy ($r(152) = -0.542$; $p < 0.001$), meaning that as hierarchical worldview increased, the level of perceived threat of climate change decreased.

Cultural Worldview & Climate Change Knowledge (RQ2)

RQ2 inquired whether climate change knowledge levels would vary among college students holding different cultural worldviews. Prior to conducting the primary analyses, respondents' answers for knowledge items with incorrect statements (items 1, 2, 4, 6, and 9) were reverse coded. "Don't know" responses were also recoded as wrong answers to produce binary data. Thus, 1 = "Correct" and 0 = "Incorrect" / "Don't know." Additionally, the last knowledge item ("If today's greenhouse gas content in the atmosphere stabilized, the climate would still warm for at least another 100 years.") was removed from the scale during analysis after conducting a preliminary test for inter-item reliability and finding a low correct response rate ($M = 0.51$, $SD = 0.50$). The item was therefore deleted to produce a corrected, yet still poor,

inter-item reliability score of 0.691. Descriptive statistics from the remaining items in the knowledge scale indicated that respondents were fairly well informed about climate change (M = 0.77, SD = 0.22). Correct response rates were highest for item three, "The increase of greenhouse gases is mainly caused by human activities" (M = 0.82, SD = 0.38), and lowest for item four, "A warmer climate will increase water evaporation, which will lead to an overall decrease of the sea level" (M = 0.63, SD = 0.49). See Table 1 for means and standard deviations of all knowledge items. As with the first research question, two Pearson's correlation tests were run to examine the relationship between knowledge and individualism and between that of knowledge and hierarchy. Test results indicated a significant and weak negative relationship between knowledge and individualism ($r(152)$ = -0.367, $p < 0.001$) and a significant and strong negative relationship between knowledge and hierarchy ($r(152)$ = -0.754, $p < 0.001$), meaning that as each of these worldview dimensions increased, climate change knowledge decreased.

Table 1

Items used to assess respondents' (n = 152) climate change-related knowledge, their means, and standard deviations

Item	Mean	Standard Deviation
1. "In past centuries, the average spatial extent of the snow blanket in the northern hemisphere remained unchanged." *	0.78	0.41
2. "Over the next few decades, the climate is expected to drastically cool down." *	0.80	0.40
3. "The increase of greenhouse gases is mainly caused by human activities."	0.82	0.49
4. "A warmer climate will increase water evaporation, which will lead to an overall decrease of the sea level." *	0.63	0.40
5. "Over the next few decades, there will be an increase in extreme events, such as droughts, floods, and storms."	0.80	0.42

6. "Climate change is mainly caused by natural variations (such as changes in solar radiation intensity and volcanic eruptions)." *	0.81	0.38
7. "A warmer climate will likely increase the melting of polar ice, which will lead to an overall rise of the sea level."	0.79	0.40
8. "The last century's global increase in temperature was the largest it's been in the past 1,000 years."	0.72	0.41
9. "Over the next few decades, the climate will change evenly all over the world." *	0.78	0.45

Note. * item was reverse coded. Respondents were provided response options of "True," "False," and "Don't know" for each item. The means and standard deviations in this table represent the correct response rate for each item (correct = 1; incorrect/don't know = 0).

Cultural Worldview & Climate Change Mitigation Behavior (RQ₃)

RQ_3 questioned whether a college student's cultural worldview was associated with his or her likelihood of engaging in climate change mitigation behaviors. Descriptive statistics on respondents' behavior scale responses suggested a moderate to high willingness to engage in mitigation behaviors ($M = 3.95$, $SD = 0.67$). Respondents were most willing to engage in behavior item one, "Walking, cycling, or taking public transportation instead of driving cars" ($M = 4.07$, $SD = 1.07$), and behavior item six, "Reducing consumption of disposable or single-use items (plastic bags, paper towels, packaged foods, etc.)" ($M = 4.07$, $SD = 1.07$). Conversely, they were least willing to engage in behavior item two, "Adopting a more plant-rich diet by eating more plant-based foods and fewer animal proteins and products (e.g. meat, dairy, eggs)" ($M = 3.77$, $SD = 1.23$). See Table 2 for means and standard deviations of all behavior items. Similar to the analyses conducted for RQ_1 and RQ_2, two Pearson's correlation tests were conducted to examine this relationship between cultural worldview and climate change mitigation behavior. The first test suggested a significant and weak negative relationship between individualism and

the likelihood of engaging in climate change mitigation behaviors ($r(152) = -0.388$; $p < 0.001$),

meaning that as individualism increased, the likelihood of engaging in these behaviors decreased.

Likewise, the second test revealed a moderate negative relationship between hierarchy and

mitigation behavior ($r(152) = -0.438$; $p < 0.001$), meaning that as hierarchy increased, the

likelihood of engaging in mitigation behaviors decreased. Both tests indicated statistically

significant correlations.

Table 2

Results of 152 respondents' willingness to engage in behaviors to mitigate climate change: Behavior items, their means, and standard deviations

Item	Mean	Standard Deviation
1. "Walking, cycling, or taking public transportation instead of driving cars."	4.07	1.07
2. Adopting a more plant-rich diet by eating more plant-based foods and fewer animal proteins and products (e.g., meat, dairy, eggs)."	3.77	1.23
3. "Consuming seasonal food whenever possible."	3.93	0.88
4. "Removing or switching off the power supply plug of electronic devices when these are not in use (e.g., mobile phone chargers and laptop power supplies)."	3.97	0.89
5. "Minimizing food waste by only buying necessary items and composting any food scraps."	3.89	0.99
6. "Reducing consumption of disposable or single-use items (e.g., plastic bags, paper towels, packaged foods, etc.)."	4.07	1.07

Note. Items were asked on a scale of 1-5 ("I am not willing to do this at all," to "I am already doing this").

Countries' GHG Emissions Levels & Climate Change Threat Perception (RQ4)

RQ_4 questioned whether college students from countries with low greenhouse gas (GHG)

emissions would perceive climate change as more or less of a threat than those from countries

with relatively higher GHG emissions. Due to the overwhelming majority of respondents who indicated that their home country was either the United States (68.4 percent, $n = 104$) or India (18.4 percent, $n = 28$), this research question could not be answered on a global scale. However, an independent samples t-test was still conducted to compare the average level of climate change threat perception between respondents who selected the United States (Total CO_2 emissions = 5.4 Gt) as their home country and those who chose India (Total CO_2 emissions = 2.7 Gt).[79] Results from the test revealed a statistically insignificant difference between the two groups' climate change threat perception ($t(130) = -1.69$, $p = 0.093$).

Discussion

The aim of the present study was to investigate the relationship between college students' cultural worldviews and their climate change-related threat perception, knowledge, and mitigation behaviors. In general, the findings from this study provided evidence of a relationship between these variables. More specifically, both individualism and hierarchy were associated with lower perceived threat of climate change, lower climate change knowledge levels, and lower willingness to engage in climate change mitigation behaviors. Additionally, while the study attempted to examine how college students' climate change threat perceptions vary as a function of their home country's GHG emissions level, no significant difference was found. Nonetheless, despite some limitations, the results of the present study suggest a number of implications for improving cross-cultural climate change communication among college students.

Cultural Worldview & Climate Change Threat Perception

Through *RQ₁,* the present study sought to understand the relationship between cultural worldview and college students' climate change threat perceptions. Results to this research

question indicated that both individualistic and hierarchical worldviews corresponded with lower levels of perceived threat of climate change among college students. This finding is consistent with the broader body of knowledge on the influence of cultural worldview on threat perception. A majority of previous studies on this topic have also found a negative relationship between both individualist and hierarchical values and climate change concern.[80] Likewise, these studies have provided evidence of a positive correlation between individualism and climate change skepticism, as well as a negative correlation between egalitarianism and climate change skepticism.[81] This particular finding is also congruous with CTR's threat perception and nature-orientation characterizations of the four worldviews, which suggest that both individualists and hierarchists view nature as "self-preserving," to a certain extent, and thus do not perceive extreme threat in environment-related issues. The results of RQ_1 therefore contribute to the growing body of research on climate change threat perception in the context of cultural worldview, suggesting that patterns observed within other populations are also present among university students. Furthermore, this finding suggests that special attention should be paid to communicating the severity of the climate crisis particularly to college students holding both individualistic and hierarchical worldviews, as these groups may be less likely to recognize the broad and detrimental scope of its impacts. For instance, college students holding more hierarchical worldviews could possibly benefit from the presence of an authoritative figure (e.g. a dean or professor) who effectively communicates the severity of the climate crisis, as hierarchists typically defer to expert knowledge in the face of risk.

Findings for RQ_1 also indicated that the average perceived threat of climate change among college students was relatively high. However, it is interesting to note that the majority (68.4 percent) of respondents reported their home country as the United States, which is

considered to be one of the top seven developed economies in the world.[82] While this result is consistent with Dunlap et al. 's HOP survey findings of a universally high level of perceived threat among all countries, it contradicts the more recent body of research on this topic.[83] These studies have found evidence of a low level of climate change threat perception among people living in developed nations as compared to those living in developing countries.[84] One possible explanation for the discrepancy in these findings is that the second most frequent home country chosen by participants was India (18.4 percent) which, according to the United Nations, is classified as a developing nation.[85] In prior studies on climate change threat perception, participants in India have indicated a much higher level of concern than those in the United States.[86] This difference in climate change threat perception may have therefore skewed the results of the present study. Additionally, this disparate finding may simply result from a lack of focus on college students within the existing literature on climate change threat perception, thus masking different threat perception patterns among college students as compared to the broader population. Nonetheless, this finding suggests that college students' climate change threat perceptions may function independently from the economic development status of their home countries. Even more, this high level of perceived threat implies that climate change advocates may be able to invest more time and energy into inspiring climate-related action among college students rather than trying to raise awareness of the issue itself.

Cultural Worldview & Climate Change Knowledge

The purpose of *RQ2* was to investigate the relationship between college students' cultural worldviews and their climate change-related knowledge. Findings from this research question revealed that both individualistic and hierarchical worldviews were associated with lower levels of knowledge regarding climate change. Additionally, the surveyed college students generally

appeared to be well informed on the issue. To date, prior research on this topic has only studied climate change-related knowledge as an intervening variable in the association between cultural worldview and climate change threat perception. To the best of the researcher's knowledge, the present study is therefore the first to examine the direct relationship between cultural worldview and climate change-related knowledge, providing evidence that an association may exist between the two variables. This finding thus suggests that lack of accurate knowledge regarding climate change may be a cultural barrier that must be overcome in order to achieve effective climate change communication with individualistic and hierarchically-minded college students.

With regard to the relatively high level of climate change knowledge observed among the study's sample—of which a majority reported coming from developed nations—this finding is consistent with the existing literature on global knowledge trends. These studies have found that adults from developed nations are more aware of and knowledgeable about climate change than those from developing nations.[87] These parallel findings therefore indicate that a similar pattern in climate change knowledge may exist among the world's college student population as in the global adult population.

Looking more closely at respondents' average correct response rates on individual knowledge items, results are also partly congruous with prior findings that college students tend to be less knowledgeable about the causes and consequences of climate change.[88] The two lowest correct response scores were on knowledge items that measured causal knowledge ("the last century's global increase in temperature was the largest it's been in the past 1,000 years") and result-related knowledge ("a warmer climate will increase water evaporation, which will lead to an overall decrease of the sea level"). However, the highest correct response score was also on an item measuring causal knowledge ("the increase of greenhouse gases is mainly caused by human

activities"). It is interesting to note, though, that the former causal knowledge item, the item with the lower scores, seems to measure a greater level of scientific understanding, as compared to the latter causal knowledge item, which assesses a more basic understanding of the anthropogenic nature of climate change. These results therefore suggest that, while college students may be generally knowledgeable about the issue of climate change, they may not possess a strong scientific understanding of its causes. Thus, efforts at improving climate change communication within this population could focus on providing students with more scientifically-based information.

Cultural Worldview & Climate Change Mitigation Behaviors

Through RQ_3, this study explored the relationship between college students' cultural worldviews and their engagement in climate change mitigation behaviors. Findings from this research question demonstrated a negative association between both individualism and hierarchy and likelihood of engaging in mitigation behaviors. These results are consistent with the current body of research on this topic, as a majority of previous studies have also found that people holding more individualistic and hierarchical worldviews are less likely to engage in climate-friendly behaviors as compared to individuals holding more communitarian or egalitarian worldviews.[89] As Xue et al. suggest, it is possible that the low climate change threat perception observed among individualists and hierarchists mediates this relationship between worldview and mitigation behavior: Decreased environmental risk perception may undermine a desire to shift behaviors and support climate friendly policies, as these actions would likely be perceived to threaten individual freedoms and disrupt existing power structures.[90] However, the present study did not test for potential intervening variables, thus no conclusions can be drawn regarding a direct association between worldview and mitigation behaviors. Nonetheless, this finding still

suggests that certain subgroups of college students holding individualistic and hierarchical worldviews may benefit from more intensive behavioral interventions in order to facilitate change towards a more climate-friendly lifestyle.

While respondents appeared willing to engage in climate change mitigation behaviors in general, their willingness varied among the individual items in the behavior scale. Results revealed that scores were highest for items involving low short-term sacrifice, such as behavior item one ("walking, cycling, or taking public transportation instead of driving cars") and behavior item four ("removing or switching off the power supply plug of electronic devices when these are not in use") Conversely, scores were lowest for behavior items referring to shifts in dietary or food consumption patterns, such as item two, "adopting a more plant-rich diet by eating more plant-based foods and fewer animal proteins and products." These findings are consistent with previous studies that have examined barriers to personal behavior change. In their research, O'Riordan and Stoll-Kleemann suggest that people's eating patterns are largely driven by "fast" thinking, habit, and "ingrained outlooks," making it more difficult to shift these behaviors as compared to others.[91] Additionally, it is possible that cognitive biases, such as the "short-term bias," may have contributed to participants' decreased willingness to make pro-environmental changes in their dietary patterns, as these changes could be perceived to be too risky in the short-term. Taken together, these results therefore suggest that, while college students seem generally willing to engage in climate change mitigation behavior, additional or more intensive intervention may be necessary to encourage changes in certain behaviors, such as shifts in dietary patterns.

Countries' GHG Emissions Levels & Climate Change Threat Perception

The purpose of *RQ4* was to examine the relationship between the GHG emissions level of a college student's home country and his or her climate change threat perception. While a demographically skewed sample prevented a global analysis of this research question, results from an independent samples t-test between respondents from the United States and India revealed an insignificant difference in climate change threat perception. Previous literature on the topic of global GHG emissions has found that, although developing nations, such as India, have accounted for the largest contributions to worldwide emissions growth in recent years, developed countries—same as the United States—are still the largest emitters. However, this finding suggests that these differences in GHG emissions levels among college students' home countries may not affect whether they perceive climate change as more or less of a threat. It is important to note, however, that both the United States and India are ranked among the top five CO_2 emitters in the world. Therefore, while the United States has a higher emissions level than India, the relatively small difference between the two nations, as compared to other countries with much smaller emissions contributions, may account for this insignificant finding. It is also possible that this finding results from a spurious relationship between the two variables, as the present study did not test for the influence of any potential intervening variables, such a religion, climate change media coverage, or political leaning. Further research would therefore benefit from examining the climate change threat perceptions of college students from countries with larger differences in GHG emissions levels, such as the United States and Denmark ($MtCO_2 = 35$), as well as controlling for confounding variables.[92]

Limitations & Future Research

Though the current study presented interesting findings on the relationship between cultural worldview and college students' climate change threat perceptions, knowledge levels, and mitigation behaviors, it had a few limitations. First, both the scale used to measure respondents' climate change knowledge and that used to assess individualism-communitarianism received poor inter-item reliability scores ($\alpha = 0.69$ and $\alpha = 0.67$, respectively) during preliminary analyses. In the case of the knowledge scale, this low alpha score may be due to the fact that only ten of the original thirty questions from Tobler et al.'s knowledge indexes were used.[93] However, the individualism-communitarianism scale was identical to that used in previous studies, suggesting that the index may not be as applicable to college students as it is to other populations. Thus, the scales may not have reliably measured respondents' climate change knowledge levels and degree of individualism. Future research would therefore benefit from testing these scales among larger samples of college students to see if stronger inter-item reliability scores can be obtained.

Second, the sample used in the present study disproportionately represented college students from the United States and India, precluding the possibility of comprehensively testing *RQ4*. This demographically skewed sample may also limit the generalizability of the study's findings to college students from those predominantly represented regions. Additionally, the use of Amazon Mechanical Turk to recruit a proportion of respondents may further limit the generalizability and reliability of the present study's findings. To gain a greater understanding of the relationship between the GHG emissions level of a college student's home country and his or her climate change threat perception, future studies should survey a larger sample of students from a more diverse range of countries in terms of their emissions contributions. Additionally,

future research should examine the relationship between cultural worldview and climate change threat perception, knowledge levels, and mitigation behaviors among a larger and more diverse sample of college students to determine whether this study's findings hold true in spite of this limitation.

Finally, while the present study found significant correlations between worldview and climate change threat perception, knowledge levels, and mitigation behaviors, the presence of intervening variables was not taken into account. It is therefore possible that these relationships are mediated by other variables, such as religion, gender, or political affiliation. It would accordingly be useful to reexamine the correlations found in the present study while controlling for other variables in future research.

Conclusion

Taken together, the results of this study reveal that certain cultural worldviews are significantly associated with college students' climate change threat perceptions, knowledge levels, and likelihood of engaging in mitigation behaviors. However, it remains unclear whether the GHG emissions level of a college student's home country influences his or her climate change threat perception. Nonetheless, the present study contributes to the existing literature a greater understanding of the factors that influence college students' climate change attitudes and behaviors. In order to achieve effective climate change communication and inspire action among college students, efforts must be made to tailor climate change campaigns and interventions to different cultural worldviews such that the conveyed information aligns with, rather than threatens, these cultural values.

Endnotes

[1] "Climate Change Impacts | National Oceanic and Atmospheric Administration," National Oceanic and Atmospheric Administration: U.S. Department of Commerce, accessed January 2,

2021, https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts; "How Climate Change Plunders the Planet," Environmental Defense Fund, accessed January 2, 2021, https://www.edf.org/climate/how-climate-change-plunders-planet.

[2] Intergovernmental Panel on Climate Change, *Global Warming of 1.5°C*, ed. Working Group I, 2018, http://www.ipcc.ch/report/sr15/.

[3] Irene Lorenzoni and Nick Pidgeon, "Public Views on Climate Change: European and USA Perspectives," *Climatic Change* 77 (August 21, 2006): 73–95, https://doi.org/10.1007/s10584-006-9072-z.

[4] Ibid.

[5] Riley E. Dunlap, George H. Gallup, and Alec M. Gallup, "Of Global Concern: Results of the Health of the Planet Survey," *Environment; Washington* 35, no. 9 (November 1993): 6.

[6] Ibid.

[7] Richard J. Bord, Ann Fisher, and Robert E. O'Connor, "Public Perceptions of Global Warming:: United States and International Perspectives," *Climate Research* 11, no. 1 (1998): 75–84;   Dunlap, Riley E. "Lay Perceptions of Global Risk: Public Views of Global Warming in Cross-National Context." International Sociology 13, no. 4 (December 1998): 473–98. https://doi.org/10.1177/026858098013004004.

[8] Bord, Fisher, and O'Connor, "Public Perceptions of Global Warming"; Dunlap, "Lay Perceptions of Global Risk."

[9] Steven R. Brechin, "Comparative Public Opinion and Knowledge on Global Climatic Change and the Kyoto Protocol: The US versus the World?," *International Journal of Sociology and Social Policy* 23, no. 10 (January 1, 2003): 106–34, https://doi.org/10.1108/01443330310790318.

[10] Ibid.

[11] Tien Ming Lee et al., "Predictors of Public Climate Change Awareness and Risk Perception around the World," *Nature Climate Change* 5, no. 11 (November 2015): 1014–20, https://doi.org/10.1038/nclimate2728; Lorenzoni and Pidgeon, "Public Views on Climate Change"; Matthew C. Nisbet and Teresa Myers, "The Polls—TrendsTwenty Years of Public Opinion about Global Warming," *Public Opinion Quarterly* 71, no. 3 (January 1, 2007): 444–70, https://doi.org/10.1093/poq/nfm031; Johanna Wolf and Susanne C. Moser, "Individual Understandings, Perceptions, and Engagement with Climate Change: Insights from in-Depth Studies across the World," *WIREs Climate Change* 2, no. 4 (2011): 547–69, https://doi.org/10.1002/wcc.120.

[12] Wolf and Moser, "Individual Understandings, Perceptions, and Engagement with Climate Change."

[13] Anthony A. Leiserowitz, "American Risk Perceptions: Is Climate Change Dangerous?," *Risk Analysis* 25, no. 6 (2005): 1433–42, https://doi.org/10.1111/j.1540-6261.2005.00690.x.

[14] "Chapter 9. Environmental Issues," The Pew Global Attitudes Project (Pew Research Center, July 23, 2009), https://www.pewresearch.org/global/2009/07/23/chapter-9-environmental-issues/; Lee et al., "Predictors of Public Climate Change Awareness and Risk Perception around the World."; Lorenzoni and Pidgeon, "Public Views on Climate Change"; Wolf and Moser, "Individual Understandings, Perceptions, and Engagement with Climate Change."

[15] "Chapter 9. Environmental Issues," 87.

[16] Bord, Fisher, and O'Connor, "Public Perceptions of Global Warming"; Brechin, "Comparative Public Opinion and Knowledge on Global Climatic Change and the Kyoto Protocol"; Dunlap, "Lay Perceptions of Global Risk"; Dunlap, Gallup, and Gallup, "Of Global Concern."

[17] Lee et al., "Predictors of Public Climate Change Awareness and Risk Perception around the World"; Anthony Leiserowitz, "International Public Opinion, Perception, and Understanding of Global Climate Change," Human Development Occasional Papers (1992-2007) (Human Development Report Office (HDRO), United Nations Development Programme (UNDP), November 2007), https://econpapers.repec.org/paper/hdrhdocpa/hdocpa-2007-31.htm; Anita Pugliese and Julie Ray, "A Heated Debate: Global Attitudes toward Climate Change," *Harvard International Review; Cambridge* 31, no. 3 (Fall 2009): 64–68.

[18] Lee et al., "Predictors of public climate change awareness and risk perception around the world."

[19] Ibid.

[20] Pugliese and Ray, "A Heated Debate," 64.

[21] IPCC, "Annex I: Glossary — Global Warming of 1.5 °C," ed. Robin Matthews (IPCC, 2018), https://www.ipcc.ch/sr15/chapter/glossary/.

[22] UN Environment Programme, "16 Ways to Take Action on Climate," *16 Ways to Take Action on Climate* (blog), October 10, 2020, https://www.unenvironment.org/news-and-stories/story/16-ways-take-action-climate.

[23] Andreas Diekmann and Peter Preisendörfer, "Green and Greenback: The Behavioral Effects of Environmental Attitudes in Low-Cost and High-Cost Situations," *Rationality and Society* 15, no. 4 (November 1, 2003): 441–72, https://doi.org/10.1177/1043463103154002; Chris von Borgstede, Maria Andersson, and Filip Johnsson, "Public Attitudes to Climate Change and Carbon Mitigation—Implications for Energy-Associated Behaviours," *Energy Policy* 57 (June 1, 2013): 182–93, https://doi.org/10.1016/j.enpol.2013.01.051.

[24] Jan C. Semenza et al., "Public Perception of Climate Change: Voluntary Mitigation and Barriers to Behavior Change," *American Journal of Preventive Medicine*, Theme Issue: Climate Change and the Health of the Public, 35, no. 5 (November 1, 2008): 479–87, https://doi.org/10.1016/j.amepre.2008.08.020; Jing Shi, Vivianne H. M. Visschers, and Michael Siegrist, "Public Perception of Climate Change: The Importance of Knowledge and Cultural Worldviews," *Risk Analysis* 35, no. 12 (2015): 2183–2201, https://doi.org/10.1111/risa.12406; Kathryn T. Stevenson et al., "Developing a Model of Climate Change Behavior among Adolescents," *Climatic Change; Dordrecht* 151, no. 3–4 (December 2018): 589–603, http://dx.doi.org/10.1007/s10584-018-2313-0.

[25] Shi, Visschers, and Siegrist, "Public Perception of Climate Change."

[26] Daniel Kahneman, *Thinking, Fast and Slow* (Macmillan, 2011); Robert L Olson, "Missing the Slow Train: How Gradual Change Undermines Public Policy & Collective Action" (Wilson Center, April 2016), https://www.wilsoncenter.org/event/missing-the-slow-train-how-gradual-change-undermines-public-policy-collective-action; Tim O'Riordan and Susanne Stoll-Kleemann, "The Challenges of Changing Dietary Behavior Toward More Sustainable Consumption," *Environment: Science and Policy for Sustainable Development* 57, no. 5 (September 3, 2015): 4–13, https://doi.org/10.1080/00139157.2015.1069093.

[27] Kahneman, *Thinking, Fast and Slow*; O'Riordan and Stoll-Kleemann, "The Challenges of Changing Dietary Behavior Toward More Sustainable Consumption."

[28] O'Riordan & Stoll-Kleemann, "The Challenges of Changing Dietary Behavior Toward More Sustainable Consumption," 5.

[29] Olson, "Missing the Slow Train: How Gradual Change Undermines Public Policy & Collective Action," 6-7.

[30] IPCC Working Group I, "AR4 Climate Change 2007: The Physical Science Basis — IPCC" (IPCC, 2007), https://www.ipcc.ch/report/ar4/wg1/; N. H. Ravindranath and Jayant A. Sathaye, *Climate Change and Developing Countries*, Advances in Global Change Research, 11 (Dordrecht: Springer Netherlands, 2002); OAR US EPA, "Global Greenhouse Gas Emissions Data," Overviews and Factsheets, US EPA, January 12, 2016, https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data.

[31] Ravindranath and Sathaye, *Climate Change and Developing Countries*; US EPA, "Global Greenhouse Gas Emissions Data."

[32] Simon Caney, "Justice and the Distribution of Greenhouse Gas Emissions," *Journal of Global Ethics* 5, no. 2 (August 1, 2009): 125–46, https://doi.org/10.1080/17449620903110300; PBL Netherlands Environmental Assessment Agency, "Global CO2 Emissions: Increase Continued in 2007," Text, PBL Netherlands Environmental Assessment Agency, December 8, 2010, https://www.pbl.nl/en/publications/GlobalCO2emissionsthrough2007; Michael R. Raupach et al., "Global and Regional Drivers of Accelerating CO_2 Emissions," *Proceedings of the National Academy of Sciences* 104, no. 24 (June 12, 2007): 10288, https://doi.org/10.1073/pnas.0700609104; Ravindranath and Sathaye, *Climate Change and Developing Countries.*

[33] Ravindranath and Sathaye, *Climate Change and Developing Countries.*

[34] Caney, "Justice and the Distribution of Greenhouse Gas Emissions"; "Global Emissions," Center for Climate and Energy Solutions, January 6, 2020, https://www.c2es.org/content/international-emissions/; PBL Netherlands Environmental Assessment Agency, "Global CO2 Emissions"; Raupach et al., "Global and Regional Drivers of Accelerating CO_2 Emissions."

[35] Caney, "Justice and the Distribution of Greenhouse Gas Emissions."

[36] Raupach et al., "Global and Regional Drivers of Accelerating CO_2 Emissions."

[37] Björn Andersson and Anita Wallin, "Students' Understanding of the Greenhouse Effect, the Societal Consequences of Reducing CO 2 Emissions and the Problem of Ozone Layer Depletion," *Journal of Research in Science Teaching* 37, no. 10 (2000): 1096–1111, https://doi.org/10.1002/1098-2736(200012)37:10<1096::AID-TEA4>3.0.CO;2-8; Aykut Emre Bozdoğan, "A Collection of Studies Conducted In Education About 'Global Warming' Problem," *Global Warming*, 2011, 7; Kathryn Stevenson et al., "Overcoming Skepticism with Education: Interacting Influences of Worldview and Climate Change Knowledge on Perceived Climate Change Risk among Adolescents," *Climatic Change* 126, no. 3 (2014): 293–304, https://doi.org/10.1007/s10584-014-1228-7.

[38] Sandra Wachholz, Nancy Artz, and Douglas Chene, "Warming to the Idea: University Students' Knowledge and Attitudes about Climate Change," *International Journal of Sustainability in Higher Education; Bradford* 15, no. 2 (2014): 128–41, http://dx.doi.org/10.1108/IJSHE-03-2012-0025.

[39] Bozdoğan, "A Collection of Studies Conducted In Education About 'Global Warming' Problem," 1620.

[40] Ibid.

[41] Anthony Allen Leiserowitz, "Global Warming in the American Mind: The Roles of Affect, Imagery, and Worldviews in Risk Perception, Policy Preferences and Behavior" (Ph.D., United States -- Oregon, University of Oregon, 2003): 44-45, https://search.proquest.com/docview/305304755/abstract/23A7D1A3E649474FPQ/1.

[42] Andrew J. Hoffman, *How Culture Shapes the Climate Change Debate* (Stanford, California: Stanford Briefs, an imprint of Stanford University Press, 2015).

[43] Leiserowitz, "Global Warming in the American Mind," 45.

[44] Hoffman, *How Culture Shapes the Climate Change Debate*.

[45] Dan Kahan et al., "The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks," *Nature Climate Change* 2, no. 10 (2012): 732–735, https://doi.org/10.1038/nclimate1547; Shi, Visschers, and Siegrist, "Public Perception of Climate Change"; Stevenson et al., "Overcoming Skepticism with Education."

[46] Kahan et al., "The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks."

[47] Stevenson et al., "Overcoming Skepticism with Education."

[48] Ibid.

[49] Ibid.

[50] Shi, Visschers, and Siegrist, "Public Perception of Climate Change."

[51] Karine Lacroix and Robert Gifford, "Psychological Barriers to Energy Conservation Behavior: The Role of Worldviews and Climate Change Risk Perception," *Environment and Behavior* 50, no. 7 (August 1, 2018): 749–80, https://doi.org/10.1177/0013916517715296; Shi, Visschers, and Siegrist, "Public Perception of Climate Change"; Wen Xue et al., "Cultural Worldviews and Climate Change: A View from China," *Asian Journal of Social Psychology* 19, no. 2 (2016): 134–44, https://doi.org/10.1111/ajsp.12116

[52] Shi, Visschers, and Siegrist, "Public Perception of Climate Change."

[53] Ibid.

[54] Lacroix and Gifford, "Psychological Barriers to Energy Conservation Behavior"; Shi, Visschers, and Siegrist, "Public Perception of Climate Change"; Xue et al., "Cultural Worldviews and Climate Change."

[55] Mary Douglas, *Purity and Danger: An Analysis of the Concepts of Pollution and Taboo*, Repr (New York, NY: Routledge, 1966); Mary Douglas, *Natural Symbols: Explorations in Cosmology with a New Introduction*, 2nd ed. (London: Routledge, 1970); Mary Douglas and Aaron Wildavsky, "How Can We Know the Risks We Face? Why Risk Selection Is a Social Process1" 2 (1982), https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1539-6924.1982.tb01365.x.

[56] Aaron Wildavsky and Karl Dake, "Theories of Risk Perception: Who Fears What and Why?," eweb:99903, September 1990, https://repository.library.georgetown.edu/handle/10822/840519.

[57] Dan M. Kahan, "Cultural Cognition as a Conception of the Cultural Theory of Risk," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, April 21, 2008), https://papers.ssrn.com/abstract=1123807.

[58] Douglas and Wildavsky, "How Can We Know the Risks We Face," 42.

[59] Shannon M. McNeeley and Heather Lazrus, "The Cultural Theory of Risk for Climate Change Adaptation," *Weather, Climate, and Society* 6, no. 4 (2014): 509.

[60] Kahan, "Cultural Cognition as a Conception of the Cultural Theory of Risk"; Sigve Oltedal et al., "Explaining Risk Perception. An Evaluation of Cultural Theory," 2004, 46.

[61] Ibid.

[62] Ibid.

[63] Ibid.

[64] Ibid.

[65] Oltedal et al., "Explaining Risk Perception. An Evaluation of Cultural Theory," 20.

[66] Kahan, "Cultural Cognition as a Conception of the Cultural Theory of Risk"; Oltedal et al., "Explaining Risk Perception. An Evaluation of Cultural Theory," 46.

[67] Leiserowitz, "Global Warming in the American Mind," 44-45; Shi, Visschers, and Siegrist, "Public Perception of Climate Change."

[68] Kahan, "Cultural Cognition as a Conception of the Cultural Theory of Risk."

[69] Shi, Visschers, and Siegrist, "Public Perception of Climate Change."

[70] Ibid.

[71] While several studies have suggested that Amazon Mechanical Turk is a reliable means of collecting large data sets and can be trusted within a 10 percent margin of error to provide results comparable to those obtained through slower, more expensive methods, other studies have provided evidence of declining quality in MTurk data quality, especially in the absence of Worker qualifications and extensive screening of HITs. Therefore, while MTurk respondents only accounted for approximately 26 percent of the present study's total participants, it is possible that the use of the Amazon Mechanical Turk platform negatively impacted the reliability of this study. Frank R. Bentley, Nediyana Daskalova, and Brooke White, "Comparing the Reliability of Amazon Mechanical Turk and Survey Monkey to Traditional Market Research Surveys," in *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, CHI EA '17 (New York, NY, USA: Association for Computing Machinery, 2017), 1092–1099, https://doi.org/10.1145/3027063.3053335; Michael Chmielewski and Sarah C. Kucker, "An MTurk Crisis? Shifts in Data Quality and the Impact on Study Results," *Social Psychological and Personality Science* 11, no. 4 (May 1, 2020): 464–73, https://doi.org/10.1177/1948550619875149; Stephanie Fowler et al., "Use of Amazon MTurk Online Marketplace for Questionnaire Testing and Experimental Analysis of Survey Features," n.d., 7.

[72] Peter D. Howe et al., "Geographic Variation in Opinions on Climate Change at State and Local Scales in the USA," *Nature Climate Change* 5, no. 6 (June 2015): 596–603, https://doi.org/10.1038/nclimate2583.

[73] Bruce Stokes, Richard Wike, and Jill Carle, "Global Concern about Climate Change, Broad Support for Limiting Emissions," *Pew Research Center's Global Attitudes Project* (blog), November 5, 2015, https://www.pewresearch.org/global/2015/11/05/global-concern-about-climate-change-broad-support-for-limiting-emissions/.

[74] Anthony Leiserowitz, "Climate Change Risk Perception and Policy Preferences: The Role of Affect, Imagery, and Values," *Climatic Change* 77, no. 1–2 (August 21, 2006): 45–72, https://doi.org/10.1007/s10584-006-9059-9.

[75] Christina Tobler, Vivianne H. M. Visschers, and Michael Siegrist, "Consumers' Knowledge about Climate Change," *Climatic Change* 114, no. 2 (September 1, 2012): 189–209, https://doi.org/10.1007/s10584-011-0393-1.

[76] Shi, Visschers, and Siegrist, "Public Perception of Climate Change."

[77] Kahan et al., "The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks"; Kahan, "Cultural Cognition as a Conception of the Cultural Theory of Risk."

[78] Corinne Le Quéré et al., "Global Carbon Budget 2018," *Earth System Science Data* 10, no. 4 (December 5, 2018): 2141–94, https://doi.org/10.5194/essd-10-2141-2018.

[79] Ibid.

[80] Kahan et al., "The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks"; Shi, Visschers, and Siegrist, "Public Perception of Climate Change"; Stevenson et al., "Overcoming Skepticism with Education."

[81] Shi, Visschers, and Siegrist, "Public Perception of Climate Change."

[82] UN/DESA, "Country Classification: Data Sources, Country Classifications and Aggregation Methodology," 2018.

[83] Dunlap, Gallup, and Gallup, "Of Global Concern," 6.

[84] Lee et al., "Predictors of Public Climate Change Awareness and Risk Perception around the World"; Lorenzoni and Pidgeon, "Public Views on Climate Change"; "Chapter 9. Environmental Issues"; Wolf and Moser, "Individual Understandings, Perceptions, and Engagement with Climate Change."

[85] UN/DESA, "Country Classification: Data Sources, Country Classifications and Aggregation Methodology."

[86] "Chapter 9. Environmental Issues."

[87] Lee et al., "Predictors of Public Climate Change Awareness and Risk Perception around the World"; Leiserowitz, "International Public Opinion, Perception, and Understanding of Global Climate Change"; Pugliese and Ray, "A Heated Debate."

[88] Bozdoğan, "A Collection of Studies Conducted In Education About 'Global Warming' Problem," 7; Wachholz, Artz, and Chene, "Warming to the Idea."

[89] Lacroix and Gifford, "Psychological Barriers to Energy Conservation Behavior."; Shi, Visschers, and Siegrist, "Public Perception of Climate Change"; Xue et al., "Cultural Worldviews and Climate Change."

[90] Xue et al., "Cultural Worldviews and Climate Change.

[91] O'Riordan and Stoll-Kleemann, "The Challenges of Changing Dietary Behavior Toward More Sustainable Consumption," 6.

[92] Le Quéré et al., "Global Carbon Budget 2018."

[93] Tobler, Visschers, and Siegrist, "Consumers' Knowledge about Climate Change."