

UNIVERSITY OF OKLAHOMA  
GRADUATE COLLEGE

REPORTING THE CLIMATE CRISIS: EXPLORING ANTHROPOMORPHIC  
LANGUAGE AND ALTERNATIVE STORY FORMATS AS JOURNALISTIC  
MECHANISMS TO COMBAT OBSTACLES ASSOCIATED WITH CLIMATE  
CHANGE COMMUNICATION

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By

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Norman, Oklahoma  
2017

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A DISSERTATION APPROVED FOR THE  
GAYLORD COLLEGE OF JOURNALISM AND MASS COMMUNICATION

BY

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## **Acknowledgements**

Foremost, I would like to express my sincere gratitude to my advisor Dr. Peter Gade for his continuous support and mentorship through this journey. His patience, knowledge, and guidance were critical to my scholarly success. I also appreciated his unwavering commitment to proper comma usage.

In addition to my advisor, I would like to thank the rest of my doctoral committee: Dr. David Craig, Dr. Claude Miller, Dr. Fred Beard, and Dr. Jaime Loke, for their time, insightful comments, and encouragement.

My sincere thanks also goes to Dr. Meta Carstarphen, Dr. Glenn Leshner, and Judy Robinson who all provided assistance and support throughout my tenure in the doctoral program.

Finally, I would like to thank my husband, Matt, and my son, Cale, who both supported me selflessly through this endeavor. Thank you both for your commitment to my success and your patience through the process.

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## **Abstract**

Reporting on climate change has been a special challenge for journalists, but new approaches to storytelling may help curb some of the inherent confounds found in environmental discourse. Through experimental analysis, this study provides insights into how anthropomorphic language (assigning human characteristics to non-human agents) and non-linear digital news story formatting can impact online media users' message retention, attitudes toward climate change, and willingness to take action to reduce the effects of global warming. This research asks simple – yet conceptually profound questions – whether journalists can adopt different story forms and literary elements (anthropomorphic language) and new digital tools (non-linear formatting) to present information that creates greater engagement and moves people past their existing dispositions to consider information in a fresher (less-biased) light.

*Keywords:* climate change, anthropomorphism, digital storytelling, environmental journalism

## Chapter 1: Introduction

As of January 2017, the Earth's atmospheric CO<sub>2</sub> levels were at 404.48 parts per million (ppm), the highest they have been in 15 million years, and the concentrations are continuing to increase at unprecedented rates (CO<sub>2</sub> Earth, 2017; NASA, 2016). The Earth's oceans are acidifying faster than in the past 300 million years, and arctic ice shelves are receding at a pace more rapid than ever witnessed in human history (Intergovernmental Panel on Climate Change, 2013; NASA, 2016).

The changing climate is leading to widespread issues across the globe. Experts contend the planet is currently in the midst of a sixth mass extinction. Every 24 hours 150 to 200 plant, bird, insect, and mammal species go extinct (Kolbert, 2014). Even the most conservative estimates surmise this level of die off is 100 times faster than any natural rate, and, if it continues, the Earth will lose more than 75 percent of all species in the next two centuries (Ceballos et al., 2015; Carrington, 2016).

Climate change is also leading to extreme weather fluctuations and increased natural disasters across the globe (Global Change Research Program, 2014; Intergovernmental Panel on Climate Change, 2014). Additionally, water borne and heat related illnesses, such as Malaria and Lyme disease, are on the rise in both human and animal populations (World Health Organization, 2017). The spread of such diseases is expected to increase at exponential rates as the planet continues to warm leading to increased death rates among those affected (Intergovernmental Panel on Climate Change, 2014).

Finally, rising sea levels caused by melting ice shelves have already begun to displace human populations. Most notably entire communities from Fiji and the



Marshall Islands have already relocated (Ferris, 2014). These displaced individuals have come to be called the first group of “climate refugees” (Davenport & Robertson, 2016). However, it is not only island nations that worry about the changing levels, cities across the globe have begun to brace for the coming impact of rising seas (Ferris, 2014). And, research finds that by 2100, oceans worldwide will be up to four feet higher and will threaten some of the world’s largest cities, including New York, Los Angeles, Miami, Mumbai, Sydney, and Rio de Janeiro (Natural Resources Defense Council, 2016).

The consequences of a changing climate have motivated a shift in thinking about the crisis itself; it is no longer a singular issue, but rather one of global concern (Hansen, 2010). According to Gelbspan (2004), climate change is “far more than just an environmental issue. It is a civilization issue” (p. 1). At the 2014 UN Climate Change Summit, U.S. President Barack Obama stated, “there’s one issue that will define the contours of this century more dramatically than any other, and that is the urgent and growing threat of a changing climate” (The White House, 2014). However, despite visible climate changes, global concerns, and a 97 percent agreement within the climate science community that climate change is real and caused by human activity (Cook et al., 2016), denialism is still prevalent among both public officials and average citizens, especially in the United States (Pew Research Center, 2015a; Ipsos MORI, 2014).

Scholarship contends one of the key barriers to acceptance and comprehension of climate change is the lack of jointly developed and compelling narratives that “allow people to see their place in the context of humanity’s and the Earth’s common fate” (Moser, 2010, p. 36). To find such narratives the general public looks to the media organizations, which are “necessary for environmental phenomena to be recognized as

issues for public or political concern” (Hansen, 2010, p. 14). Over recent decades the mass media, especially in the U.S., have “evolved into a powerful actor in the production, exchange, and dissemination of ideas within and between the science, policy, and public spheres” (Boykoff & Boykoff, 2007, p. 1201).

Indeed, today, the news media remain the primary source of the public’s exposure to issues related to general science and environmental concerns, as well as more specific issues such as climate change (Wilson, 2000; Boykoff & Boykoff, 2007; Moser, 2010). As the primary brokers of such information, the media have the unique opportunity to enhance the public’s exposure to and understanding of these critical issues (Valenti, 2000). The media’s differentiated role acts as a critical function for potential problem solving measures to emerge. McComas and Shanahan (1999) state that creating and maintaining the public’s “interest in environmental issues is key to finding and implementing solutions to environmental problems” (p. 30). However, it can be difficult to maintain the public’s interest in climate change stories (Sachsman, Simon, & Valenti, 2010; Gelbspan, 2004). Limited interest is motivated by a number of factors, some inherent in the narrative itself, and others which are external, such as journalistic values and norms, as well as industry, economic, and social evolutions.

Anthropogenic, or human-induced, climate change is a multifaceted issue that encompasses elements of science, morality, and human progress. Due to the complexity and scope of environmental geoscience issues, trying to fully convey the climate crisis via the mass media is an extremely difficult task (Boykoff, 2008). In addition to its complexity, climate change is systematic and progressive over time; therefore the crisis lacks immediacy and relevance (Moser, 2010), both of which are key news values often

relied upon by journalists to justify coverage (Kovach & Rosenstiel, 2001). Uncertainty is also an obstacle within the narrative itself. Hansen (2010) describes this ambiguity as a “superficial familiarity” on behalf of the public, or the idea that while people are aware of the changing climate, they know little about how it works or interplays with other aspects of life such as weather, biodiversity, or atmospheric degradation. Finally, climate change coverage is often presented in a disjointed way, which leads to a lack of clear and unified directives. According to Moser (2010) the lack of clear “social symbols” is a primary detriment to climate change understanding among lay people.

Impediments external to the narrative exist, as well. The media’s institutional and organizational norms and values often function as constraints upon climate change coverage. Boykoff and Boykoff (2007) assert one of the subtlest, yet most powerful influences on climate change inaction, especially in Western cultures, is “journalists’ faithful adherence to their professional norms” (p. 1191), which limits their ability to tell the story of anthropogenic climate change in productive and progressive ways. Adherence to notions of objectivity, especially when it is perceived to be a balancing mechanism, often lead to a misrepresentation of scientific consensus behind climate change (Oreskes, 2004; Hansen, 2010; Boykoff & Boykoff, 2007). In addition, attempts to present “balanced” reporting can also function as a constraint. For example, to create drama and retain professional objectivity, dissension among scientists is often emphasized through the use of specific news frames (Zehr, 2000). The employ of such news frames serves to “politicize” the natural phenomenon of climate change, and motivates the formation of social judgments on the issue (Cox, 2013; Belkin, 1987).

Industry and social changes have also introduced new barriers to the effective relating of the climate change narrative. Digital disruption, shifting market demands, and postmodern idealism, have fostered a surge of uncertainty in the current media landscape (Lowrey & Gade, 2011; Gade, 2011; Picard, 2010).

While innovation has always ushered in adaptation and change, no other singular innovation has facilitated more disruption in mass media industry than the Internet (Beam & Meeks, 2011; Baran & Davis, 2006). The birth of the digital age has rerouted and diversified communication models, content, and availability, which has redefined and, in many ways, reduced the media's role as a primary "gatekeeper" of content (Scott, 2000; Castells, 2007; Singer, 2011). Increased access to information and news content, as well as the ability of the audience to create content for itself has driven to the commoditization of news and the decline of legacy media consumption (Gade & Lowrey, 2011; Dimmick, Powers, Mwangi, & Stoycheff, 2011). As a result of a digitally-induced oversaturation of information, news holes continue to shrink and available space is limited, especially for environmental content and climate change coverage, which is often replaced by more impactful or breaking news (Friedman, 2004).

Furthermore, the abundance of choice provided by the digital age has driven consumers to turn away generalized media content in favor of more personalized platforms and outlets that reinforce their personal preferences and views (Gade & Lowrey, 2011; Gillmor, 2009). Thus, media outlets in today's environment are expected to confirm preconceived notions, rather than introduce facts and shared knowledge.

Digital innovation has also introduced economic hardships, especially among legacy news outlets. Diversification of the media market has led to decreased numbers of readers and viewers for legacy entities, which subsequently reduces advertising income, leading many outlets to attempt to compensate for those losses through employee layoffs (Lacy, Martin, & Hugh, 2004). Over the last 20 years, workforces at traditional media organizations have shrunk by nearly 40 percent (Barthel, 2016). Such economic realities have been especially damaging to climate change coverage, as many outlets have been forced to reduce their specialty offerings, including their science, health, and environmental reporting teams (Bagley, 2013; Daley, 2010).

Shifts in social perspectives have also altered the ways in which climate change is conveyed. Most notable among these is the emergence of postmodernity, which represents not an “extension of modernity; rather it is a rejection of it and its associated ideals” (Gade, 2011, p. 65). While postmodernism encompasses a number of conditions, key among them is the end of mass acceptance of “the grand narrative” (Lyotard, 1993). The collapse of metanarrative acceptance represents a major epistemological shift, one that suggests that truths are multifaceted and formed through “symbolic discourse, intuition, and subjectivity” (Gade, 2011, p. 66). Thus, in a postmodern world, truth is created through social interactions and relationships (Friedman, 2007). As such, truth, in the postmodern era has become a highly subjective process (Baudrillard, 1994), one that defies preordained institutional claims to authority, including those asserted by the media or scientific entities.

To combat these changes media organizations have begun to embrace new practices and routines to meet the needs of a new, more involved audience, as well as

the demands of an emergent, networked era of communication. To survive the dynamic nature of change, media outlets must reconfigure their organizational structures and business strategies, as well as begin to supply innovative products that serve to both bolster their professional value and create unique added value for their organizations (Christensen & Skok, 2012; Deuze, 1999; Picard, 2011). While there are many strategies media entities are turning toward to meet these new demands, one of the most practical and promising means is the employ of alternative story forms, or “tools that quickly engage a reader’s attention” (Quinn, 2007).

Alternative story forms typically present information in non-linear formats, and move away from traditional models of presentation, such as the inverted pyramid or the five-graph model (Akpem, 2015). The characteristics of alternative story forms pairs concisely with added journalistic value in a digital age, which are based in elements of “hypertextuality, interactivity, [and] multimediality” (Deuze, 2001), and supply the individuality needed to highlight the Web as a distinct publishing medium (Deuze, 1999).

New story forms have also proven to be highly effective in relating information, especially complex or science-related content (Quinn, 2007; Ma et al., 2012), which is a critical component to the effective conveyance of the climate crisis. And, when paired with literary devices, such as metaphors or suspense, new story forms have been found to increase information retention and comprehension of concepts, as well as enhance context and perspectives in news presentations (Machill, Köhler, & Waldhauser, 2007).

Literary devices are commonly employed in journalistic writing. They are most frequently seen in narrative style journalism, which has existed in some form or fashion

since the late 19th century (Hartsock, 2000). Similar to alternative story forms themselves, literary or narrative journalism does not adhere to rigid composition models, but rather “enjoys greater freedom in researching a story and greater flexibility in telling it, often refocusing in an instant to take [readers] beneath the surface and into the psyche, either a character’s or the writer’s own” (Kerrane, 1997, p. 20). The ability to employ narrative devices to create relevance among audiences could be a key in advancing the effectiveness of climate change narratives, especially in a digital age.

According to Nisbet (2009):

To break through the communication barriers of human nature, partisan identity, and media fragmentation, messages need to be tailored to a specific medium and audience, using carefully researched metaphors, allusions, and examples that trigger a new way of thinking about the personal relevance of climate change. (p. 15)

One such linguistic tool, or metaphor, that could break down such barriers is anthropomorphism.

Anthropomorphism, or the imbuing of human characteristics upon non-human agents (Guthrie, 1993), has already been shown to be a prolific part of human society (Horowitz & Bekoff, 2007; Knoll, 1997). According to Hume (1757/1957) there is a “universal tendency among mankind to conceive all beings like themselves” (p. 29). This innate desire is motivated by humanity’s social needs, and is a crucial survival skill that develops early in life (Mead, 1934; Erikson, 1968). Neurological determinants also contribute to anthropomorphic tendencies. Neuroscientists have empirically established that individuals process anthropomorphized non-human entities in the same brain sector as they process humans (Cullen, Kanai, Bahrami, & Rees, 2014; Gazzola, Rizzolatti, Wicker, & Keysers, 2007). Anthropomorphism is also linked to the mirror-neuron

mechanism (Rizzolatti & Craighero, 2004) or the ability of humans to learn through imitation as a means to ensure species survival.

Current research applications have found anthropomorphic language can increase comprehension of complex or distant ideas (Waytz et al., 2010; Abrahamse, Steg, Vlek, & Rothengatter, 2005), and “anthropomorphized agents can act as powerful agents of social connection when human connection is lacking” (Epley, Waytz, & Cacioppo, 2007, p. 864). In addition, anthropomorphism can foster beneficence toward non-human animal species and related ideals such as conservation and environmentalism (Butterfield, Hill, & Lord, 2012), and it can increase feelings of self-efficacy and mobilize individuals to partake in environmental efforts (Tam, 2014). And, recently, Ahn, Kim, and Aggarwal (2013) found empirical support for “the premise that anthropomorphism of social causes and their symbolic entities is an effective tool for influencing people to behave prosocially—an action that emanates from their anticipatory guilt for not helping the anthropomorphized cause” (p. 228).

In summary, climate change is an imminent and dangerous threat to the global community (Intergovernmental Panel on Climate Change, 2014; Gore, 2009; Gelbspan, 2004). However, despite a 97 percent agreement among the climate science community regarding the nature and seriousness of anthropogenic climate change (Cook et al., 2016), denialism persists, especially in the U.S. (Ipsos MORI, 2014). Disruption and change within the news industry caused by the shift to the digital age has contributed to the uncertainty surrounding the climate change crisis. Journalistic norms and values may also constrain the ways journalists report on climate change (Hansen, 2010; Cox,



2013). However, alternative forms of storytelling offer a potential avenue to address the issues associated with journalistic communication of climate change.

Currently, little research exists in the area of alternative story forms, and there are no studies that address alternative storytelling techniques and climate change coverage. Thus, this dissertation seeks to explore the potential of such alternative forms in relation to reporting the climate crisis. Through experimental design, this study examines the impacts of alternative story forms on the effective conveyance of the climate change narrative and seeks to understand how alternative ways of telling the story of climate change can affect news consumers' attitudes toward and comprehension of the ensuing environmental crisis. It will also examine the extent to which literary devices can impact the effect of alternative story form usage in regard to climate change coverage.

Through an experimental approach that exposes participants to a combination of alternative story formats and anthropomorphic language, this dissertation has five key purposes. First, a primary goal is to add to the existing literature on climate change coverage by exploring elements that can assist in more effective conveyance of the crisis. Second, by studying climate change in conjunction with both alternative story formats and anthropomorphic language use, this dissertation can also contribute to the advancement of the understanding and implementation of new news strategies in the digital age. Third, this study examines the effectiveness of new formats juxtaposed against traditional forms, which can further advance the understanding of today's digital news consumer's preferences. Fourth, this dissertation will address the ability of anthropomorphic language as an effective tool in communicating the climate change

narrative via narrative news forms, an area that has yet to be analyzed in existing scholarship. Finally, this study will explore the audience's ability to retain complex information regarding the climate change crisis in relation to the format in which it is presented to them.

To address the problems presented in this introduction, as well as the subsequent goals outlined above, the following chapters of this dissertation are organized as follows. Chapter two offers an introduction to the current climate change crisis. It begins with an overview of the Earth's climate crisis, the causes behind it, and the subsequent fallout from it. Chapter two also explores inherent and external factors that impede the successful explication of the climate change narrative. Chapter three details the contemporary environmental movement and the emergence of the "green" beat in U.S. newsrooms. It concludes with an outline of the unique aspects of environmental reporting, as well as some of the difficulties associated with covering the climate change crisis. Chapter four explores the changing media landscape and the effect digital disruption, economic evolutions, and social shifts have had on the climate narrative. Chapter five explicates the ubiquitous nature of anthropomorphism in human culture. It begins with an overview of its history, following by explanations of the psychological and neurological motivations behind it, and concludes with an overview of its application in current research. Chapter six will explain the measure and methods of this study, and chapter seven will provide the results of the experimental analysis. Chapter eight will present the discussion for this study.

## **Chapter 2: Climate Change: Causes, Consequences, & Constraints**

The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 at the behest of the World Meteorological Organization (WMO) and the United Nations (UN). Formed to “evaluate the state of climate science as a basis for informed policy action, primarily on the basis of peer-reviewed and published scientific literature” (Oreskes, 2004, p. 1686), the Intergovernmental Panel on Climate Change is the predominant expert in the area of anthropogenic climate change (Gelbspan, 2004). In the first pages of its Fifth Assessment, released in 2014, the panel stated in no uncertain terms the reality of the climate crisis. The panel found that “human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history” (p. 4). Additionally, the report notes “recent climate changes have had widespread impacts on human and natural systems, and warming of the climate system is unequivocal” as “atmosphere and oceans have warmed, the amounts of snow and ice have diminished, and the sea level has risen” (p. 2).

Renowned climate activist Al Gore (2009) explained the current state of the environment in more dramatic terms, stating: “Human civilization and the earth’s ecological system are colliding, and the climate crisis is the most prominent, destructive, and threatening manifestation of this collision” (p. 32).

However despite numerous calls to action and a 97 percent consensus within the climate science community (Cook et al., 2016), uncertainty regarding the state of the climate crisis persists among the general public (Moser, 2010; Oreskes, 2004). As such, a burgeoning area of research has begun to emerge in many scholarly genres. In hard sciences alone, climate change research more than doubled between the years of 2005

and 2010 (Intergovernmental Panel on Climate Change, 2014), and in other areas such as communications and humanities interest is also accelerating (Cox, 2013). Today top journals within the social sciences are dedicating entire volumes and paper calls to climate research, a recent example includes *Mass Communication and Society's* 2016 special issue dedicated to advancing research on “climate and sustainability communication” (Pompper, 2016, p. 543). In addition, submissions continue to increase to interdisciplinary journals devoted solely to the study of climatic change, such as *Climatic Change*, *Environmental Communication*, and *The International Journal of Climate Change*.

Coverage of climate change by major media outlets didn't began to surface until the late 1980s, and in the beginning, stories concerning the issue were often limited to coverage of government proceedings, international conferences, scientific findings, and, on rare occasions, extreme weather, biological, or ecological events (Moser, 2010; Weart, 2003). However, by the second decade of the 21<sup>st</sup> century, global concerns spurred more expansive discussion and coverage of environmental issues by the mass media (Hansen, 2010).

Nonetheless, growing concern has done little to combat the difficulties, both internal and external, of the climate change narrative (Gelbspan, 2004). This chapter begins to explore those difficulties. The chapter begins with an overview of the Earth's changing climate, followed by an explication of the main anthropogenic contributions to the climate crisis and an overview of the consequences of a steadily warming planet. Finally, this chapter will explore the difficulties of communicating the realities of climate change and its potential impacts.

## **The Earth's Changing Climate**

Three main factors exert the most influence on the Earth's climate systems: the atmosphere, the sun, and the oceans (Withgott & Brennan, 2007).

Earth's atmosphere, or the layer of gases that surround the planet, is composed of permanent gases, which remain at stable concentration, and variable gases, which vary in concentration due to natural processes and human activities (Withgott & Brennan, 2007). When the chemical composition of the atmosphere is altered, the Earth's climate system begins to change too (Houghton et al., 2012; National Oceanic Atmospheric Administration, 2008a). According to Withgott and Brennan (2007), without the protection of stable atmospheric systems the Earth would be "as much as 33° C (59° F) colder on average, and temperature differences between night and day would be far greater" (p. 530).

According to NASA (2013), the Earth's atmosphere is composed of six parts or layers. The bottom most layer, the troposphere, covers the planetary surface and provides organisms the air needed to survive (Withgott & Brennan, 2007). The densest layer of the atmosphere, the troposphere extends approximately 5 to 9 miles high, and houses nearly all of the Earth's weather (NASA, 2013).

Pollutants can affect all layers of the lower atmosphere, however the troposphere is where highest rates of warming are observed (Withgott & Brennan, 2007). This tropospheric warming is due to the composition of the Earth's atmosphere, which operates much like a green house. In the simplest terms, the greenhouse effect is the exchange of energy. The sun provides the Earth with energy and warmth via sunlight. In turn, the Earth emits infrared energy. (Withgott & Brennan, 2007). This exchange of

incoming and outgoing radiation that warms the Earth is referred to as the greenhouse effect (Lallanila, 2016).

For a stable “greenhouse,” the Earth should maintain a “rough equilibrium,” emitting and receiving similar amounts of solar energy (Kiehl & Trenberth, 1997). However, an accumulation of greenhouse gases in the Earth’s atmosphere is affecting its ability to maintain the status quo. Greenhouse gases absorb infrared radiation from the planet’s surface (Withgott & Brennan, 2007), and include such gases as water vapor, carbon dioxide, methane, nitrous oxide and others (Lallanila, 2016). As these gases accumulate due to human activities, they increase the amount of radiation emitted from the atmosphere and sent back to Earth, which subsequently increases temperatures across the globe (Kiehl & Trenberth, 1997). And, while the greenhouse effect is a natural phenomenon, “human activities have increased the concentrations of many greenhouse gases in the past 250-300 years, and [they] have thereby enhanced the greenhouse effect” (Withgott & Brennan, 2007, p. 530).

The second layer, the stratosphere, extends 7 to 31 miles above sea level and has a composition similar to the troposphere, but is drier and less dense (Withgott & Brennan, 2007). The stratosphere houses 90 percent of the ozone layer, which absorbs and disperses ultraviolet solar radiation; the remaining 10 percent resides in the lowermost layer, the troposphere (National Oceanic Atmospheric Administration, 2008a; NASA, 2013). And, while the chemical makeup of ozone molecules is identical in both atmospheric layers, the effect each has on the environment is very different.

Stratospheric ozone reduces the amount of ultraviolet sunlight (UV-B) that reaches the Earth’s surface, which is beneficial as excessive exposure to UV-B “can

damage living tissues and induce DNA mutations” (Withgott & Brennan, 2007, p. 499). Furthermore, ozone “plays a key role in the temperature structure of the Earth's atmosphere” (National Oceanic Atmospheric Administration, 2008a, para. 3).

Tropospheric ozone also referred to as “bad ozone” occurs at the Earth’s surface, and, at high levels, is toxic to living systems (Withgott & Brennan, 2007). The detrimental effects of surface ozone have been documented on crop production, forest growth, and human health” (National Oceanic Atmospheric Administration, 2008a, para. 4).

The third layer of the Earth’s atmosphere is the mesosphere, which extends about 31 to 56 miles above sea level (NASA, 2013). Here, air pressure is extremely low and temperature begins to decrease with altitude (Withgott & Brennan, 2007). The fourth layer, called the thermosphere, extends 372 miles high and is the holding area for satellites (NASA, 2013). The fifth layer, the ionosphere, reaches to the edge of space and overlaps with the mesosphere and the thermosphere (NASA, 2013). The final layer is the exosphere, which is the upper limit of the Earth’s atmosphere and extends from the top of the thermosphere to approximately 6,200 miles (NASA, 2013).

The amount of energy released by the sun, as well as the Earth’s rotation and orbit also influence the planet’s climate (Withgott & Brennan, 2007).

In the 1920s, Serbian astronomer Milutin Milankovitch determined that the Earth “wobbles’ in its orbit” and that the Earth’s “tilt’ is what causes seasons, and changes in the tilt of the earth change the strength of the seasons” (National Oceanic Atmospheric Administration, 2009, para. 4). These variations in the planet’s orbit and rotation, now referred to as Milankovitch Cycles, change the distribution of solar

radiation across the Earth's surface, which in turn "contributes to changes in atmospheric heating and circulation that have triggered climate variation, such as periodic glaciation episodes" (Withgott & Brennan, 2007, p. 533).

And, while the sun is the "fundamental source of energy that drives our climate system" (NASA, 2016, para. 18), studies find the current global warming trends cannot be explained solely by changes in solar energy levels (Thomson, 1995). According to NASA (2016), a number of factors explicate this presumption, such as the average amount of solar energy output has remained relatively consistent since 1750, current climate models cannot replicate the observed temperature changes based on solar irradiance fluctuations alone, and finally, the organization asserts "if the warming were caused by a more active sun, then scientists would expect to see warmer temperatures in all layers of the atmosphere. Instead, they have observed a cooling in the upper atmosphere, and a warming at the surface and in the lower parts of the atmosphere. That's because greenhouse gases are trapping heat in the lower atmosphere" (para. 23).

Finally, the oceans play a significant role in the Earth's climate. Ocean currents move energy from place to place, and ocean waters exchange vast amounts of heat with the atmosphere (Withgott & Brennan, 2007). The most noted climate-ocean interactions are El Niño and La Niña.

El Niño refers to "the large-scale ocean-atmosphere climate interaction linked to a periodic warming in sea surface temperatures across the central and east-central Equatorial Pacific" (National Oceanic Atmospheric Administration, 2016, para. 5). El Niño conditions typically begin with equatorial winds weaken and allow warm Western Pacific waters to move easterly, thus circumventing cold water from surfacing in the



eastern Pacific (Withgott & Brennan, 2007). El Niño is viewed as the ocean's mechanism for expelling stored heat (Gelbspan, 2004), and its effects include warmer temperatures and wetter or drier conditions depending on regional location. El Niño can also affect "weather patterns, ocean conditions, and marine fisheries across large portions of the globe for an extended period of time" (National Oceanic Atmospheric Administration, 2016, para. 6). Finally, while the El Niño phenomenon has always existed, it typically occurred on average every seventh year, but in the 1970s a distinct rise in frequency and intensity of El Niño events was observed, and has since been credited to the rise in global ocean temperatures (Cai et al., 2014; Collins et al., 2010).

La Niña is the opposing counterpart to El Niño. In La Niña episodes, cold surface waters extend westward and induce lower than average ocean surface temperatures across the eastern Pacific (National Oceanic Atmospheric Administration, 2016). Generally speaking, La Niña climate impacts tend to be opposite those of El Niño, whereas winter temperatures are warmer than normal in the Southeast and cooler than normal in the Northwest (National Oceanic Atmospheric Administration, 2016).

These three factors contribute to the organic processes involved in the Earth's climate, which is a "homeostatic system that varies naturally with time" (Withgott & Brennan, 2007, p. 553). However, while the planet's climate has never been entirely static, the rate at which current climate changes are taking place is unprecedented and likely to cause severe detriments to eco-systems and sustainability across the globe (Hansen et al., 2008; Intergovernmental Panel on Climate Change, 2013; Gore, 2007; NASA, 2016). Furthermore, the vast majority of climate scientists agree that human activities, or those of an anthropogenic nature, are largely responsible for the rapid

climate and atmospheric modifications currently occurring (Cook et al., 2016; Intergovernmental Panel on Climate Change, 2013).

### **Anthropogenic Factors of Climate Change**

The scientific community attributes anthropogenic climate change to six different types of pollutants – commonly known as greenhouse gases – all of which trap heat and contribute to raising air, ocean, and surface temperatures on Earth (Environmental Protection Agency, 2016). The six pollutants include (1) carbon dioxide, CO<sub>2</sub>, (2) methane, CH<sub>4</sub>, (3) black carbon, (4) Halocarbons, (5) carbon monoxide, CO, and volatile organic compounds (VOCs), and (6) nitrous oxide, N<sub>2</sub>O. Each of these six contributes a unique proportional role (Gore, 2009) in the global warming equation. A seventh subsequent greenhouse gas, water vapor, is also a major contributor to climate degradation, but it differs in that it is a result of human-based pollutant use, and not an independent factor.

By far, the largest contributor to the climate crisis is carbon dioxide (CO<sub>2</sub>) (Environmental Protection Agency, 2016). Although CO<sub>2</sub> is absorbed and emitted through natural means such as “plant and animal respiration, volcanic eruptions, and ocean-atmospheric exchange” (Environmental Protection Agency, 2016, para. 11) human activities are to blame for the current massive amounts of CO<sub>2</sub> emissions, which cause concentrations of the gas in the atmosphere to rise (Environmental Protection Agency, 2016). The largest human-caused sources of carbon dioxide release are the burning of coal, oil, and natural gases for industrial activities (Gore, 2009). After fossil fuel consumption, land use changes are the second most significant contributor to rising CO<sub>2</sub> concentrations in the Earth’s atmosphere (Houghton et al., 2012). The most

predominant form of land repurposing is deforestation for agricultural purposes, and it is most commonly conducted in developing nations (Gore, 2009).

Since the industrial revolution, CO<sub>2</sub> levels on Earth have increased by nearly a third (NASA, 2016), and today carbon dioxide levels are higher than they have been in more 800,000 years (Intergovernmental Panel on Climate Change, 2013). Currently, human activities release more than 30 billion tons of CO<sub>2</sub> into the atmosphere every year (Intergovernmental Panel on Climate Change, 2013). Because the increase of carbon dioxide released into the atmosphere is caused by human activity, the gas is considered an “external forcing,” or an influence on the climate that originates from outside the climate system itself (National Oceanic Atmospheric Administration, 2008). Most recently, climatologists found that the annual concentration of CO<sub>2</sub> will surpass 400 parts per million (ppm), the ratio of carbon dioxide molecules to all of the other molecules in the atmosphere, in 2016 (Betts et al., 2016). In addition, expert analysis projects CO<sub>2</sub> concentrations will not fall below that number again in the near future (Betts et al., 2016).

High carbon dioxide levels are especially concerning for climatologists. Scientific evidence suggests at the birth of human civilization, the Earth’s atmosphere contained only 275 ppm of carbon dioxide; however since the 18<sup>th</sup> Century the amount of CO<sub>2</sub> released into the atmosphere has continued to increase (Hansen et al., 2008). Recent data finds carbon dioxide concentrations are growing at a rate of 2 to 2.5 ppm per year (Lindsey, 2014) The effects of higher CO<sub>2</sub> concentrations in the atmosphere are already showing, since 1880, the average land and ocean surface temperatures across the globe have warmed by 1.53 degrees Fahrenheit (Intergovernmental Panel on

Climate Change, 2013), and current heat models predict if CO<sub>2</sub> emissions continue to climb at the current rate, a doubling of the pre-industrial carbon dioxide levels will occur, which will likely cause global average surface temperature to rise between 2.7 and 8.1 degrees Fahrenheit (Lindsey, 2014). According to climate experts, a rise in global surface temperatures of even the most modest degree can have catastrophic effects. Hansen and colleagues voiced their concerns in a 2008 study, citing if “humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO<sub>2</sub> will need to be reduced...to at most 350 ppm” (Hansen et al., 2008, p. 217).

The second most powerful contributor to climate change is methane, CH<sub>4</sub>. Methane, a hydrocarbon, is released in smaller amounts than carbon dioxide, but it is much more potent in its ability to trap heat in the atmosphere (NASA, 2016). Similar to carbon dioxide, CH<sub>4</sub> is emitted through organic means, such as natural wetlands, volcanoes, and forest fires, as well as human activity, such as agricultural endeavors and fossil fuel extraction and transportation (Environmental Protection Agency, 2016).

Globally 60 percent of CH<sub>4</sub> emissions are derived from human activity (Environmental Protection Agency, 2010). And, more than half of human-induced methane emissions come from livestock operations, livestock waste, and rice cultivation (Gore, 2009). The second large segment of methane release is due to oil and gas production activities, coal mining, landfills and waste management endeavors, and fossil fuel combustion (NASA, 2016).

According to the Intergovernmental Panel on Climate Change (2013) methane is now more abundant in the atmosphere than at any time in recent history. Compounding the issue, current research finds that the thawing of permafrost in arctic and sub-arctic regions is beginning to release large amounts of methane, once previously frozen underground, into the atmosphere, which is accelerating climate degradation (Schuur et al., 2015).

The third main contributor to climate change is black carbon, also known as soot, which is not a gas, but rather an aerosol or solid particle (Environmental Protection Agency, 2016). Black carbon is the shortest lived of the six primary contributors to global warming, and it operates in a distinctly unique way (Gore, 2009). Unlike the greenhouse gases, black carbon can absorb both infrared radiation and incoming and reflected sunlight (Environmental Protection Agency, 2016) the absorption of solar energy in turn warms the atmosphere (Cho, 2016).

Additionally, black carbon can adhere to snow and ice, which darkens the polar surface thereby accelerating melt (Environmental Protection Agency, 2016). The hastening of the snow and ice melt in this process is due to a reduction of what scientists call albedo, or the measure earth's reflectivity (Cho, 2016). Loss of albedo is a critical issue, as the lower the reflectivity of the earth's surface; the more energy is absorbed, which directly contributes to global warming (Cho, 2016). Furthermore, the "most reflective surfaces are snow and ice, which send as much as 90 percent of the sun's energy back toward space" and as "the sea ice melts, it exposes the far more energy-absorbent ocean" (Gore, 2009, p. 45).

The main sources of black carbon pollution include exposed burning of biomass such as “residential burning of solid fuels such as coal, wood, dung and agricultural residue; fossil fuel combustion for transportation; and industrial activities” (Diesel Technology Forum, 2014, para. 5).

The fourth category of pollutants is a grouping of industrial chemicals known as halocarbons. This assembly includes: chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>) (Environmental Protection Agency, 2016). Together these gasses are know as “F-Gases,” and unlike the other forms of climate pollutants, these fluorinated gases have no natural origin and stem solely from human-related activities (Environmental Protection Agency, 2016a).

Typically used in propellants, such as in aerosol cans, and refrigerants, like Freon, as well as in air conditioning systems, heat pumps, and foam plastic production, halocarbons are long lasting greenhouse gases that not only trap heat, but also deplete the ozone layer (Forster & Joshi, 2005; Environmental Protection Agency 2016a).

Due to their destructive ozone capabilities, halocarbons are highly regulated today under the Montreal Protocol (1987). The Montreal Protocol on Substances that Deplete the Ozone Layer, and its subsequent amendments, is considered a landmark agreement that successfully reduced the global production, consumption, and emissions of ozone-depleting substances (Velders et al., 2007). However, while the use of halocarbons is steadily declining, they still account for a significant portion of the climate crisis, thus science and environmental organizations continue to push for stronger regulations on their use (Gore, 2009).

A grouping of air pollutants that includes carbon monoxide (CO) and volatile organic compounds (VOCs) makes up the fifth primary causal category behind climate change.

In the United States and other developed countries, the biggest output of CO comes from vehicles. CO is also produced in other areas via the burning of biomass (Gore, 2009). Carbon monoxide affects methane, carbon dioxide, and the tropospheric ozone (NASA, 2016). According to Shindell (2007), “CO is unique among pollutants in the lower atmosphere in that it lasts for roughly a month, long enough for it to be transported long distances but not so long that it becomes distributed nearly uniformly” (para. 1). Carbon monoxide’s primary causal role in climate decline is its interaction with other chemicals in the atmosphere that leads to a continued increase in trapped surface heat (Environmental Protection Agency, 2016).

Volatile organic compounds include non-methane hydrocarbons and other organic compounds containing elements like oxygen (Houghton et al., 1995). Like carbon monoxide, VOCs do not trap heat themselves, but rather instigate chemical reactions with other elements, such as nitrogen oxides ( $\text{NO}_x$ ), that lead to rising global temperatures and increased production of low-level ozone pollution (Houghton et al., 1995). In addition, the reaction between VOCs and variations of  $\text{NO}_x$  may also cause a decrease in hydroxyl radical (OH) concentrations, which can lead to the accumulation of methane and other greenhouse gases in the atmosphere (European Science Foundation, 2010). VOC pollution is higher indoors, and the compounds are known to have direct negative implications on human health. Many VOCs are listed as carcinogens by the Environmental Protection Agency, and chronic exposure to certain

VOC agents has resulted in a variety health issues including, cancer, birth defects, organ damage, nervous system disorders, and immune systems deficiencies (Metzger, 2005; Environmental Protection Agency, 2016).

The last of the direct contributors to the changing climate is nitrous oxide, N<sub>2</sub>O. Produced both naturally and via anthropogenic means, nitrous oxide is most closely linked to farming and food production. The vast majority of N<sub>2</sub>O emissions stem from “agricultural practices that rely heavily on nitrogen fertilizers, magnifying the natural emissions resulting from the bacterial breakdown of nitrogen in the soil” (Gore, 2009, p. 49). Nitrous oxide concentrations have risen nearly 20 percent since the Industrial Revolution, and in the past century levels have increased more rapidly than at any other time in the last 22,000 years (Intergovernmental Panel on Climate Change, 2013).

Nitrous oxide molecules stay in the atmosphere for more than 100 years, and the “impact of 1 pound of N<sub>2</sub>O on warming the atmosphere is almost 300 times that of 1 pound of carbon dioxide” (Environmental Protection Agency, 2016a, para. 1). And, as with methane, thawing permafrost is compounding the problem of N<sub>2</sub>O emissions. According to Elberling, Christiansen, and Hansen (2010), permafrost soils emit mass amounts of nitrous oxide after thawing and re-saturation, which increases nitrous oxide production by more than 20 fold, and almost one third of the N<sub>2</sub>O produced in this process travels up to the atmosphere.

Finally, water vapor is a major contributor to climate change, but it’s important to note that its role in the process differs greatly from the pervious six pollutants. Water vapor is the most abundant greenhouse gas (NASA, 2016), and it traps more heat than CO<sub>2</sub>, however this technicality can be misleading.



The extent to which water vapor traps more heat than normal in the earth's atmosphere is determined by the extent to which global warming pollutants raise the air and ocean temperatures, increasing the amount of water vapor the atmosphere can hold. The amount of water vapor in the air is responsive to its temperature and atmospheric circulation patterns that help determine the relative humidity. Because changes in these variables are being driven by the emission of CO<sub>2</sub> and other global warming pollutants, human activities are really controlling the change in atmospheric water vapor. (Gore, 2009, p. 49)

Because water vapor functions as part of the feedback cycle in the greenhouse effect (NASA, 2016), as anthropogenic climate change advances, so will the accumulation of vapor in the atmosphere. In addition, a recent study confirmed that increasing amounts of water vapor collecting in the upper troposphere will intensify the impacts of climate change in the coming decades (Chunga, Sodena, Sohn, & Shic, 2014).

### **Consequences of Climate Change**

Findings synthesized by the Intergovernmental Panel on Climate Change (2013) indicated the impacts of anthropogenic climate change are set to be drastically more significant in the coming decades. All species, both human and otherwise, as well as every form of habitat on the planet will be affected by changes in global temperatures, precipitation patterns, and increased natural disaster occurrence (NASA, 2016; U.S. Global Change Research Program, 2014; Intergovernmental Panel on Climate Change, 2014).

In its Fifth Assessment Synthesis Report, the Intergovernmental Panel on Climate Change (2014) was candid with its predictions regarding climate vulnerability. In the opening chapter of the report the committee states two direct assessments. One, the committee finds that “human influence on the climate system is clear, and recent anthropogenic emissions of green house gases are the highest in history” (p. 2). And,

two, they conclude, that the “warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia” (p. 2). Due to these findings, the Intergovernmental Panel on Climate Change (2014) clearly asserts that “recent climate changes have had widespread impacts on human and natural systems” (p. 2) and those changes are accelerating at unprecedented rates (Intergovernmental Panel on Climate Change, 2014; NASA, 2016).

While the Fifth Assessment Synthesis Report goes into detail, it broadly defines six key areas of concern regarding the long-term consequences of climate change: (1) continued warming of the planet; (2) changes in precipitation patterns and weather conditions; (3) rising sea levels; (4) ocean acidification; (5) disruptions to eco-systems and loss of biodiversity; and (6) threats to human health, safety, and welfare.

According to the World Meteorological Organization (2016), global temperatures during 2016 surpassed previous warming records, thus positioning 2016 to be the hottest year on record to date. And, while scientists contend that El Niño is a factor in the rising global temperatures, the most significant factor driving the increase in warming continues to be CO<sub>2</sub> emissions (World Meteorological Organization, 2016; McGrath, 2016).

The Intergovernmental Panel on Climate Change (2014) forecasts that global temperatures will rise 2.5 to 10 degrees Fahrenheit over the next century; however, because anthropogenic global warming is “superimposed on a naturally varying climate, the temperature rise has not been, and will not be, uniform or smooth across the country or over time” (NASA, 2016a, para. 8). Changes to the planet’s atmospheric temperature typically happen very slowly, therefore even a single degree rise in the surface

temperature of the Earth is a major event of critical importance (The World Counts, 2014). Scientific consensus asserts that even the most modest degrees of global warming, less than one degree Fahrenheit, can have significant, devastating effects (Natural Resources Defense Council, 2016).

As such, global warming is one of the direst conditions caused by human-driven climate change, and it is the driving force behind the other long-term consequences of continued climate dissemination (Hansen et al., 2008).

Global warming leads to changes in precipitation patterns and weather patterns, included increases in extreme climactic activity (Intergovernmental Panel on Climate Change, 2014; NASA, 2016a).

According to the World Meteorological Organization (2016), current average precipitation across the globe varied significantly leaving some regions arid, and others over saturated. In the U.S. precipitation levels have increased since 1900, but, like the global analysis, levels across sectors are highly variant (NASA, 2016a). Future projections trend toward increased heavy precipitation events across the planet, which “implies greater risks of flooding” on regional levels (Intergovernmental Panel on Climate Change, 2014, p. 7).

In conjunction with increased variant precipitation patterns, global warming is also leading to droughts and long-lasting heat waves (NASA, 2016a). The Intergovernmental Panel on Climate Change (2014) finds that across the globe periods of intense heat will last longer while cold waves will become less frequent in the coming decades.

Increased frequency of severe weather events is another result of global temperature increase. According to National Oceanic Atmospheric Administration National Centers for Environmental Information (2016), in 2015, in the United States, there were ten weather and climate disasters, as of September of 2016 that number had already grown to twelve.

Changes in extreme weather frequency have been observed since 1950 (Intergovernmental Panel on Climate Change, 2014), and empirical evidence finds that higher global temperatures are the catalyst behind the worsening of many natural disasters (Natural Resources Defense Council, 2016). As early as 1995, these changes were attributed with 90 percent certainty to rising levels of greenhouse gases (Karl, Knight, & Plummer, 1995). The Intergovernmental Panel on Climate Change Fifth Assessment (2014) analysis of extreme weather shifts contends there will be long-lasting effects from such across the planet: “Impacts from recent climate-related extremes, such as heat waves, droughts, floods, cyclones and wildfires, reveal significant vulnerability and exposure of some ecosystems and many human systems to current climate variability” (p. 8).

Rising sea levels are also a primary concern associated with climate change. Because polar regions are especially vulnerable to global warming, temperatures there are rising at double the rate of the rest of the planet, thus massive ice sheets are melting rapidly contributing to sea level increases (Natural Resources Defense Council, 2016). Today, Earth’s two ice sheets cover most of Greenland and Antarctica, and together they span more than 13 million square miles and contain more than 99 percent of the freshwater ice on Earth (National Snow and Ice Data Center, 2016).

Since 2007, there have been meaningful advancements in the understanding and projections concerning rising sea levels (Intergovernmental Panel on Climate Change, 2014). Most current assessments find the global mean sea levels will continue to rise, though not uniformly across regions, however the escalation will occur at a much faster rate than initially expected (Intergovernmental Panel on Climate Change, 2014; NASA, 2016a).

According to the Intergovernmental Panel on Climate Change (2014), nearly 70 percent of coastlines across the globe will experience a sea level change within “±20% of the global mean” (p. 13). Estimations also predict, by 2100, oceans worldwide “will be one to four feet higher, threatening coastal systems and low-lying areas, including entire island nations and the world's largest cities, including New York, Los Angeles, and Miami as well as Mumbai, Sydney, and Rio de Janeiro” (Natural Resources Defense Council, 2016, para.11).

Climate change is also driving the acidification of oceans worldwide. While scientific interest in ocean pH levels is a relatively recent development, findings so far suggest dire outcomes for marine eco-systems. Currently, the oceans absorb nearly one third of human-induced carbon dioxide emissions, which equates to about 22 millions tons absorbed daily (National Geographic, 2015). In 2014, the Intergovernmental Panel on Climate Change asserted, with “high confidence,” that if anthropogenic CO<sub>2</sub> emissions continue to rise, ocean acidification will continue to increase and it will strongly affect marine ecosystems. Devastation will be considerably high for shell-forming marine animals such as corals, oysters, lobsters, etc. (Intergovernmental Panel on Climate Change, 2014).

Of additional concern, as the world's oceans continue to absorb carbon dioxide, "their capacity as a carbon storehouse could diminish," which "means more of the carbon dioxide [emitted] will remain in the atmosphere, further aggravating global climate change" (National Geographic, 2015, para. 7).

Climate change is also wreaking havoc on the earth's biodiversity. Currently the planet is in the midst of what scientists call the Sixth Mass Extinction, but "unlike the mass extinction events of geological history, the current extinction challenge is one for which a single species—ours—appears to be almost wholly responsible" (World Wildlife Fund, 2016, para. 11). Today, even by the most conservative estimates, extinction rates are 100 times higher than they would be without human impact (Ceballos et al., 2015). Studies find if the current trends continue, the earth will lose 75 percent of species in the next few centuries (Carrington, 2016).

According to the Intergovernmental Panel on Climate Change (2014), most of the species, both plant and animal, face increased extinction risk "due to climate change during and beyond the 21st century, especially as climate change interacts with other stressors" (p. 13). There are a number of key stressors to factor into the equation of climate change and extinction. For example, changes to geographic ecosystems are occurring too quickly for species to adapt and/or relocate (Intergovernmental Panel on Climate Change, 2014). This is especially true for highly sensitive areas such as the rain forests, polar regions, and marine habitats (Environmental Protection Agency, 2016b; Intergovernmental Panel on Climate Change 2014). In addition, warming can have significant impacts on food web distributions, disease rates, and threshold abilities of ecosystems and species groupings (Environmental Protection Agency, 2016b).

While plants and non-human species are the two groupings facing mass extinction rates, humans will not be immune to the fallout associated with climate change. The Intergovernmental Panel on Climate Change (2014) finds that changes in the global climate, temperature norms, and rainfall levels negatively impact crop yields, and destruction of fresh water ecosystems will have adverse effects on consumable water resources (Natural Resources Defense Council, 2016).

In addition, climate change poses direct threats to human health. The Environmental Protection Agency (2016b) finds that “climate change and shifts in ecological conditions could support the spread of pathogens, parasites, and diseases, with potentially serious effects on human health, agriculture, and fisheries” (para. 14). The Intergovernmental Panel on Climate Change (2014) also reports a rise in both heat-related mortalities and the spread of water-borne illnesses.

Predictions related to these impact assessments suggest climate change could be a key factor in widespread famine and disease. The Intergovernmental Panel on Climate Change (2014) quantifies this with regard to society, noting that devastation will be more severe in low-income and rural areas, where inhabitants are likely to “experience major impacts on water availability and supply, food security, infrastructure and agricultural incomes, including shifts in the production areas of food and non-food crops around the world” (p. 14).

### **Constraints Inherent in Climate Change Discourse**

Covering the complexity of climate change in context and detail is a major endeavor for journalists, one laden with obstacles inherent in the narrative itself. Indeed Boykoff (2008) likens the task to “trying to adequately summarize the contours of

biogeochemistry in the space of a picture post-card” (p. 11). However, despite the difficulties inherent in the story, the need to communicate the reality of climate change effectively is essential for social growth and sustainability (Moser, 2010). This crucial task is a momentous undertaking as climate change “involves less certainty and immediacy than other, more familiar problems, yet also has the potential for far graver implications than previous challenges” (Moser, 2010, pp. 31-32).

There are four broad areas of difficulty intrinsic in the climate change dialogue: (1) the lack visibility, immediacy, and proximal relativity of the issue; (2) the complexity and uncertainty of the issue; (3) disillusionment and denialism in public and governmental discourse; and (4) the absence of clear signals and directives in existing narratives (Moser, 2010; Hansen, 2010; Neuzil, 2008).

**Lack of immediacy.** Climate change is systematic and progressive over time; therefore the crisis lacks immediacy in many ways (Moser, 2010). The lack of immediacy in relation to the climate change narrative is best explicated through two key constraints: invisibility and distance, or lack of proximal relativity.

Many causal factors of climate change, such as fossil fuel emissions, lack visibility, thus the nature of those factors conflicts with the nature of the environmental vocabulary, which is primarily visual (Hansen, 2010). This invisibility of greenhouse gasses and similar climate change associations creates the first substantial hurdle to overcome when reporting on the issue.

More than 80 percent of the carbon dioxide emitted into the atmosphere is due to human activity (Environmental Protection Agency, 2016), however, despite its prevalence, it is invisible, making its existence more latent rather than explicit. Many of



the other main contributors to climate change, such as nitrous oxide, methane, and water vapor, have a similar invisibility. Supporting this claim, the largest methane leak in U.S. history occurred just outside of Los Angeles in 2016, and *The New York Times* cover story detailing the disaster was aptly titled: “The Invisible Catastrophe” (Rich, 2016).

Since most greenhouse gas emissions are an unseen force in the average citizen’s daily life, there are limitations on the way in which mass media can visually advance the climate change narrative. Thus, “the prevailing imagery of climate change is often remote, abstract and scientific, or else so fantastic and catastrophic that we doubt it can be taken seriously” (Sheppard, 2012, p. 3).

In addition, the impacts of climate change are distant to many, or in other words, they lack proximal relativity, which makes them even more inconspicuous to the general public. First, even though the consequences of climate change are accelerating at unprecedented rates (NASA, 2016; Intergovernmental Panel on Climate Change, 2014), the “end game” is still years, decades, and in some cases centuries away, therefore the public often does not comprehend the need for immediate and decisive action (Moser, 2010).

Compounding the issue, the areas with the highest levels of visually recognizable elements of environmental degradation are also the areas that humans do not typically inhabit, such as the Arctic, the oceans, and the rain forest (Intergovernmental Panel on Climate Change, 2014).

Finally, most humans are “insulated” by urban living and spend the majority of their time in climate-controlled environments, which can further limit their ability to notice “subtle, incremental environmental changes” while at the same time making it

easier for them to dismiss the need to take action regarding climate change (Moser, 2010, p. 34).

**Complexity and uncertainty.** Climate change has been a well-established concept in the public sphere for the past quarter-century (Wuthnow, 1992), however, that does not coincide with widespread comprehension of this complex global crisis.

Hansen (2010) states:

...the public vocabulary on the environment and environmental change...is a vocabulary which is strangely familiar and recognizable, but probably, for most, only in a superficial kind of way; that is, behind most of these terms lurk some immensely complex issues that require a great deal of scientific, philosophical, ethical, moral, economic, etc., engagement well beyond what most of us have the time, or perhaps the inclination, to delve into. (p. 1)

A common example of Hansen's notion of superficial familiarity is the general public's inability to clearly identify the difference between weather and climate (Cox, 2013). While weather can refer to many different elements including, temperature, precipitation, barometric pressure, and more, it can only describe an area's atmospheric conditions over short-term periods; in contrast, climate is an area or region's long-term pattern of atmospheric circumstance (Withgott & Brennan, 2007). This perspective garnered further support in a recent study that found a person's belief in climate change was affected by their individual experience of their local weather fluctuations over time (Kaufmann et al., 2016).

Complexity can also be compounded due to the nature of the narrative. Often, environmental news stories are filled with scientific jargon, data sets, or numerical representations, all of which can overwhelm readers, and in turn encourage them to move on and move past articles addressing climate issues (Sachsman, Simon, & Valenti, 2010).

Uncertainty is also a key difficulty within the climate change narrative. The existence of climate change and its anthropogenic nature is well established (Cook et al., 2016), however the science behind such claims can lead to uncertain interpretations, especially among laypeople. Climate science, similar to other scientific pursuits, does not operate under an umbrella of 100 percent predictability rather it functions in likelihoods and casual assessments (Intergovernmental Panel on Climate Change, 2014; Gore, 2009).

The most common method used to assess the condition of the global climate is climate modeling. There are a number of climate models that assess many different aspects of climate change including precipitation levels, cloud cover, ocean temperatures, and atmospheric trends (Spencer, 2009); however due to the complexity of the mathematical equations used in these models, the equations can only be solved approximately (Barsugli, Averyt, & Ray, 2009). According to former NASA scientist Roy Spencer (2009) the main source of uncertainty in climate modeling is not the negative impacts of rising greenhouse gases, but rather, what the climate system will do with them; “will the climate system act to reduce, or enhance, the small amount of CO2 warming?” (para. 16).

The scientific community itself also perpetuates the uncertainty of climate change and its subsequent consequences. According to Gelbspan (2004), the issue of uncertainty is compounded when scientists employ “extremely conservative and qualified language” in their public statements, a language, which is a requirement in the scientific arena, but an ambiguity in the public sphere. Furthermore he contends, such constrained language only provides fuel to lobbying organizations that promote agendas

based on lessening environmental protections and to maintaining “global warming as a theory rather than a fact” (Gelbspan, 2004, p. 51).

According to Moser (2010), uncertainty in the general public’s understanding to climate change can arise from other factors. “Uncertainty can stem from the lack of data, lack of adequate theoretical understanding of environmental system interactions, the unavoidable inadequacy of representing nature’s complexity in models, limitations in the processing capacity of computers, and the inherent indeterminacy of processes in complex systems” (p. 35).

Finally, uncertainty is also a factor in the public’s evaluation of possible outcomes in relation to taking action to curb climate change, as well as its understanding of what actions or engagements are needed. In a nationally representative survey of more than 2,000 respondents, 51 percent reported they believed humans could stop global warming, but were uncertain that people would do what was needed to do so (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010). And, Moser (2010) contends that even if the general public accepted the scientific consensus of anthropogenic climate change as valid, uncertainty would remain in regard to “technically feasible, environmentally benign, economically affordable, and morally preferable mitigation (and adaptation) responses” (p. 35).

**Denialism.** Most recent polling finds that 97 percent of the climate science community agrees that climate change is happening and that it is driven by human action (Cook et al., 2016). And, a recent survey conducted by the Pew Research Center (2016) found citizen majorities in 40 nations believed that climate change was a serious problem. Unfortunately, however, effective steps toward combating climate change

have been partly obstructed, because some individuals, officials, and organizations still deny it is a problem (Gore, 2009; Jylhä, Cantal, Akrami, & Milfont, 2016).

A denialist is “a person who refuses to admit the truth of a concept or proposition that is supported by the majority of scientific or historical evidence” (Denialist, n.d.). A broad area of study has found denialism has deep roots in social foundations, such as geographic location, political and religious ideology, race, and gender.

A recent survey of 16,000 individuals from 20 different countries found the United States has more climate change denialists than any other country (Ipsos MORI, 2014). Additionally, in a comprehensive analysis of print media across six different countries, Painter (2011) found the voice of public dissent was often echoed via the mass media, as climate skepticism was much more prevalent in the U.K. and U.S. publications than in other countries’ media output. And, on a regional level, in the United States, high pockets of skepticism exist across the Deep South and through the Heartland, while coastal regions and northern states express much more concern toward and belief in climate change (Yale Project on Climate Change Communication, 2015).

Research on political ideological identification and attitude toward climate change is an established area of scholarship. Results indicate self-expressed liberals and Democrats are much more likely to voice concerns regarding climate degradation than those who identify as conservatives and Republicans (Hamilton, 2008; McCright & Dunlap, 2011). The most current datasets suggest the politically driven climate change divide is continuing to expand. A recent Pew Research Survey (2015) found 92 percent of liberal Democrats agree there is solid evidence that the Earth’s average temperature

is raising, while only 38 percent of conservative Republicans agree that there is solid evidence of global warming. Further highlighting this partisan divide, the 2016 Republican president-elect Donald Trump maintained the position that climate change was a hoax devised by the Chinese government to secure unfair trade advantages, after the sitting Democratic president Barack Obama moved to curb U.S. coal consumption as a means to combat global warming (Wong, 2016).

While the scholarship in the area of religious affiliation and climate change is not as developed as that of political ties, theological preference has been found to be an intervening factor in acceptance and comprehension of the climate crisis. In general, “it is the religiously unaffiliated, not those who identify with a religious tradition, who are particularly likely to say the Earth is warming due to human activity” (Pew Research Center, 2015a, para. 3). Within respect to individual religions themselves, minorities who identify as Catholic are the most likely group to believe in the Earth’s warming (Pew Research Center, 2015a).

Finally, race and gender are also prime determinants in an individual’s attitude toward climate change. In the broadest assessment, non-white females are more likely than their counterparts, white males, to express environmental concerns (McCright & Dunlap, 2011; McCright, 2010; Hamilton, 2008). An assessment of eight years of Gallup data, McCright (2010) found women not only comprehend climate change more extensively, but they also express greater concern about environmental changes.

An established racial gap on the topic has also been identified via polling. Non-whites consistently express the fighting of global warming as a top priority, more so than whites, and, even when controlling for other key factors such as party affiliation

and education, non-whites consistently espouse lower levels of skepticism than whites (Enten, 2014).

**Absence of clear directives.** Climate change has been described as the biggest market failure in history by economists, the direst threat to humanity by activists, and an epic moral tragedy by ethicists, yet no clear and comprehensive directive have been established by any group to assist in advancing public understanding, acceptance, and action (Gore, 2009; Moser, 2010; Gelbspan, 2004).

According to Moser (2010) the lack of “social symbols” is an extreme detriment to climate change understanding among lay people. Such symbols, across all nations, are only in their infancy in terms of advancement. Recycling efforts, economic signals, such as tax incentives, and literacy opportunities are scarce and unsystematic in implementation in all regions, thus no clear perspective is advanced. “In many countries, maybe most conspicuously the United States, these signals did not begin to emerge until very recently, in others, they are still missing” (Moser, 2010, p. 36). Without adequate social cues, the public is often left unmotivated and uninformed.

Finally, a second key to advancing clear public directives is to develop comprehensive narratives on climate change that communicate the interconnectedness of the issues across species, regions, and ideologies (Moser, 2010; Sachsman, Simon, & Valenti, 2010). Through implementation of inclusive and compelling messages about climate change, self-interest barriers to public engagement may be minimized or, in some cases, alleviated (Moser, 2010).

In summary, climate change is an imminent and serious threat to the global community (Moser, 2010; Gore, 2008). According to the Intergovernmental Panel on

Climate Change (2014) all forms of life will be significantly affected by the changing climate in the coming decades. And, while the Earth's climate does vary naturally over time, the rate at which current climate changes are taking place is unprecedented (Hansen et al., 2008; Intergovernmental Panel on Climate Change, 2014). These “unprecedented” climate changes are driven by human activities associated with the use and dispersion of six key pollutants—commonly known as greenhouse gases—which trap heat in the Earth's atmosphere and lead to warming of the air, ocean, and planetary surface (Environmental Protection Agency, 2016).

However, despite a 97 percent consensus among climate experts that global warming is indeed occurring and that it is caused by human activity, denialism and dismissal of the issue persist (Cook et al., 2016; Moser, 2010). Issues inherent in the climate change narrative, such as complexity, uncertainty, and invisibility, make effective conveyance of the crisis difficult, especially for journalists (Moser, 2010; Boykoff & Boykoff, 2007). However, it is critical that the media are able to communicate the seriousness of the climate crisis threat in comprehensive and clear ways (Hansen, 2010; Moser, 2010). To fulfill this role journalists must overcome not only the barriers inherent in the story, but also institutional conventions that can function as obstacles to effective climate change communication. The following chapter will begin to explore the nature of environmental reporting and the ways in which journalistic norms, practices, and values may affect the climate change narrative.



## **Chapter 3: Environmental Journalism: Communicating Climate Change**

For the past quarter century environmental discussions ripe with buzzwords like global warming, acid rain, and greenhouse gases are prevalent and commonplace, as environmental communication has become an integral component in the “vocabulary of public life” (Wuthnow, 1992). However, such conversations have not always been customary, nor have they always been fixtures upon the public consciousness.

This chapter will begin with an overview of the contemporary environmental movement and its relationship to the emergence of an environmental beat in mainstream media newsrooms. This chapter will then explore mass media coverage of climate change paying particular attention to the difficulties and constraints associated with reporting on the climate crisis.

### **The Contemporary Environmental Movement**

While the early environmental movement was marked by pioneers such as John Muir and Henry David Thoreau (Cox, 2013), the emergence of contemporary environmental communication in the public sphere dates back to a symbolic point in the mid 1960s when environmentalism shifted from a personal concern to a collective issue, or more specifically when environmental questions became emergent social problems (Hansen, 2010; Schoenfeld, Meier, & Griffin, 1979).

The beginnings of the modern era of environmentalism are often attributed to the 1962 publication of American marine biologist Rachel Carson’s book *Silent Spring* (Hansen, 2010; Stoll, 2012; Cox, 2013). Wyss (2008) described Carson’s publication as a watershed moment for environmentalism, both domestically and abroad that was so

powerful it “overshadowed earlier environmentalists and environmental writers” (p. 20). Her book detailed the detrimental effects of indiscriminate pesticide use on the environment. In her opening chapter she writes:

The most alarming of all man’s assaults upon the environment is the contamination of air, earth, rivers, and sea with dangerous and even lethal materials. This pollution is for the most part irrecoverable; the chain of evil it initiates not only in the world that must support life but in living tissues is for the most part irreversible. (Carson, 1962, p. 6)

Carson’s evocative language, coupled with her commitment to conservation led to revolutions in industry and laid the foundation for the formation of long-lasting environmental organizations and policies (Paull, 2013; Wyss, 2008).

Focused primarily on the depletion and degradation of bird populations, *Silent Spring* took aim at chemical companies; more specifically it took to task the manufacturers of dichlorodiphenyltrichloroethane, or DDT (Carson, 1962). Developed in the 1940s, DDT was a widely utilized insecticide that was favored for its simplicity and cheapness of manufacture, as well as its potency (Environmental Protection Agency, 2015). Carson’s book, a product of nearly five years of observation and scientific evaluation (Stoll, 2012), described in detail the fallouts from widespread use of the popular pesticide. She concluded that DDT had irrevocably harmed the animal population, in turn seriously contaminating the world’s food supply (Carson, 1962).

In 1972, Carson’s work led to a nationwide ban of DDT use in agriculture; a prohibition that still stands today (Environmental Protection Agency, 2015). In addition, her work is credited as a motivating force behind the eco-based movement that led to the development of the Environmental Protection Agency (Trefethen, 1975; Paull,

2013). Finally, *Silent Spring* helped to instill the idea of environmentalism upon the public consciousness.

Carson's book presented this scientific information in a context that engaged the attention—and debate—of millions of readers and scores of public officials. In doing this, *Silent Spring* gave rise to a sphere of influence as she translated technical matters into subjects of public interest. (Cox, 2013, p. 25)

### **The Emergence of the Environmental News Beat**

Since the appearance of the modern environmental movement in the 1960s, nothing has been a more powerful mediating factor and crucial central player in the advancement of the movement than the mass media (Sachsman, Simon, & Valenti, 2010; Cox, 2013; Neuzil, 2008). According to Hansen (2010) the media's role in relation to environmentalism is dichotomous.

What particularly distinguishes the history of the recent half-century is the crucial role played by the mass media and communication in not only helping to define 'the environment' as a concept and domain, but more particularly in bringing environmental issues and problems to the public and political attention. (p. 6).

While environmental journalism is not a new beat in the newsroom it is still fairly young and composed of uncertain dimensions. Instances of environmental coverage were seen as early as the 1940s (Sachsman, Simon, & Valenti, 2010), but sustained environmental coverage did not begin until the mid 1960s (Wyss, 2008; Cox, 2013). In addition to *Silent Spring*, a number of images and stories, including Apollo 8's image of the Earth from the moon and *Time's* exposé of the Cuyahoga River, an Ohio waterway so polluted that it burst into flames, spurred public interest in environmentalism in the mid 1960s and through the coming decades (Cox, 2013).

However, one major event, an oil spill off the coast of California, was pivotal in developing a true environmental news beat (Wyss, 2008).

The Santa Barbara oil spill occurred in January of 1969. According to reports, nearly 3-million gallons of crude oil seeped into the ocean, leaving a 35-mile long oil slick along the California coastline, as well as thousands of marine mammals, birds, and fish dead (Miller, 1999; Mai-Duc, 2015) “Following the spill, the region became ground zero for some of the most significant conservation efforts of the 20th century” (Mai-Duc, 2015, para. 3). Over the next year monumental environmental legislation was passed to protect the earth’s oceans and atmosphere, as well as new requisites for regular environmental impact reports (Miller, 1999). During the same period, the Nixon administration “allowed for unprecedented environmental gains” (Wyss, 2008, p. 31) most notably the establishment of the Environmental Protection Agency in 1970.

However, despite the serious nature of the crisis itself, research contends without the mass media’s attention, the Santa Barbara oil spill would not of had near the impact:

Despite the severity of the Southern California spill, it’s doubtful whether the event would have sparked a national outcry were it not for television. Just as the medium had done for the antiwar and civil rights movements earlier in the decade, television brought home to the American living room the devastation of the pristine seaside. Night after night, viewers were sickened by images of oil-drenched birds that couldn’t fly, sea otters that couldn’t swim, and tides that brought in the corpses of dead seals and dolphins. (Miller, 1999, paras. 14-15)

Just as the public’s interest in the environment was motivated by the media’s portrayal of the Santa Barbara crisis, so too were media executives motivated to change their focus and devote more resources to environmental coverage (Wyss, 2008).

Throughout the '70s, "the environment gradually became recognized as a legitimate subject for media coverage" (Shabecoff, 2002, para. 7), and it began to emerge as its own beat within the newsroom (Sachsman, Simon, & Valenti, 2010). One way environmental journalists distinguished themselves during this period was by expanding the definition of their beat (Neuzil, 2008). According to Friedman, Dunwoody, and Rogers (1986) the environmental movement of the 1970s, in many ways, refocused "journalists' attention on science's social, economic and political contexts" (p. xiv). As a result, environmental coverage expanded as well, and began to cover issues of environmental quality instead of focusing singularly on environmental disasters (Neuzil, 2008).

The "green" beat continued to evolve, and by the 1980s general assignment reporters were dedicating nearly one quarter of their time to energy and environment stories, particularly in breaking news and feature style formats (Storad, 1984). However, while advancements in the understanding of the complexity of the environmental beat began to emerge in the 1970s (Neuzil, 2008), coverage in the 1980s was still primarily event-driven in nature (Wyss, 2008; Hansen, 2010) and suffered from oversimplification of issues and inadequate context coverage (Neuzil, 2008; Friedman, 2004).

According to Friedman (1991) although some reporters during the 1980s were beginning to understand the dynamic nature of environmental coverage, too many relied on too few sources, failed to provide perspective on complex issues, and focused too much coverage on transitory topics. Major ecological catastrophes of the decade, such as the 1984 chemical spill in Bhopal, India, the Chernobyl nuclear power plant disaster

in 1986, and the Exxon Valdez oil spill in 1989, highlighted the naïveté of environmental reporters of the time (Wyss, 2008). Neuzil (2008) found, similar to Friedman’s assessment, that reporting on these disasters lacked perspective and context and seemed to be “poorly understood by journalists” leading him to surmise that environmental reporters of the time “struggled with the idea of environmental risk and how to present it in everyday language” (p. 196). The language of science is a persistent issue in environmental reporting. Few journalists are “comfortable with complex scientific information,” and, to make matters more difficult, news writers are often deprived of the time needed to “fully digest complex scientific papers” (Gelbspan, 2004). This issue is compounded by scientists themselves, who often present their findings in highly conservative and qualified language, per the nature of their craft; however, this often leaves journalists uncertain in regard to the impact or importance of the findings forwarded (Gelbspan, 2004).

In conjunction with this series of major disasters, the ‘80s also ushered in a new wave of environmental coverage, one focused on the emerging, and highly complex issue of climate change (Moser, 2010; Shabecoff, 2002). In response to the inherent difficulties of covering the environment, and the emergence of even more complexity in the field, environmental journalists looked inward to create professional organizations as a means to improve their practice and approach (Neuzil, 2008).

A project spurred by Scripps-Howard executive David Stolberg and finalized by a group of working journalists led to the creation of the first professional organization dedicated strictly to environmental journalism, the Society of Environmental Journalists (SEJ).

Founded in 1990, the SEJ describes its organizational mission as a drive to “strengthen the quality, reach and viability of journalism across all media to advance public understanding of environmental issues” (Society of Environmental Journalists, 2016, para. 1). Although based in North America, SEJ’s current membership is composed of more than 1,200 journalists and academics from across the globe, a substantial expansion from its initial 79 charter members in 1990 (Society of Environmental Journalists, 2016).

Today the SEJ promotes the advancement of environmental journalism through a number of endeavors including coverage guides, grants, workshops, and conferences (Society of Environmental Journalists, 2016). According to Friedman (2004) the development of professional organizations such as the SEJ, in conjunction with better training, technological advancements, and data resources, have led to better-equipped environmental reporters.

The area of environmental journalism continued to develop though the early 2000s (Wyss, 2008; Cox, 2013). Survey research compiled during the same period showcased factors within the genre that contributed to the emergence of its individualized identity. According to Sachsman, Simon, and Valenti (2008) newspapers were much more likely to staff a designated environmental reporter than television stations, however, while newspaper circulation correlated with the number of “staffed specialists” each outlet had, broadcast station size was not an indicator of the number of television-based environmental reporters. The study also highlighted regional differences across the U. S., and showcased the “Pacific West” as the area most likely to

have staffed environmental specialists in both print and broadcast genres (Sachsman, Simon, & Valenti, 2008).

However, shortly after the publication of Sachsman, Simon, and Valenti's survey, the growth of environmental journalism took a detour. The country experienced a severe recession, the longest lasting economic downturn since WWII, which impacted media firm revenues (Rich, 2013; Cage, 2016). At the same time, the impact of the digital age and Internet contributed to declining audiences for legacy media, prompting widespread layoffs in both newspapers and television across the country (Cage, 2016). The environmental beat was not immune to these cost-cutting measures.

One of the most public and prominent examples of this digression came in 2008 when *CNN* laid off its "entire science and technology staff, a reporting team that consisted of 12 full-time journalists, plus interns, covering climate change, wildlife, alternative energy and more" (Project for Improved Environmental Coverage, 2012, para. 3). The erosion continued in 2009 with the eradication of the *Boston Globe's* Monday "Health and Science" section (Revkin, 2008), a trend that others quickly followed. According to demographics compiled by the *San Jose Mercury News*, in 1992 nearly 150 newspapers had science or technology sections however by 2012 less than 20 such sections remained (Project for Improved Environmental Coverage, 2012).

In 2013, *The New York Times* made headlines for dismantling its entire environmental desk, blaming economic realities as the factor behind the dismissal of 30 journalists (Bagley, 2013; Haughney, 2012). However, 19 months later the *Times* announced a new editor, Adam Bryant, was to take the reins of the paper's science coverage, overseeing climate change and environmental interests (Abbruzzese, 2014).



The *Times*' move to integrate environmental reporting into its larger science beat has become common practice across news outlets (Bagley, 2013; Daley, 2010). And, while specialized science reporting teams at established legacy outlets are becoming increasingly rare, the number of freelance environmental journalists continues to grow (Daley, 2010).

The profile of the environmental reporter has also endured an evolution over the years. Initially, the environmental journalist was the desk generalist who was assigned to cover the ecological issue of the moment (Sachsman, Simon, & Valenti, 2010). But, by the late '80s a profile of environmental reporting began to surface, and by the early years of the 21<sup>st</sup> Century a clearer picture of "who" environmental journalists were began to emerge (Shabecoff, 2002; Sachsman, Simon, & Valenti, 2010).

Survey research conducted by Sachsman, Simon, and Valenti (2010) found the environmental reporters tend to remain specialists longer and are more likely to hold a science-based degree. Additionally, environmental journalists tend to flock together and maintain stronger relationships with other specialized reporters, even if they are from competing news organizations (Dunwoody, 1980). In their work routines, environmental journalists tend to enjoy more autonomy regarding what to cover and how to cover it (Hansen, 2010; Sachsman, Simon, & Valenti, 2010). And, finally, research finds environmental and science correspondents tend to develop a "deferential and uncritical relationship with their sources in what has been called a 'symbiotic' interdependency" (Hansen, p. 83).

### **Covering Climate Change: Constraints and Difficulties**

Environmental journalists focus on a number of issues such as alternative energy sources, conservation, food production, waste management, and more, however no story of the current century is more “important,” “meaningful,” or “exciting” to cover than global climate change (Sachsman, Simon, & Valenti, 2010; Moser, 2010; Gelbspan, 2004). However, covering the climate crisis is a difficult task (Boykoff & Boykoff, 2007).

Mass media are the primary means through which the public is exposed to and educated about general environmental issues, as well as more specific issues such as climate change (Wilson, 2000; Boykoff & Boykoff, 2007; Moser, 2010), and while many obstacles related to conveying climate change are inherent in the narrative, such as heightened complexity and prolific “denialism,” certain journalistic practices serve to exacerbate those issues. Boykoff and Boykoff (2007) assert one of the subtlest, yet most powerful influences on climate change inaction, especially in the Western cultures, is “journalists’ faithful adherence to their professional norms” (p. 1191), which limits their ability to tell the story of anthropogenic climate change in productive and progressive ways.

Journalists, much like other professionals, operate on a daily basis “according to a uniform mission, agreed-upon routines, and established societal relationships” (Robinson, 2007, p. 305). These routine journalistic practices are often ritualized through repeated and ambiguous application (Tuchman, 1977, 1978). Similar to the constraints these routinized professional norms place upon general environmental reporting traditional news values and norms can be especially constraining when

covering issues associated with climate change (Hansen, 2010; Sachsman, Simon, & Valenti, 2010).

According to Hansen (2010), a “key problem with the core journalistic value of objectivity, particularly where this is translated as being synonymous with giving equal prominence to opposing arguments in public controversy, is that it may often in itself lead to a distortion or misrepresentation of the balance of opinion on a given subject” (p. 17). This “distortion or misrepresentation” is often the case in climate change reporting. “By operating in accordance with the widely accepted journalistic norms, influential mass-media newspaper and television sources in the United States have misrepresented the top climate scientific perspective, and thus have perpetrated an informational bias regarding anthropogenic climate change” (Boykoff & Boykoff, 2007, p. 1191).

The misrepresentation of climate change and its anthropogenic foundations is primarily fueled by the media’s false suggestion that substantive disagreement exists within the scientific community (Oreskes, 2004); a suggestion motivated by the long-held newsroom belief in story balancing and “objective” reporting (Boykoff, 2007; Tuchman, 1978). Furthermore, Gelbspan (2004) suggests due to their adherence to objectivity the mainstream media “has basically played the role of unwitting accomplice by consistently minimizing the story, if not burying it from public view altogether” (p. 67).

The adherence to objectivity and balance in climate change reporting is well established in many countries, but the U.S. media tend to utilize the tactic most frequently. In content analyses of both the U.S. and U.K. media output, dichotomous

truth claims, or a he said/she said style of reporting, proved to be a more prevalent impediment to effective climate change coverage (Boykoff, 2007) than in other developed countries (Painter, 2011). Furthermore, a comparative analysis found U.S. media outlets, more so than their British counterparts, frequently relied on balancing claims between climate change activists and denialists, which further perpetuates the belief that there is a mass disagreement in the scientific consensus (Boykoff & Rajan, 2007). While less prominent, this “balance bias” tendency can also be found in mainstream U.K. outlets (Boykoff & Rajan, 2007; Boykoff, 2007).

Additionally, scholarship finds mass media utilize a number of news frames and other techniques that present the climate change narrative in an air of uncertainty, including the practice of emphasizing dissension among scientific claims to create drama and retain professional objectivity (Zehr, 2000), as well as juxtaposing scientific claims with those forwarded by industry “experts,” many of whom have ties to fossil fuel corporations (Gelbspan, 2004). These forwarded news frames and reporting techniques serve to “politicize” the natural phenomenon of climate change, because although “nature invites different responses from [individuals], it is, in itself, politically silent” (Cox, 2013, p. 24). This politicization of the issue supplies more than factual scientific information on climate change, it also motivates the formation of social judgments on the issue (Belkin, 1987). Through their choice of words, metaphors, and frames “journalists convey certain beliefs about the nature of science, investing them with social meaning and shaping public conceptions” (Wilson, 2000, p. 206).

In addition to the constraints associated with objectivity and balance, journalists' reliance on officials as primary sources is also a routinized practice that tends to limit the scope and effectiveness of environmental reporting (Hansen, 2010).

With issues of global crisis or concern, such as climate change, news media outlets typically resort to heavy dependence on these official sources (Hansen, 2010). The utilization of official sources in such situations helps the media claim legitimacy and also provides a means of professional protection and shielding from possible libel litigation or audience criticisms (Herman & Chomsky, 2002; Tuchman, 1978). Cunningham (2003) suggests that a misguided interpretation of objectivity coupled with a dependency on official dictation has led the U.S. media especially to become "passive recipients of news, rather than aggressive analyzers and explainers of it" (p. 26). Gelbspan (2004) asserts the journalistic passivity in the face of the current robust science and increased certainty regarding the severity of climate crisis is more than just a misstep, rather it is "a crime against humanity" (p. 61).

Furthermore, this routine reliance on official sources has led to congruence in crisis coverage and a form of "groupthink" in regard to formulation of national climate change narratives. Bennett, Lawrence, and Livingston (2007) find this result is not surprising, as reporting that aligns "its course so closely to the leads of officialdom results in stunningly homogeneous outcomes across the majority of mainstream media outlets" (p. 1).

Researchers have "long recognized that journalists tend to cue off one another in their coverage, producing "pack journalism" and "metanarratives" (Baum & Groeling, 2010, p. 447). With crisis narratives, such as climate change, these journalistic practices

are amplified and can lead to both internalization of administrative rhetoric and the reinforcement of a dominant, and often monolithic, worldviews (Lewis & Reese, 2009). Numerous studies have confirmed environmental reporters tend to rely predominantly on “government and ‘authoritative’ institutions, on scientists and independent experts, rather than on non-governmental organizations (NGOs) or indeed on environmental pressure groups” (Hansen, 2010, p. 85).

In direct relation to climate change coverage, this reliance tends to reflect the perspective and directives of those “in charge,” which can be problematic for journalists trying to cover the climate based on scientific information rather than political ideological representation (Langlois, 2015). This issue was further complicated in 2017, when President Donald J. Trump took office. Within hours of his inauguration, the new president ordered his administration to remove all documentation regarding climate change from the official White House website (Davenport, 2017). One week later the new president enacted “contact freezes” and “media blackouts” on a number of government research entities including the Environmental Protection Agency, which was subsequently directed, by the Trump administration, to begin removing climate change data from its website as well (Biesecker & Flesher, 2017; Heikkinen, 2017).

In conjunction with adherence to journalistic values such as objectivity and balance, and a heavy reliance upon official sources, the desire to meet the expectations of traditional news values also plays a defining role in climate coverage. News values are directly related to newsworthiness, or the ability of a story to attract readership and attention (Cox, 2013). The Western press associates itself, in general, with seven key news values: impact, timeliness, prominence, proximity, human interest, conflict, and

novelty (Stovall, 2015; Filak, 2016). However, most environmental issues, and especially those associated with climate change do not meld well with these preconceived determinants of news.

Many environmental problems take a long time to develop; there is often uncertainty for years about the causes and wider effects of environmental problem (climate change, again, is the obvious example, as is BSE or ‘mad cow disease’) and even where a scientific and political consensus may emerge, the ‘visualization’ for a wider public audience of what is happening requires a great deal of skillful journalistic and communicative work. (Hansen, 2010, p. 96)

Climate change is a continual and progressive process that is not typically situated around breaking news events (Moser, 2010). As such, stories regarding the climate crisis are difficult for reporters to package. Climate change stories cannot draw upon the same pillars of worthiness, such as impact or proximity, because unlike other environmental events like the Exxon Valdez crisis or the Deepwater Horizon explosion in the Gulf of Mexico, climate stories are, by nature, perpetual and ongoing (Wyss, 2008; Moser, 2010; Hansen, 2010).

Furthermore, many stories associated with climate change lack sufficient means of visual representation, a key factor in the vocabulary of the digital age (Sheppard, 2012). Veteran journalist Bob Wyss (2008) finds environmental stories are often much less dramatic than they need to be and rather than “striking with a fury, some ooze, seep, or bubble silently and are often unseen” (p. 8). Without visual impact, climate change stories often lack the “values” needed to gain significant placement on news agendas.

Segmented presentation of climate issues is also associated with the story’s inherent lack of news value. According to Cox (2013), to ascribe to the nature of event-driven news many environmental stories only provide “a snapshot, a specific moment,

event, or action from a larger phenomenon” (p. 146). Such segmented presentation can be problematic to public information dissemination. As the “news consumer may not be presented with all sides of a story on any one day, but he will receive a diversity of views over a period of time” (Tuchman, 1977, p. 666). This structuring of news can be viewed as a partial depiction of reality, thus limited citizens’ abilities to make informed decisions. Such coverage also makes it difficult for environmental journalists to effectively convey the seriousness of climate change (Wyss, 2008).

Public demand also interacts with news values to drive cyclical coverage of climate change issues. Longitudinal studies have found the public’s interest in environmental issues, including climate change, is highly correlated with economic and social conditions of the time (Hansen, 2010; Sachsman, Simon, & Valenti, 2010). It is difficult to retain people’s interest in environmental issues (Boykoff & Boykoff, 2007; Gelbspan, 2004), and as such, the public demand for such coverage tends to diminish significantly when more pressing economic or social issues emerge. “Indeed, over the years, the frequency of environmental news has risen and fallen as wars, economic recession, terrorism, other concerns have seized TV and newspaper headlines” (Cox, 2013, p. 146).

Finally, the emergence of the digital age has provided both benefits and additional constraints to environmental reporters. The rise of the Internet has provided journalists with better tools to sharpen their craft. For environmental correspondents especially the rise of the Internet age has allowed them to connect with broader and more diverse sources and contacts, regardless of distance or time constraints, and it has enabled them to access knowledge quickly and succinctly via online databases and



archives (Hansen, 2010; Wyss, 2008). However, while the Internet has made research and mediated source contact easier, it has introduced a number of new problems.

According to Sachsman, Simon, and Valenti (2010), now there is too much information available, which compounds the duties of reporters, who now have to not only locate information, but also tediously test its reliability. The excess of information provided by the digital age also creates legitimacy issues for reporters themselves. “The Internet has significantly increased both the volume of information and the variety of voices that are reaching the public. [And,] while these new websites and blogs have broadened and diversified news sources, they have also made it more difficult to assess the credibility of what information is in the marketplace” (Wyss, 2008, p. 239).

Additionally, while journalists can easily and quickly access sources, according to Hansen (2010) the economic and organizational pressures of the digital age have led to an increasingly “desk-bound” style of journalism, which deprives journalists of networking and source checking opportunities, while at the same time promoted the propagation of prepackaged and subsidized news content.

In conjunction with credibility and sourcing concerns, environmental journalists also reported the demands of a new digital market and its shrinking news hole was one of the most frequent obstacles to sustained environmental news coverage (Sachsman, Simon, & Valenti, 2010). Associated with event-driven nature of coverage and the lack of primary news values, environmental stories are often disregarded or allocated less prominent placement in both legacy and digital publications (Cox, 2013; Hansen, 2010). Friedman (2004) notes this competitive nature of a niche market system is a growing pain felt across journalistic genres, but for science and environmental reporters the

wounds run especially deep: "...environmental coverage, like most other journalism faces a shrinking news hole brought about by centralization of media ownership, revenue losses, and challenges from new media. Environmental journalism's dilemma was dealing with a shrinking news hole while facing a growing need to tell longer, complicated, and more in-depth stories" (p. 176).

In summary, the contemporary environmental movement was motivated by the publication of Rachel Carson's book *Silent Spring* (Trefethen, 1975; Paull, 2013), which ushered in a new era of eco-activism. As the environmental movement began to gain traction in the 1970s newsrooms took notice, and beats focused more directly on the environment began to emerge across the country (Cox, 2013; Hansen, 2010). While professional organization such as the SEJ helped to legitimize the "green beat," recently dwindling revenue streams among legacy outlets has led to the diminishment of staffed specialty reporters (Neuzil, 2008; Friedman, 2004; Bagley, 2013). Those who remain on the environmental beat are often freelancers or part of larger, more expansive areas of coverage such as general science or health (Bagley, 2013; Daley, 2010).

Despite a decline in staffed environmental reporters, covering climate change is considered one of the most important jobs of 21<sup>st</sup> Century journalists (Sachsman, Simon, & Valenti, 2010; Moser, 2010; Gelbspan, 2004). However covering climate change is not an easy task and is often challenged by institutional norms, values, and routines (Hansen, 2010; Cox, 2013). And, most recently, the climate coverage has been further complicated by the introduction of the digital age (Friedman, 2004; Hansen, 2010). The primary complication emerging from digital innovation is the overload of information availability, which has forced both journalists and news consumers to wade

through enormous amounts of data and details to find accurate elements and factual concepts.

The following chapter will explore the emergence of the digital age more in-depth, paying particular attention to the economic and social disruptions that have added additional layers of uncertainty to journalistic endeavors. Conversely, it will also begin to explore the opportunities the digital age affords environmental reporters and the climate change narrative.

## **Chapter 4: The Changing Media Landscape: Emergence of the Digital Age**

The media landscape has not always been the chaotic enclave of rapid change it is today. Throughout the 20<sup>th</sup> Century the industry experienced a long period of economic stability and minimally challenged professional legitimacy. This period of security coincided with the era of mass communication, which was driven by the unidirectional flow of information, a system that situated journalists as informational “gatekeepers” and audiences as passive recipients of the chosen content (Shoemaker & Reese, 2014; Lowrey & Gade, 2011; Chaffee & Metzger, 2001). Due to the characteristics of the mass communication era, information content was not the unbounded frontier it is today, rather its availability was less plentiful and not as individualized. Audiences had little direct interaction with media professionals or influence upon the message content itself (Castells, 2000; Singer, 2011), as such journalists enjoyed a period of informational supremacy.

However, due to digital disruption, shifting market demands, and postmodern idealism, the current media landscape is one filled, not with stability, but with uncertainty (Lowrey & Gade, 2011; Gade, 2011; Picard, 2010). Due to this disruptive environment, media organizations are attempting to evolve and adapt to meet the needs of a new and dynamic climate. Typically, industry focus, in these uncertain times, has revolved around reviving plummeting revenue streams, however scholarship suggests that linear attention to economic means is a shortsighted tactic that will yield disappointingly static results (Piskorski, 2014; Lacy, Stamm, & Martin, 2014; Mintzberg, 2009; Chyi, 2012).

In order to stay relevant, the media must evolve to meet the times and demands of the new networked era of communication. An era characterized by the self-directed, fragmented content consumption by an increasingly active audience, situated in a niche market system designed to benefit those who can differentiate themselves in an age of immeasurable access to information (Picard, 2011; Lacy & Sohn, 2011).

This chapter will begin to explore the dynamics of the new media marketplace. It will start with an exploration of how digital media have impacted nearly every phase of journalism, shifting control from media organization to audiences and creating a more interactive, participatory media that legacy organizations have been slow to respond to. This inter-industry shift has created a new mandate for legacy media establishments—to survive they must evolve, to remain legitimate and influential institution, innovation for legacy media is essential (Lowrey, 2011). These new mandates have also presented both obstacles and opportunities in relation to climate change coverage. This chapter will also explore how new techniques employed by legacy outlets are providing new directions for climate coverage. Finally, this chapter will conclude by elaborating on one such innovation—new storytelling forms.

First, the chapter will begin with an overview of the changing media landscape and the three primary digital, economic, and social facilitators that shaped the current industry evolution. This chapter will then explore the opportunities and advancements provided by recent innovations in the industry, as well as the media's move toward implementation of new practices, such as alternative story forms, as a strategic response to institutional change.

### **Digital Disruption, Market Evolution, & Postmodernism**

Many forms of technological innovation have functioned as destabilizers to existing media modes and industry models. The printing press revolutionized access to written materials, television dethroned radio as the king of communication, and video technology surpassed the benefits provided by film, however, no singular innovation has facilitated more disruption in mass media industry than the Internet (Beam & Meeks, 2011; Baran & Davis, 2006).

The creation of the Internet has cultivated an oversaturation of information in the media market and enabled the redirection of communication flows. The emergence of digital technologies served to reroute the once unilateral media models of the mass era, which were characterized by few media outlets disseminating content to large, homogeneous audiences (Scott, 2000; Castells, 2007). In addition, during the “mass era” of communication, audience feedback was seldom sought and media as vehicles for audience expression were severely limited (Shoemaker & Reese, 2014).

The multitude of choice provided by the Internet in regard to both content and connectivity served to unseat the superiority enjoyed by media during the mass era by transitioning the power from the creators to the consumers (Gade & Lowrey, 2011; Chaffee & Metzger, 2001), as Gillmor (2009) explains it, in the digital age the “media are becoming democratized” (p. 1). Access to unlimited choices, individualized content, and multiple platform delivery modes have driven the commoditization of news, the decline in legacy media consumption, and encouraged secular consumption of self-directed content (Gade & Lowrey, 2011; Dimmick, Powers, Mwangi, & Stoycheff, 2011).

Additionally, technological innovation has empowered today's audience in remarkable ways (Gade & Lowrey, 2011), and they are taking advantage of their increased autonomy by "exercising unprecedented control over the creation and distribution of media products" (Turow, 2013, p. 1). According to Singer (2011), this advancement is "one of the most profound changes associated with the exponential growth of the Internet since the 1990s" (p. 214). And, the rapid evolution of modern Internet applications has expedited the consumer-to-producer transition. Today "anyone with access to a computer and rudimentary technical expertise can create their own media products—including news and commentary—and distribute them to an audience that transcends geographic boundaries" (Gade & Lowrey, 2011, p. 22).

While the notion of audiences interacting and integrating with media outlets is not a new concept (Kovach & Rosenstiel, 2001; Merrill, Gade, & Blevens, 2001), today's modern conception has introduced new challenges to institutional legitimacy, and proved to be a double-edged sword for journalists as it has eroded the defining parameters of their professionalism (Singer, 2011).

Journalistic authority in terms of its institutional cache cannot help but become diluted as it makes room for such expansions. With these changes to journalistic missions, routines, and societal relationships, newspapers and their websites are turning into an interactive public sphere that just may be forming a new kind of institution, one whose enduring boundaries are malleable and constructed as much by the content receivers as by the information producers. Such changes must have implications for the press's power to dictate knowledge to society. The institution of the press is still fully functioning, but the news is no longer the sole purview of the press. (Robinson, 2007, p. 318)

Despite concerns, changes within in the industry have continued to gain momentum, but media professionals have been resistant to accepting their renovated roles in the digital age (Singer, 2011). A defining factor of journalists' intransigence is

relinquishment of their traditional gatekeeping authority. However, to remain relevant media outlets must adapt their understanding of their perceived role in the new, networked age. They must re-examine what it means to be a gatekeeper, and, in the digital age, they must reposition themselves more as “gate watchers” (Singer, 2011). Journalists have to redefine their gatekeeping understanding so “it rests on normative judgments and ethical enactment of those judgments.” Journalists must also “reshape the definition of their role to fit the new information ecology” and “re-establish limits on admission to that role in an unlimited media space” (Singer, 2011, p. 215).

For some, this adaptation means journalists should embrace new roles such as functioning as “gate-openers” (Boczkowski, 2004), while others suggest journalists should retain their gatekeeping title, but apply it in new, more inclusive ways (Domingo et al, 2008). No matter the type of change adopted, the transition of power from the producer to consumer has wreaked havoc on the industry. The fluidity of the new, emerging gatekeeping role has “become a hinge between tradition and change” (Mitchelstein & Boczkowski, 2009, p. 572), highlighting areas of deep uncertainty in the new media landscape.

Regardless of media outlets’ readiness to evolve, progress will continue: “Whether traditional journalists ask or help or not, and whether they recognize new entrants or not, the trend for a wider and more diverse ecosystem is unstoppable” (Gillmor, 2009, pp. 7-8). The excess of information availability and the conversion of content control have redefined the nature of news production. In turn, these innovative disruptions have left many news outlets, especially those grounded in legacy products, with flailing business models that are unable to navigate the Darwinian culture of a



niche market system where only the most specialized, adaptive, and flexible survive (Lacy & Sohn, 2011; Picard, 2010; Bass, 1991).

Increased content choices and heightened audience autonomy have translated into fewer legacy media consumers and waning profit margins for many traditional news outlets. With almost limitless choices in content, media consumers have turned away from a one-size-fits-all approach to news and migrated instead toward personalized platforms and sources that cater to their individualized preferences and beliefs (Gade & Lowrey, 2011; Gillmor, 2009). Just as the network era has ushered in an evolution of communication delivery and dissemination that allows for communication to flow in many directions (Castells, 2007), so too has this shift served to change the media market by promoting a niche system based on fragmentation, individualization, and instant gratification (Dimmick, Powers, Mwangi, & Stoycheff, 2011; Picard, 2010).

The fragmented, on-demand market of today, where a multitude of outlets are competing for consumers' attention and time, has prompted the need for media organizations to diversify and carve out specified niches to stay relevant, however this has not been an easy feat for most (Dimmick, Powers, Mwangi, & Stoycheff, 2011). Unlimited choice coupled with an abundance of available content due to diminishing industry entry barriers (Singer, 2011), has led to low "product" demand and decreased revenue opportunities (Lowrey & Gade, 2011). Additionally, alternative, web-based content sources continue to appear in the marketplace, which further dilutes the profit pool and pilfers consumers from legacy outlets (Lacy & Sohn, 2011).

New demands forwarded by a digital audience are one catalyst driving market change. In addition to the desire for a more self-directed news experience, today's consumers seek instant, on-demand gratification, a role in the news making process, and engagement and social networking opportunities (Gade & Lowrey, 2011; Castells, 2010; Chaffee & Metzger, 2001). Additionally, the increasing commodification of news has led consumers to want, or more poignantly, to expect such aspects for free (Chyi, 2012; Jarvis, 2015). In response to new audience expectations and market fragmentation, the digital age has redirected conventional revenue streams for traditional media outlets.

Typically, legacy outlets have relied heavily on advertising for revenue, a practice that was linked to circulation and readership numbers (Picard, 2010), but today, advertisers are departing for digital platforms due to declining, less-mass circulation numbers caused by audience migrations toward more personalized hubs.

With more diversity on the market, and increasingly niche web-based platforms, advertisers who once turned to newspapers and television for ad placement are departing in favor of web-based mediums that offer a more direct consumer reach and channels for audience engagement (Lacy & Sohn, 2011; Kluver, 2014). According to a recent report, this trend is likely to continue, as 2016 was the first year that online advertising sales were projected to surpass those of television. By the end of 2016, U.S. digital advertising represented 36.8 percent of the total U.S. media advertising costs, while television represented 36.4 percent of the market share (eMarketer, 2016). The year was worse for newspapers. Advertising revenue for newspaper outlets fell nearly 8 percent in 2016, leading to the industry's largest drop since 2009 (Barthel, 2016).

The Internet has also reconfigured the value of journalistic content. Today aggregation sites have confounded the worth of news, and made legacy outlets' previously scarce and valuable content widely available, and more importantly, available for free (Simon, 2011; Olmstead, Mitchell, & Rosenstiel, 2011). While news aggregators manifest in many forms, in general, they operate in similar ways. Aggregation sites collect news content from a variety of online channels or outlets and summarize it for pre-ordained readers or profiles (Anderson, 2013, Chowdhury & Landoni, 2006). This process, in turn, means many online consumers never actually visit the content producer's web site. This market shift has affected even the most dominant of legacy outlets. Among "the top nationally recognized news site brands, Google remains the primary entry point. The search engine accounts on average for 30 percent of the traffic to these sites" (Olmstead, Mitchell, & Rosenstiel, 2011, p. 2).

In response to revenue losses, media organizations are attempting to institute pay walls, or acting barriers between the digital consumer and a news outlet's online content, which require would-be users to pay a fee to access content (Chyi, 2012; Simon, 2011). However, such practices have been met with strong resistance from consumers, and have proven unable to revive dissipating revenue streams (Pickard, 2014; Jarvis, 2015).

In the digital age, consumers expect their news for free, thus pay walls violate not only the audience's expectancy, but also struggle to hold ground in an abundant and highly competitive marketplace. Media outlets have traditionally functioned via business models based on the high value of controlled information, however in digital age information, once shared, especially in digital form, such information is quickly

commoditized (Jarvis, 2015). Therefore, if consumers cannot access one outlet's information without submitting to a fee or subscription requirement, they will move on to the next readily available and unrestricted source (Chyi, 2012; Dimmick, Powers, Mwangi, & Stoycheff, 2011; Jarvis, 2015).

The current period of industry uncertainty is also marked by additional economic challenges. Legacy media outlets continue to contract, in the last 20 years, the newspaper workforce has shrunk by nearly 40 percent, and according to the most recent data available, as of 2014 there were 126 fewer daily newspapers than there were in 2004 (Barthel, 2016). Local television news stations have experienced continual decreases in viewership. According to Nielsen Media Research data, in 2015, "network affiliate news stations (ABC, CBS, Fox, NBC) lost viewership in every key timeslot – morning, early evening and late night" (Matsa, 2016, para. 2).

Decreased numbers of readers and viewers have reduced advertising and circulation incomes for legacy outlets; in turn news organizations attempt to compensate for these losses through employee layoffs (Lacy, Martin, & Hugh, 2004), which reduces the organization's available resources and its ability to provide the diversified, quality content needed to stay relevant in the current market system. Such economic realities have forced many outlets to reduce their specialty offerings, including investigative reporting efforts, and most pertinent to the current research science, health, and environmental reporting teams (Lowrey & Gade, 2011; Bagley, 2013; Daley, 2010).

In addition to digital disruption, market changes, and economic struggles, social transformations have also affected the media landscape, most notable among them the

emergence of postmodernity. According to Gade (2011) postmodern notions are associated with the fast-paced, fluid aspects of contemporary life, and as a form of knowledge, postmodernity rejects the notions of absolute truisms, “instead [it seeks] to explain a world in rapid change” (p. 67).

Lyotard (1993), one of the first philosophers to explore the demise of the modern era, found postmodernism to encompass a multitude of conditions, but most noted among them was the end of mass acceptance of “the grand narrative.” Simply put, metanarratives, or the universally accepted truisms of mankind, were the basis of modernity’s claims to legitimacy in many social institutions, such as science and politics, however the postmodern era encompasses an “incredulity toward metanarratives” (Lyotard, 1993, para. 3) and a rejection of predefined or preordained realities.

The collapse of metanarrative acceptance represents a major epistemological shift from modernity, one that suggests there are not ultimate truths, but rather multifaceted realities or narratives formed through “symbolic discourse, intuition, and subjectivity” (Gade, 2011, p. 66). Thus, in a postmodern world, truth is created through social interactions and relationships (Friedman, 2007). And, while modernity resided upon pillars of familiarity, customs, and universally acknowledged truths regarding the human condition (Lyotard, 1993), in postmodernism “context and history are of minor importance; personal impulse and subjectivity are arbiters of truth” (Gade, 2011, p. 63). Thus, the contemporary era is one characterized by questions—questions regarding what one believes, whom one believes, and how one comes to believe such things (Anderson, 1995). Truth has become a highly subjective process linked to social

meaning, representation, and interpretation (Baudrillard, 1994; Gade, 2011). The postmodern era's rejection of predetermined authority and pluralistic approach to truth challenges the long-held values and norms of the journalistic profession.

Traditionally, due to the news industry's implied authority based on its once held unique ability to determine and disseminate "truth," journalism has maintained its institutional legitimacy based on modern notions of objectivity. Journalistic objectivity finds its basis in the application of scientific methodology as means to find and define truth, thus the rejection of grand narratives grounded in science leads to the rejection of the processes and forms of traditional journalistic output (Gade, 2011). Postmodern ideals further challenge such claims, by rejecting absolute truisms, especially those advanced by elite institutions (Lyotard, 1993), and they further the idea that objectivity cannot exist in an era where truth is defined as a social process that requires multiple ways of knowing and interpreting (Gade, 2011; Baudrillard, 1994).

In regard to climate change, which is based on scientific underpinnings, this de-institutionalization and rejection of science complicates the ability to create effective narratives, especially when such narratives are presented in "traditional" formats. To combat this social evolution, journalism has begun to seek alternative means through which to convey information. Such alternative story forms, supported by the digital, may prove a more effective mechanism for climate change coverage, as well.

### **The Networked Era & Alternative Story Forms**

The emergence of the digital market has posed challenges due to journalists' reluctance to relinquish certain constraining practices and routines (Singer, 2011). Adherence to traditional norms such as heavy reliance on official sourcing, claims of

objectivity as a professional distinction, and reluctance to move away from traditional, linear story forms, such as the inverted pyramid model, have served as formidable obstacles to successful integration into the digital age for many journalism outlets (Deuze, 1999; Singer, 2011; Hansen, 2010; Cox, 2013).

The transition has also proved challenging due to the industry's failure to recognize the Internet as a separate product and publication genre (Picard, 2011, Deuze, 1999). However, current institutional trends such as the adoption of "Web-First" publications practices (Grabowicz, 2014) and expansions of ethical and practical perspectives are beginning to highlight not only the fallouts caused digital disruption, but also the opportunities inherent in it. And, according to Van der Haak, Parks, and Castells (2012) recognition of the potential afforded in the digital age is beginning to restructure the narrative of journalistic uncertainty:

This dynamic landscape of continuous and diversified witnessing and reporting does not represent a crisis of journalism, but rather, an explosion of it. In fact, the profession seems to be more alive than ever and going through a multiplication of both forms and content at amazing speed. (p. 2923)

Despite what Van der Haak and colleagues describe as an invigoration of purpose, to survive, news outlets today must still adhere to the unfolding dynamics and reconfigure their organizational structures and business strategies to meet the expectations of the networked era. Organizations must "challenge their own assumptions by looking beyond their existing business models for new ways of finding value" (Christensen & Skok, 2012, p. 12). According to Picard (2011):

Traditional media contents were created in technical, economic, political and information environments that no longer exist. If they are to evolve and prosper, media companies must revisit the foundations of their businesses to ensure that they are providing (a) the central value that customers want, and (b) their

products and services in unique or distinctive ways, and in ways appropriate for the contemporary networked setting. (p. 8)

There are many ways media outlets can begin to provide value to consumers and distinguish their products and services in the digital age. Some suggested strategies include the incorporation of broader network connections and the embrace of new values that can help redefine professional boundaries and incorporate user-generated content (Gade & Lowrey, 2011; Deuze, 2001). Another avenue media entities are beginning to explore, to meet new audience demand, is the incorporation of alternative story forms. However, successful implementation of new story formats relies heavily on the understanding of the new, growing base of news consumers— the “digital natives.”

Research has established today’s digital news consumer is a vastly different individual than that of the legacy era. Today’s news audience seeks an active role in the news making process, instant gratification, and engagement and social networking opportunities (Gade & Lowrey, 2011; Castells, 2010; Chaffee & Metzger, 2001). Additionally, unlike preceding generations, digital natives, or consumers who have only known or existed within a digitized culture, process information differently (Prensky, 2001).

In general, digital natives are accustomed to fast-paced information flows and parallel stimulus processing. Additionally, they “prefer their graphics before their text rather than the opposite. They prefer random access (like hypertext). They function best when networked. They thrive on instant gratification and frequent rewards. [And,] they prefer games to ‘serious’ work” (Prensky, 2001, p. 2). These new audience expectations coincide with what Deuze (2001) categorizes as key characteristics of added journalistic



value in a digital age: “hypertextuality, interactivity, multimediality.” And, consequently, these “added values” are the basis of alternative story forms.

In the broadest sense, alternative story forms are “tools that quickly engage a reader’s attention: a timeline, a checklist, a fact box or a graphic — anything that doesn’t fit the standard model of most newspaper narratives” (Quinn, 2007, para. 2). Alternative story forms typically present information in non-linear formats, which pair concisely with the needs of contemporary news consumers.

New storytelling techniques are a departure from traditional news information designs, such as the inverted pyramid and five-graph models. The digital age is motivating this departure primarily because the Internet “operates in ways that can conflict with our traditional view of what a ‘story’” is (Akpem, 2015, para. 8).

According to Viray (2014), adoption of alternative news formats is a critical evolution for the industry, one that is becoming more of an imperative than a choice.

Being linear is no longer a winning recipe. The digital landscape disrupted the one-directional brand storytelling method every traditional marketer practiced for decades. Online media refocused the lens on how stories must be crafted in a world where consumers can choose what they want to hear, see, and share at any point in time. The audience is in control. (para. 4)

The inverted pyramid model has been the most traditional and most utilized story style presentation employed by print news outlets. Composed much as the title contends, inverted pyramid style presents information to the reader in a hierarchical, linear format, which begins with the most important information followed by less important material as the story progresses (Filak, 2016). Traditional news writing also tends to conform to the rules of typical linear story construction, which presents articles in formats that highlight a clear beginning, middle, and end in sequential order (Green

& Brock, 2000). However, although the meaning of the word “news” has deep-rooted origins in narrative form, the traditional understanding and definitions of news designs and functions failed to accurately pay homage to this foundation (Nell, 1978) by restricting the literary nature of “creative journalism” to a fringe group of “soft news” reporters (Wolfe, 1972; Hartsock, 2000).

In contrast, alternative story forms are based on the presentation of information in a non-linear style, and they often deconstruct perceived barriers between “hard” and “soft” news styles by incorporating literary elements and techniques (Akpem, 2015; Viray, 2014). Non-linear story forms are described as groupings of associated content, organized around a central story or theme (Akpem, 2015). They provide multiple “entry points” for readers who may prefer a more grab-and-go style of news presentation (Loeb, 2016). In addition, especially in relation to data journalism, alternative story forms are an affective way to filter and convey information in an attention-grabbing manner (Yikun & Zhao, 2015). Non-linear elements can include video, text, images, hyperlinks, charts, timelines, infographics and more. And, while such forms do not follow traditional story structure many still employ similar components such as plots, conflicts, and settings (Akpem, 2015). Alternative story forms also rely on visual representations to simplify concepts and to enhance effective transference of complex ideas and information (Yikun & Zhao, 2015).

Non-linear formats offer a number of benefits for both the content producer and the audience. First, the style is praised for its flexibility in both form and function. Primarily because non-linear formats are built around a central idea rather than upon a structure hierarchy, such stories can be refined over time. Such flexibility can assist

journalists' aggregation of breaking news and information on complex stories by allowing them to add verified pieces as they develop, and it also offers increased opportunities for audience feedback to be incorporated into news content and design (Akpem, 2015). *Vox*, an organization that routinely employs non-linear approaches, highlighted the form's flexibility in regard to information aggregation in a 2014 story stream on the outbreak of MERS-CoV, a viral respiratory disease (Locke, 2014). Here the outlet supplied a self-directed experience on the health crisis, and broke down each element into smaller, more manageable bits of information, all the while maintaining a 24-hour approach to updates as the story progressed.

In addition to flexibility, non-linear approaches also add value by allowing the reader increased autonomy (Massey, 2004). Such narratives allow the news consumer to experience the news on their own terms by allowing for easy navigation and flow of information and an individualized approach based on choice. According to Akpem (2015) this increased agency also promotes higher levels of participation and engagement. An often-cited example of increased autonomic reader experience is the Pulitzer Prize winning work "Snow Fall: The Avalanche at Tunnel Creek." This *New York Times* multimedia piece by John Branch (2013) combined traditional narrative storytelling elements with interactive maps of the disaster, podcasts of 911 calls, embedded photos, hyperlinks, and more, all of which allowed the reader to roam and chose the direction of their story experience.

Recently, the benefits of alternative story forms are gaining more traction in the news industry. The 2016 State of the Media Report, published by the Pew Research Center, found a number of new developments and experiments geared toward more

original storytelling approaches for digital platforms. For example, a number of news outlets are exploring virtual reality as a means to increase engagement by letting consumers “experience” the news. Other entities seek to hyper-personalize the news through the use of “chatbots,” which employ programs similar to Apple’s Siri to provide interactive and individualized elements to consumers. Outlets are also looking for ways to utilize social messaging platforms to advance data-driven journalism initiatives (Mitchell & Holcomb, 2016).

Not only do new story formats supply organizations with ways to diversify themselves, they have also been found to be highly effective in relating information. A 2007 study conducted by Poynter found alternative story forms helped readers remember facts and, through the use of eye tracking software, the study also confirmed alternative formats drew greater visual attention than regular text (Quinn, 2007). Furthermore, alternative story forms have been found to be highly effective when relating fact-laden stories (Quinn, 2007), and have proven benefits, such as increased comprehension and interpretation, especially in relation to scientific communication (Ma et al., 2012).

There are a number of noted examples of complex climate and science issues presented through alternative formats. A few highlights include the *BBC*’s interactive video presentation titled: “Deepwater Horizon: Surviving the Oil Spill,” which explored the impact and devastation of the BP Gulf Coast spill three years after the disaster occurred (Strasser et al, 2013). The format prompts audience engagement and increased comprehension through the implementation of pop-up boxes of additional information. The insets of added context appear throughout the video and allow the viewer to choose

to pause and review more content or to keep watching the original video, these added elements add clarity by breaking down complex concepts into more easily digested bits.

A more recent example, published in 2017 by *The New York Times*, encourages readers to take a personal stake in climate change with an online, interactive time line titled: “How Much Warmer Was Your City in 2016?” (Lai, 2017). Created in conjunction with a report released by NASA and National Oceanic and Atmospheric Administration, the *Times* piece allows readers to input their city and see on a timeline readout how much their own piece of the globe has warmed over the years. This type of hyper-local approach to explicating global warming could increase personal relevance, a key obstacle currently standing in the way of effective climate change communication (Moser, 2010).

In addition to non-linear approaches, research also suggests that the combination of narrative devices and alternative formats could increase storytelling effectiveness. Machill, Köhler, and Waldhauser (2007) found, in television news, information retention and comprehension could be heightened by employing a literary device. The study also concluded utilization of narrative devices could enhance context and perspectives in news presentations.

Journalism is no stranger to the use of storytelling devices. Literary journalism, or the style of news writing that incorporates factual reporting combined with literary devices, narrative techniques, and extended character development (Riley, 1997), has been employed in the industry, in some fashion, since the late nineteenth century (Hartsock, 2000). Similar to alternative story forms and non-linear presentations,

literary journalism does not adhere to rigid composition models, but rather embraces creative forms and freedoms (Kerrane, 1997).

While this more creative form of journalism existed, and flourished in the decades after the Civil War and through the age of “Yellow Journalism” (Hartsock, 2000), some suggest the starting point of the modern resurgence of literary journalism was Tom Wolfe’s (1972) *New Yorker Magazine* expose: “The Birth of ‘The New Journalism.’” Today, contemporary literary or narrative journalism has advanced in many respects, (Hartsock, 2000), and some suggest the digital age is promoting a higher demand for the craft (Boynton, n.d.).

Examples of literary journalism presented via alternative story formats have become commonplace on many news websites. The *Washington Post*’s “Exodus” is a full-length feature story released in 2015 that tells the tale of one family’s journey from war-torn Aleppo to sanctuary in Austria (Faiola & Ommanney, 2015). The narrative series welcomes readers with an opening slideshow, and then invites them to follow the family via an interactive map and data inserts throughout the longer written story segments. In 2013, the *Guardian* published a lengthy human-interest piece titled “Firestorm,” which chronicled a family’s plight to escape a raging brush fire as well as their life in the aftermath (Henley, 2013). In the same year, the *Boston Globe* earned acclaim for its non-linear, literary endeavor “The Fall of the House of Tsarnaev,” which wrapped two narratives into one and attempted to address some of the issues and questions surrounding the Boston marathon bombing (Jacobs, Filipov, & Wen, 2013).

In summary, digital disruption, new, emerging market expectations, and social shift to postmodernism have created a new environment for media organizations. Faced

with declining revenue streams and new audience expectations, media outlets must adapt to survive, thus many are turning to, alternative story forms as a way to create and foster “added value” (Deuze, 1999). The departure from traditional models offers a prime opportunity to explore the impact alternative story forms may have on the conveyance of the climate change crisis.

In essence, alternative story form provide potential for a more effective way to present climate change narratives, which rely on extensive amounts of complex, scientific, and factual information. In addition alternative formats coupled with narrative devices may also help to alleviate other issues inherent in climate change communication, such as the lack of relativity and immediacy (Moser, 2010). One such device that could prove to be beneficial to relating the severity and reality of climate change is anthropomorphism; a literary device that could “literally” serve to humanize the crisis.

## Chapter 5: Anthropomorphism

### Introduction and Definition

In his 2007 Nobel Lecture Al Gore assertively argued the direness of anthropogenic climate change. He quoted scientists and world leaders, supplied impressive empirical calculations, and made bold projections regarding the state of the Earth's future. Yet, one of the most powerful and resounding lines in his speech was the simple statement: "the earth has a fever" (Nobelprize.org, 2016). This ubiquitous form of personification, known as anthropomorphism, or applying human traits upon non-human agents, is an immensely powerful and multifaceted linguistic tool that has been an integral feature in the process of human meaning making for centuries.

The term anthropomorphism comes from the Greek words *ánthrōpos*, or man, and *morphé*, meaning form or shape (Guthrie, 2008). In the simplest terms, anthropomorphism is the imbuing of human characteristics upon non-human animals and objects, either real or imagined (Guthrie, 1993). Anthropomorphism goes beyond animism, or the act of simply attributing life to non-living things. And, it is not merely statements of observable action or descriptions of behavioral traits in non-human beings or things; rather to anthropomorphize is to go beyond those basic characterizations to make inferences regarding unobservable human traits in non-human agents (Epley, Waytz, Akalis, & Cacioppo, 2008). For example:

Regarding a fox as quick does not necessarily denote anthropomorphic reasoning, but regarding a fox as wily does. The former is simply a description of an observable behavior, whereas the latter refers to a distinctively mental quality. (Waytz, Cacioppo, & Epley, p. 220, 2010)

Bekoff (2008) argues that anthropomorphism is a natural human cognitive application and that it "is merely an extension of Charles Darwin's well-accepted ideas



about evolutionary continuity, in which it is argued that the differences among species are differences in degree rather than in kind” (p. 773). And, as such, anthropomorphism can manifest in many ways including, social context suggestions, transference of personality traits, and relationships and notions of possessiveness (Carnegie Mellon University, 2005; Kiesler & Kiesler, 2004) applied to non-human agents.

One of the most common anthropomorphic allocations is the simple act of naming non-human entities. Within this act, specifics often contribute to the degree to which the transference of humanistic traits occur: “Just naming an animal or object makes it seem more humanlike, especially when the name is a person’s name,” for example, certain names such as “Max, Wendy, and Larry are probably more likely to be anthropomorphized than Patches and Flip” (Carnegie Mellon University, para. 7, 2005). And, while most commonly associated with household pets or other animal species, anthropomorphized agents can take nearly any form, real or imagined; some typical examples include all types of non-human animals, religious figures, gadgets, natural phenomenon, and mechanical objects.

This chapter will explore the aspects and application of anthropomorphic language. More precisely this chapter will reveal the variety of ways in which anthropomorphic language is used by communicators, as well as how it can impact audiences as a distinctive storytelling element that can affect the way information is processed and appraised. First, the historical and contemporary significance of anthropomorphism will be discussed. Second, the psychological motivations and distinctions of the linguistic form will be reviewed, followed by an explanation of the intertwining physiological and neurological factors associated with its use. Third, an

overview of current research applications will be outlined, as well as the implications for journalistic application of anthropomorphic language. Finally, this chapter will offer a summary of the subsequent literature review and conclude with an explication of this study's hypotheses and research questions.

### **Historical and Modern Significance**

Examples of anthropomorphism have been found in conjunction with human existence throughout history, in fact it is difficult to find the absence of such wherever humans and other phenomena intertwine.

The earliest anthropomorphic depictions are often found as imagery or sculpture. One of the oldest known objects of prehistoric anthropomorphism is an ivory statue known as *Der Löwenmensch*, or the Lion Man (Vermeersch, 2011). The statue is carved from the tusk of a mammoth and was discovered in 1939 by geologist Otto Völzing on his final day excavating a German cave known as Hohlenstein-Stadel (Vermeersch, 2011). Estimated to be 40,000 years old, the carving depicts the head of a lion atop a human form (Stadt Ulm Ulmer Museum, n.d.). Based on its small size, only about a foot in height, researchers contend it was probably a totem with religious significance and most likely crafted as a representation of a shaman or tribal healer (Vermeersch, 2011). Today, the piece remains on display at the Stadt Ulm Ulmer Museum in Ulm, Germany.

Another renowned, historic example of early anthropomorphism is a cave painting known as *The Sorcerer*. Dated about 13,000 B.C., the painting was found in an inner sanctum of the *Cave of Les Trois-Frères*, or the cave of three brothers, which is located in the foothills of the Pyrénées in southern France (Bégouën & Bégouën, 2013).

Prominently displayed on the cave's wall, the painting depicts a human figure with the features of several different animals including felines, birds, and a variety of hooved beasts. Again, this portrayal was linked to religious representation by its discoverer, Henri Breuil, who believed it to be a Paleolithic god (Berman, 2000).

The discovery of anthropomorphic art during the Upper Paleolithic period is linked to the modernization of human behavior and an evolution of social intelligence. Mithen (1998) argues such depictions coincide with humanity's shift from gatherers to hunters, noting that the change was most likely motivated by the need for humans to better understand their natural world coupled with the need for them to be more predictive about the behavior of their prey.

Anthropomorphism is also prolific in written form throughout history. The earliest use of the term anthropomorphism is dated to sixth century B.C., and is credited to Xenophanes of Colophon, a Greek philosopher and theologian, who criticized the practice in relation to religious and spiritual representation (Spada, 1997; Waytz, Epley, & Cacioppo, 2010). Xenophanes' critique of what is referred to as anthropotheism, or "the doctrine that the gods originated as human beings or are essentially human in their nature" (Merriam-Webster, n.d.), is based on the notion that to ascribe human characteristics to gods is erroneous, as deities cannot be God-like if they hold mankind's flaws (Schoen, 2008).

The use of anthropomorphism is also commonly seen in fiction and folklore. Although not the first to utilize anthropomorphic language to foster perspective, Aesop and his fables are some of the most popular early works to do so. Aesop's fables, which use animals to provide a view of the human condition and understanding of relational

interactions, were deemed so socially integral and powerful that they were adapted, told, and published many times over throughout history (McClintock, 2000).

Anthropomorphism is also commonplace in fairy tales in both historical literatures like the Ancient Egyptian tale of *Two Brothers* which features talking cattle (Simpson, 2003), and in more contemporary versions, many adapted by Walt Disney, some examples include the talking mice who assist in *Cinderella*, and more recent still Dreamworks' comical take on marital arts with their box office hit *Kung Fu Panda*.

Modern literature in general, as well as television and film are also ripe with anthropomorphic content. From Lewis Carroll's *Alice in Wonderland* to George Orwell's *Animal Farm* and television shows like Fox's *Family Guy*, as well as contemporary films like the *Fantastic Mr. Fox* and video games such as *Animal Crossing*, anthropomorphic content has become a pervasive and persistent part of contemporary society.

However its presence is not restricted to fables, fairy tales, and fantasy narratives, non-fiction writing is also commonly riddled with personified representations. While its use was and remains a point of contention within the scientific community (see Fisher, 1991; Shapiro, 1993; Rollin, 1997), anthropomorphism was utilized in nearly every comparative psychology perspective of the nineteenth century and prior (Thomas, 1983), and it served as the basis of argumentation for one of the most well known perspectives on evolution: Darwinism (Knoll, 1997). Darwin's use of this device is an excellent example of science combined with social psychology and persuasion:

...Darwin might have attempted to demonstrate continuity by pointing out the bestial qualities in human beings; there is certainly plenty of evidence for their

existence. However, that tactic would not only have been off-putting, it would not have answered any triumphant pointing to unique human abilities and virtues. So Darwin argued for continuity by providing examples of human qualities in beasts. Thus he could simultaneously face the hard theoretical problems and give what he would call a truer and more cheerful view. (Knoll, 1997, p. 13)

Two more recent examples of anthropomorphic content in non-fiction writings and representations include the naming of weather-related events in human likeness as a means to increase public comprehension (Waytz, Epley, & Cacioppo, 2010), and the rise of “social computing” or the instructional technique that utilizes anthropomorphic language as means to simplify human-computer interactions (Duffy, 2003).

Finally, social media have become a common platform for anthropomorphic content. Each year, a number of mainstream and alternative media outlets curate lists of impactful animal presence on the Web, exposing the broad sphere of socially mediated uses of anthropomorphism.

To cite a few examples, on Twitter, the most followed humanized animal is @sockington, a domesticated housecat who takes his massive fan base of nearly 1.5 million followers along with him as he relates his daily activities in first person form (Shortlist, 2016). On Instagram, Norm, the “adorable pug from outside Seattle” is holding his own with more than 200,000 followers who relish his outfits and “attitudes” (D’Onfro, 2014). And, on Facebook, Grumpy Cat, the perpetually pouty feline reigns supreme with 8.3 million likes (Staff, 2015).

In conjunction with social media accounts, viral videos of anthropomorphized content are also commonplace. The most notable recent example is “Pizza Rat” who rose to fame by “living his best life.” The rodent was captured on video hauling a full slice of pizza up the stairs of a New York City Subway tunnel. Posted on YouTube in

September 2015, by December of the same year, the “Pizza Rat” video had been viewed in excess of 8.5 million times (Staff, 2015).

### **The Psychology and Physiology of Anthropomorphism**

David Hume (1757/1957) in *The Natural History of Religion* surmised there is a “universal tendency among mankind to conceive all beings like themselves” (p. 29) and, Asquith (1984) argued such tendencies, in relation to non-human animals, are unavoidable and inherently linked to the human condition. More recent still, Horowitz and Bekoff (2007) contend that among “lay people, anthropomorphism is not only prevalent, it is the nearly exclusive method for describing, explaining, and predicting animal behavior—whether the animals are kept as pets, visited in the zoo, or observed in nature” (p. 24).

The desire to see likeness in the proverbial “other” is motivated by humanity’s social needs. According to Erikson (1968), the ability to identify with others is a crucial social skill that develops early in life, and Mead (1934) described the creation of “self” as a highly social process that links psychological identification to the formation of group identity. The effectiveness of anthropomorphism is driven in many ways because of its ties to social learning processes and symbolic representations; however, a number of additional psychological and neurological mechanisms also add potency and context to the understanding and application of the linguistic tool.

For some time the science behind the psychology of anthropomorphism was assumed to be an automatic response, an invariant feature of human judgment (Guthrie, 1993), but in 2007 Epley, Waytz, and Cacioppo advanced a theory composed of three

key psychological determinants, elicited agent knowledge, effectance motivation, and sociality motivation, which influence anthropomorphic inferences.

Elicited agent knowledge, the first component, asserts the knowledge about humans and the self in general is highly familiar, therefore it serves as the basis for induction of anthropomorphism because it is acquired early, supplies abundant knowledge, and is easily accessible at the time of judgment (Epley, Waytz, & Cacioppo, 2007). Put more simply, elicited agent knowledge, speaks to the limitations of human comprehension, as humans can only truly know what it feels like experientially to be human, they are predisposed to anthropomorphize non-human agents as means to foster understanding.

The second key psychological factor that makes anthropomorphism highly influential is a human's integral aspiration for productive interaction with their external environment (White, 1959). Epley, Waytz and Cacioppo (2007) suggest effectance motivation "operates in the service of enhancing one's ability to explain complex stimuli in the present and to predict the behavior of these stimuli in the future" (p. 866). Applying human characteristics to non-human entities, therefore, assists humans in making sense of a non-human agent's actions. Recently, evidence was found to support this claim. An experimental investigation concluded participants reported greater comprehension and predictability for anthropomorphized non-human agents in comparison to those treated objectively (Waytz et al, 2010).

Third, and finally, sociality motivation refers to the human need to cultivate and develop relationships with other humans. This tendency and desire to form social groups is satisfied through anthropomorphism, as it allows for humanlike connection

with non-human agents. Further research on sociality motivation and anthropomorphism found that individuals who were chronically lonely were more likely to anthropomorphize their pets as a means to satisfy their need for social connection (Epley, Waytz, Akalis, & Cacioppo, 2008).

In addition to Epley, Waytz, and Cacioppo's (2007) three key determinants, recent studies have found anticipatory guilt can also contribute to the potency of anthropomorphic language. Research finds "guilt plays a crucial role when people are considering their current behavior" (Ahn, Kim, & Aggarwal, 2013, p. 225) The anticipation of feeling guilty is, in some cases, sufficient enough to make individuals act in ways aimed at ensuring they will not feel bad in the future (Baumeister, Vohs, DeWall, & Zhang, 2007). Thus, when an agent is anthropomorphized, anticipatory guilt is more likely to play an intermediating role in an individual's cognitive assessment. Ahn, Kim, and Aggarwal (2013) cited empirical support for this premise finding "that anthropomorphism of social causes and their symbolic entities is an effective tool for influencing people to behave prosocially—an action that emanates from their anticipatory guilt for not helping the anthropomorphized cause" (p. 228).

Anthropomorphic tendencies are not only a product of psychological processes, physiological, or more aptly neurological elements play a role, as well.

The human species' innate tendency to "explain one's own and others' actions in terms of beliefs, desires, and goals has been called 'theory of the mind (ToM),' or mentalizing" (Cullen, Kanai, Bahrami, & Rees, 2014). According to Mahy, Moses, and Pfeifer (2014) the brain regions most typically implicated in the mentalizing process are: the "(a) cortical midline structures (CMS) comprised of the medial prefrontal cortex



(MPFC), adjacent rostral anterior cingulate cortex (rACC), and medial posterior parietal cortices (MPPC) including posterior cingulate and precuneus and (b) the bilateral temporal parietal junction (TPJ)” (p. 69).

In 2007, Gazzola, Rizzolatti, Wicker, and Keysers found humans processed behaviors performed by anthropomorphized non-human entities in similar brain regions in which human behavior was considered. And, more recent work in neuroscience has established that “the degree to which individuals anthropomorphize non-human animals was correlated with variability in regional gray matter density of the left TPJ—a brain area involved in mentalizing” (Cullen, Kanai, Bahrami, & Rees, 2014, p. 1278).

Finally, anthropomorphism is driven by the innate need to understand others’ actions in order to survive (Mithen, 1998). Rizzolatti and Craighero (2004) refer to this neurological process as the mirror-neuron mechanism, which allows humans and primates to learn through imitation. The ability to learn through imitation also provides a framework for social organization and is the basis of human culture (Rizzolatti & Craighero, 2004).

The similarities in processing of human and anthropomorphized non-human beings and entities is closely related to mind perception, and hinges on the notion that non-human animals have sentience, or experiential emotional capabilities, which increases psychological relevancy to humans (Gray, Gray, & Wegner, 2007; Ahn, Kim, & Aggarwal, 2013).

Regardless of the type of motivation, either psychological or neurological, the act of anthropomorphizing carries with it some important implications. First, anthropomorphized entities become responsible for their actions and as such can be

attributed punishments or rewards for such endeavors (Gray, Gray, & Wegner, 2007). In turn then, those agents “capable of judgment, intention, and feeling are also capable of directing their judgment, intentions, and feelings toward us, and therefore become agents of social influence” (Waytz, Epley, & Cacioppo, 2010, p. 59). Second, when an agent is anthropomorphized, or perceived to hold human qualities, it is rendered worthy of both moral care and consideration (Waytz, Epley, & Cacioppo, 2010).

Finally, a salient distinction of anthropomorphism is the way it varies among individuals. Many factors contribute to differences in relation to who typically anthropomorphizes and to what extent they do so.

First, the prevalence of children, more so than adults, to engage in anthropomorphic descriptions of the non-human world is well documented and established throughout the social science community (Carey, 1985; Piaget, 1929/1951). Second, cultural inclinations, values, and norms also play a major role in the likelihood of humans of all ages to engage in anthropomorphic acts (Waxman & Medin, 2007; Asquith, 1986).

Third, recent empirical research finds that psychology is also a key determinant of anthropomorphic tendencies. Epley, Akalis, Waytz, and Cacioppo (2008) found that people who are placed in isolated social conditions or people who experience frequent and prolonged periods of loneliness in their lives are more likely to anthropomorphize non-human agents.

Finally, attitudes toward other species are often highly varying in themselves and are influenced by a myriad of conditions and “mentalizing” processes (Galvin & Herzog, 1993). Some species such as dolphins and chimpanzees are often attributed

human abilities such as sentience and intelligence, while other species, like invertebrates are rarely afforded such considerations (Herzog & Galvin, 1997). These between species “relativities” also contribute to the likelihood of metaphoric language use and human characteristic attribution.

### **Applications and Findings**

Previously, in the world of scholarship, anthropomorphism was often viewed as “stupidity” or “misconception;” however, today it has become a serious and fruitful field of study (Wright, 2016). It has been widely studied in many disciplines, including anthropology, behavioral and animal sciences, psychology, advertising, ecology, and many more. The flexibility in application and implementation across a diverse set of disciplines has promoted the sustained study of anthropomorphic content and its implications.

Research in the area of anthropogenic content has yielded a number of practical, real-world results. For example, recent work finds that anthropomorphism can increase individuals’ sense of comprehension and predictability toward a stimulus (Waytz et al, 2010). This finding was operationalized by the World Meteorological Organization that noted, “the naming of hurricanes and storms—a practice that originated with the names of saints, sailors’ girlfriends, and disliked political figures—simplifies and facilitates effective communication to enhance public preparedness, media reporting, and the efficient exchange of information” (Waytz, Epley, & Cacioppo, 2010, p. 60).

In addition to general material comprehension and predictability, research also finds anthropomorphic language can increase understanding of objects and/or issues that are foreign or distant human experience. Empirical studies in this area found

individuals reported higher levels of understanding and predictability for objects and issues when such had been anthropomorphized (Waytz et al, 2010; Abrahamse, Steg, Vlek, & Rothengatter, 2005).

In addition to comprehension, anthropomorphism can elicit attitudinal change. In a two-part study, Butterfield, Hill, and Lord (2012) found that anthropomorphized messages not only increased participants' beneficence toward personified animals, but such messages also encouraged pro-animal attitudes in relation to welfare and advocacy, and incited increased support for vegan and vegetarian lifestyles.

Not only can anthropomorphic attributions increase positive attitudes toward relative concepts, they can also increase an individual's feelings of efficacy when faced with issues commonly perceived as overwhelming or daunting. In direct relation to environmental crises, Tam (2014) found that people who had a predisposition to anthropomorphize the natural world held a stronger belief in their own ability to affect positive environmental change. In the same study, it was noted that anthropomorphism could be extremely powerful in "mobilizing conservation efforts" (Tam, 2014, p. 276).

The use of anthropomorphism as an advertising tool has also yielded interesting findings. Delbaere, McQuarrie, and Phillips (2011) were among the first to explore this notion and found, when embedded in print advertisements, personification can lead to more positive emotions and attitudes toward the brand, as well as higher attributions of brand personality. In 2013, Pfeifer, Groeppel-Klein, and Helfgen advanced research in this area by examining the humanization of products in television ads. The results of their online survey concluded, "product presentation causing anthropomorphism can be

very effective due to the elicitation of positive emotions and its impact on purchase behavior” (Pfeifer, Groeppel-Klein, & Helfgen, 2013, p. 265).

Elicitation of more positive emotions is not limited to products. Research has also concluded anthropomorphic digital representations of computer programs designed to interact with human users led to significantly more favorable attitudes toward the hosting Web sites (Nan et al, 2006). And, Nowak and Rauh (2005) found in virtual spaces participants were more likely to choose to be represented by anthropomorphized avatars, which they perceived to be more attractive and credible.

While not much research has been conducted in the area of anthropomorphic language use in journalistic content, news content is no stranger to the literary device.

Today, a cursory Web search provides a plethora of anthropomorphized news stories. The examples come from all formats, from mid-sized newspapers like the *Arizona Daily Sun*, which published the following headline in April 2016: “Hero dog helps to save freezing Flagstaff man;” to major network stations like *ABC News* which, in June 2016, invited viewers to “Meet Mosha, the Elephant With a Prosthetic Leg.” Alternative news outlets are not immune either, *Buzzfeed* published a careful collection of photos in October 2016 to showcase the “23 Times Dogs Really, Really Embarrassed Their Humans” and *Mashable* enticed readers with the headline “Baby orangutans fall in love at first sight” in January of the same year. However, perusal of the academic databases using the key words “journalism” and “anthropomorphism” yields but two studies. The first, an ethical essay advocating the need for journalists to include more animal “voices” in their coverage (Freeman, Bekoff, & Bexell, 2011), the second, a

more recent exploration of “automated journalism” and the perceptions of anthropomorphized robotic authorship (Montal & Reich, 2016).

However, despite the lack of research in this area, use of the linguistic device, most commonly employed as a metaphor, is becoming more prevalent in the industry. While mid-century journalists, especially those who covered nature and science ardently avoided the use of anthropomorphism, as a means to protect their “objectivity,” today’s reporter often embraces it (Dockray, 2016). The rise in the use of anthropomorphic language in journalism is motivated, in part, by the emergence of the digital age—a time when journalists are beginning to stray from their deep roots in legacy notions and turn to new norms and values based on novelty and the needs of a highly visual digital audience (Lowrey & Gade, 2011; Dockray, 2016; Gade, 2011). This embrace of such literary tools, may serve as an asset for the industry as, research finds, in relation to emergent media, stories containing Web-based anthropomorphic agents can increase readers’ positive attitudes toward the hosting Web site (Nan et al, 2006).

### **Literature Summary**

In summary, climate change is a growing and salient threat to global society (Moser, 2010; Gore, 2009). According to the Intergovernmental Panel on Climate Change’s Fifth Assessment (2014) humanity’s impact on the climate is evident. Currently, anthropogenic greenhouse gas emissions are the highest in history, the Earth’s atmosphere and oceans are warming at unprecedented rates, sea ice is receding in arctic regions, and global sea levels are rising (Intergovernmental Panel on Climate Change, 2014).

However, despite a 97 percent consensus among climate scientists that climate change is happening and that it is anthropogenic in nature, denial persists among the general public and elected officials (Cook et al., 2016; Moser, 2010; Jylhä, Cantal, Akrami, & Milfont, 2016). Continued denialism along with high levels of complexity and uncertainty, as well as a lack of visibility make effectively communicating climate change difficult, especially for journalists (Moser, 2010; Hansen, 2010; Boykoff, 2008).

The mass media are one of the most powerful and dominant players in the exchange of climate change communication because they are the public's primary source for information regarding scientific and environmental concerns (Wilson, 2000; Boykoff & Boykoff, 2007; Hansen, 2010; Moser, 2010). However, media's own values, norms, and routines can act as constraints to the effective relating of climate change stories (Boykoff & Boykoff, 2007; Hansen, 2010; Cox, 2013). Adherence to journalistic norms and values, such as objectivity and balance, can lead to misrepresentations of the climate crisis (Oreskes, 2004; Hansen, 2010; Boykoff & Boykoff, 2007). And, selective news "framing" by journalists often functions as a "politicizing" mechanism, which further advances ideological representations of climate issues (Cox, 2013; Belkin, 1987).

Industry disruption and social evolutions have added to the difficulties associated with relating the climate change narrative. The shift to the digital age has altered communication models and market demands, thus fostering levels of uncertainty and perpetual change among journalistic outlets (Lowrey & Gade, 2011; Gade, 2011; Picard, 2010). In society, an evolution to postmodernism has also created significant challenges for environmental reporting. Chief among these impediments is the

abandonment of singular and ultimate truths and an erosion of assumed institutional credibility (Lyotard, 1993; Gade, 2011).

To adapt to the new and emerging digital age, news media outlets are embracing a number of contemporary techniques. One of the most practical evolutions is the move toward new storytelling formats, or alternative story forms. Alternative story forms move away from traditional news writing models and provide avenues for more individualized and enhanced user experiences (Akpem, 2015). Research in the area of new story forms finds their use to be highly effective in increasing comprehension among readers (Quinn, 2007). This finding is especially true with fact-laden stories, and more specifically with stories that address complex scientific information, such as climate change issues (Quinn, 2007; Ma et al., 2012).

In conjunction with new story telling techniques, the climate change narrative may also benefit from a more literary style of journalism. Research found, when coupled with alternative story forms, literary devices such as suspense or metaphor bolstered comprehension and retention rates among readers (Machill, Köhler, & Waldhauser, 2007). Such writing elements, or linguistic tools, are commonplace in literary journalism, which, as a style, has deep roots in the industry (Kerrane, 1997; Hartsock, 2000). One such type of metaphorical language that could prove beneficial to advancing climate change communication is anthropomorphism, or the imbuing of human characteristics upon non-human agents (Guthrie, 1993).

Anthropomorphism has been a pervasive part of the human experience for centuries (Horowitz & Bekoff, 2007; Knoll, 1997). Both psychological and neurological elements contribute to the prolific use of anthropomorphic language in human culture



(Mead, 1934; Erikson, 1968; Cullen, Kanai, Bahrami, & Rees, 2014; Gazzola, Rizzolatti, Wicker, & Keysers, 2007). A vast amount of research regarding anthropomorphism has been conducted. Contemporary study in the area has found anthropomorphic language can increase comprehension of complex and distant ideas, create social connections, foster beneficence toward non-human agents, increase pro-social efforts, and increase individuals' self-efficacy related to environmental efforts (Waytz et al., 2010; Abrahamse, Steg, Vlek, & Rothengatter, 2005; Epley, Waytz, & Cacioppo, 2007; Butterfield, Hill, & Lord, 2012; Ahn, Kim, & Aggarwal, 2013; Tam, 2014). Together the elements could prove beneficial to advancing the climate change narrative in a more comprehensive and relative fashion.

Although an area of growing interest, there is little existing research that specifically addresses the impact alternative story forms have on audiences. Additionally, no follow up studies have been conducted to advance the understanding of the mediating role that literary devices may play in conjunction with alternative story formats. And, finally, there is no research that examines alternative storytelling techniques in relation to climate change coverage. Thus, the purpose of this research is to test the extent to which story forms and anthropomorphized language can impact how people process and think about climate change. The purpose of the study and the preceding literature review has led to the following nine hypotheses and five research questions.

### **Hypotheses and Research Questions**

Hypotheses will address main effects for both the use of anthropogenic language and alternative story forms, as well as interactions between the two. Research questions

will focus on exploratory areas of anthropogenic language use and characteristics of alternative story formats.

Three primary hypotheses are forwarded regarding anthropomorphism, the first main effect under review. First, since anthropomorphism has been found to elicit more positive emotions and attitudes toward topics and brands<sup>1</sup> (Pfeifer, Groeppel-Klein, & Helfgen, 2013; Nan, Anghelcev, Myers, Sar, & Faber, 2006), it follows that:

H1a: Participants exposed to news articles with anthropomorphic language will report more positive attitudes toward the climate change topic than those participants who are exposed to news articles that do not contain anthropomorphic language.

Second, since anthropomorphism has been found to increase an individual's beneficence toward non-human agents and increase "pro-animal" attitudes (Butterfield, Hill, & Lord, 2012), it follows that:

H1b: Participants exposed to news articles with anthropomorphic language will report more positive attitudes toward animal related issues such as conservation and advocacy efforts than those participants who were exposed to news articles that did not contain anthropomorphic language.

Third, anthropomorphism has also been found to increase individuals' retention of information (Waytz et al, 2010; Waytz, Epley, & Cacioppo, 2010; Abrahamse, Steg, Vlek, & Rothengatter, 2005) thus, it follows that:

H1c: Participants exposed to news articles with anthropomorphic language will report higher retention levels of factual information presented in the article than those participants who were exposed to news stories without anthropomorphic language.

In regard to alternative story forms, the following three hypotheses are forwarded.

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<sup>1</sup> For the purposes of this study a more "positive" attitude toward climate change reflects a higher level of acceptance of the reality and causality of the climate change crisis.

Alternative story formats conform to the expectations and desires of today's digital audiences (Deuze, 1999; Akpem, 2015), therefore it follows that:

H2a: Participants exposed to news articles presented in alternative formats will report more positive attitudes toward the climate change topic than those participants who are exposed to news articles presented in traditional formats.

It is also hypothesized that such positive appraisals will extend to associated content, thus:

H2b: Participants exposed to news articles presented in alternative formats will report more positive attitudes toward animal related issues such as conservation and advocacy efforts than those participants who were exposed to news articles presented in traditional formats.

Alternative story forms, or story formats that approach content in nonlinear, multimodal ways, have been found to be highly effective when relating fact-laden stories, and science communication, as they enable consumers to more readily recall and retained information (Quinn, 2007; Ma et al, 2012). Therefore, it follows that:

H2c: Participants exposed to news articles presented in alternative formats will report higher retention levels of factual information presented in the article than those participants who were exposed to news stories presented in traditional formats.

Based on previous research, the following three hypotheses address the expected interactions between the use of language and story format.

H3a: Participants exposed to alternative story formats using anthropomorphic language will report more positive attitudes toward climate change than participants exposed to traditional story formats that do not contain anthropomorphic language.

H3b: Participants exposed to alternative story formats using anthropomorphic language will report more positive attitudes toward animal related issues than participants exposed to traditional story formats that do not contain anthropomorphic language.

H3c: Participants exposed to alternative story formats using anthropomorphic language will report higher retention levels of factual information presented in

the article than participants exposed to traditional story formats that do not contain anthropomorphic language.

In conjunction with the preceding hypotheses, five primary research questions are also forwarded.

Currently, no research exists to examine the extent to which alternative story forms or anthropomorphic language in journalistic content affect behavioral intentions; therefore, the following two research questions are forwarded:

RQ1: Will participants exposed to certain conditions be more likely to share the story via social media?

RQ2: Will participants exposed to certain conditions be more willing to take action to stop the effects of climate change?

Additionally, there is no scholarship regarding anthropomorphic language and alternative story forms in relation to cognitive appraisals. Therefore, the following research question will explore this relationship.

RQ3: Will there be differences in participants' cognitive appraisals of the story based on language, format, or a combination of the two conditions?

Finally, to explore how, if at all, demographics affect participants perceptions of the content, the following two research questions are posited:

RQ4: Will there be significant differences in participants' attitude toward climate change, attitude toward associated content, and information retention based on their gender or political affiliation?

RQ5: Will there be significant differences in participants' cognitive appraisals of the story and behavioral intentions based on their gender or political affiliation?

## Chapter 6: Methods

Through experimental analysis, this study will examine the extent to which story forms and language can impact how individuals process and appraise climate change news coverage.

Experimental method is one of the oldest approaches to mass media research (Wimmer & Dominick, 2011). Experiments provide researchers with the opportunity to collect evidence of causality, control variables, conditions, and measures, and present replicable scholarship in their field of study (Wimmer & Dominick, 2011). While one of the most established methods, experiments were seldom used in mass media research until recently when interest in their application began to rise among media scholars (Thorson, Wicks, & Leshner, 2012; Wimmer & Dominick, 2011). Current researchers applaud this renewed interest. According to Thorson, Wicks, and Leshner (2012):

Experiments are important to the theoretical development of fields like journalism and mass communication because they provide the most rigorous way to establish causal relationships between independent and dependent variables (as well as moderators and mediators), relationships critical for building and evaluating theory. (p. 112)

This dissertation moves in the direction of this scholarly advancement by utilizing experimental design to explore the relationship between alternative story forms, literary devices, and the effective conveyance of the climate change crisis.

This study utilized a 2x2 factorial design. Factorial designs involve the simultaneous analysis of two or more independent variables and allow for investigation of both main effects and interactions (Wimmer & Dominick, 2011). Furthermore, this study utilized a between-subjects, or independent-measures, design, which subjected participants to one of four different experimental treatments (Ender, 2000).

This experimental design has two independent variables, language and format, each of which has two levels. The following four experimental treatment groups were employed in this study: (1) traditional story form with anthropomorphized language, (2) traditional story form without anthropomorphized language, (3) alternative story form with anthropomorphized language, and (4) alternative story form without anthropomorphized language.

### **Participants**

An a priori power analysis was conducted using the online software G\*Power (Faul, Erdfelder, Buchner, & Lang, 2013) to determine the appropriate sample size for this experiment. Developed by Jacob Cohen, statistical power analysis provides an estimation of the number of participants needed to determine the existence, or absence of a phenomenon (Wimmer & Dominick, 2011). In brief statistical power is a function of probability level, sample size, and effects size (Wimmer & Dominick, 2011).

For this experiment, an a priori power analysis was conducted for a MANCOVA with four levels and four dependent variables. Based on an alpha of 0.05, a power of 0.80, and a medium effect size ( $f = 0.25$ ), the approximate, desired sample size for this study was 55 participants per cell or  $N=220$ . The final sample utilized in the study was  $N=226$ .

The study sample was drawn from a population of undergraduate students registered in either communication or journalism classes at a large Midwestern university. Participants were offered extra credit for their participation.

### **Materials**

Four news stories were created for this experiment (see Appendix A). The stories were designed to mimic actual news articles in both appearance and content. Three primary sources were utilized to create the content of the articles. All materials presented in the article were adapted from the following sources: (1) a 2017 *Washington Post* news article (Fears, 2017); (2) a short narrative on the plight of polar bears (Thompson, 2009); (3) NASA (2016). Elements from each of the sources were carefully curated and edited together to create the articles used in the study. All factual elements of the story were presented without fabrication, such as current arctic ice levels, global warming facts, and polar bear population numbers.

Articles were presented in two different story formats—traditional and alternative, and two different language conditions—anthropomorphic and non-anthropomorphic (see Appendix A). Both story forms began with a vignette, or an anecdotal, feature-style lead that introduced the “actors” in the story—two polar bears, a mother and her cub.

There were two format conditions for the news articles—traditional (linear) and alternative (non-linear). The traditional story format followed a feature news style, which does not adhere to the rigid constraints of most “hard news” reporting, but often still follows a linear style (Kerrane, 1997). After the opening anecdotal lead, the body copy followed the inverted pyramid style, which presented information in a hierarchal format with the most important information at the top followed by points of lesser importance, or news value (Filak, 2016).

The alternative story format opened with the same short story that introduced the “actors.” After the opening, the story is presented in non-linear fashion, a hallmark of

alternative story forms (Akpem, 2015). Data visualization is utilized to present the story and provide “entry points” through which participants can navigate the article. For example, rapid rate of sea ice loss the arctic region is currently experiencing is due to global warming, thus a brief background of this phenomenon was included in the stories. In the traditional version, this was utilized as “background information” and placed in the last graph of the story, or the bottom of the inverted pyramid. In the alternative version, this information was in the fifth block of the story, near the midpoint.

The language treatment also had two conditions—non-anthropomorphic and anthropomorphic.

In the non-anthropomorphized version, the main actors—the bears— are referred to as polar bears, bears, or animals. References to the mother bear and her cub in these versions are without attributions of emotional behavior or other implied human characteristics, such as preference or rationality. In a second version of each story form, anthropomorphized language is used. In these formats, the bears are named Nora and Charlie. They are attributed emotional behaviors through subjective language cues, such as words that imply Nora was saddened by the loss of her cub. They are also allocated other humanistic traits, such as the notion that she and Charlie have “favorite” food sources.

Other than the use of anthropomorphic language as an independent variable within the experimental conditions, story content remained the same across presentation styles. The alternative story format utilized graphic design elements, however all primary photographic visuals were kept constant throughout all conditions. Finally,



although they are widely employed, hypertexts, or active links were not included in any experimental condition. Their exclusion was purposive, as implementation of such devices could confound the study's internal validity.

### **Procedure**

Study participants were invited to volunteer for a “science communication study” via the SONA registration system or through in-class recruitment efforts. The SONA system is a registration platform utilized by the Department of Communication that provides a population of communication students for faculty research.

Communication students are required to participate in research studies in order to receive credit for their interdepartmental courses. Thus, for their participation, communication students received credit toward this departmental requirement.

Journalism students received equitable credit, which was applied at the each individual professor's discretion.

Fifty-four research sessions were held over a three-week period, which began on April 12, 2017 and ended on April 28, 2017. Sessions were held in an on-campus lab, and were all attended by a research associate. Each session could accommodate up to 16 individuals, however attendance varied between 3 and 16 participants at each session. All materials, including stimulus and measures, were administered via the online platform Qualtrics.

Upon arrival in the lab, participants were seated at individual computer terminals and informed that they would be asked to complete a number of survey-style questions, as well as read a news article related to a scientific topic. Then, participants

were instructed to begin by clicking a provided link, after which they were to follow the on-screen prompts and instructions.

The link took participants to an informed consent document, which outlined the terms of the study. Participants were prompted to read and acknowledge the informed consent document before moving on. Following consent, participant identification was collected in order to substantiate their involvement and allocate the credit for their participation.

Participants then completed pre-test measures, after which they were randomly exposed to one of four experimental conditions—(1) traditional story form with anthropomorphized language, (2) traditional story form without anthropomorphized language, (3) alternative story form with anthropomorphized language, (4) alternative story form without anthropomorphized language. After reading one of the four news articles, participants completed post-test measures, behavioral intention measures, and demographics.

The study concluded with a short debrief message that thanked the participants and provided the required principal researcher's contact information.

## **Measures**

This study employed a pre-test, post-test between subjects design in which language and format were the IVs. The relationships of these IVs to three DVs, attitude toward climate change, attitude toward associated content, and information retention were tested. To account for pre-existing attitudes two variables, pre-test toward climate change and an anthropomorphism questionnaire, were measured as covariates.

Measures utilized in this experimental design were cultivated from both a number of existing studies and created specifically for this research by the author. Particular attention was paid to the order in which measures were presented to avoid a non-sampling error related to “Primacy” and “Recency” effects, which can occur in survey delivery models (Sanjeev & Balyan, 2014). In addition, “dummy” survey questions were also employed to limit the effects of serial response positioning and to limit testing sensitivity (Wimmer & Dominick, 2011). As a direct attempt to limit Primacy effects, or the likelihood that participants will maintain a predisposition toward materials they are first exposed to (Sanjeev & Balyan, 2014), a “dummy” survey of six questions regarding gun control regulation was the first survey measure used.

**Dependent variables.** There were four primary dependent variables in the study, attitude toward climate change, attitude toward associated content, such as animal conservation, cognitive appraisals of the message, and information retention.

**Attitude toward climate change.** To measure participants’ attitude toward climate change after stimulus exposure, a 12-item scale was created. This measure included statements regarding participants’ beliefs regarding climate change, such as “I am worried about climate change,” and “Future generations will be impacted by climate change.” A 7-point Likert-type scale, where 1 represented “strongly disagree,” 4 represented “neutral/don’t know,” and 7 represented “strongly agree” was used to evaluate participants’ responses.

Due to the fact that this scale had not been previously used, an exploratory factor analysis (EFA) was conducted using maximum likelihood extraction and Promax rotation. Promax rotation was utilized because it provides the most conservative

approach to analysis as it assumes that non-zero correlations among the factors are theoretically possible (Tabachnick & Fidell, 2007). A single factor emerged from the EFA procedure, which accounted for 59 percent of the variance (see Appendix B). The scale was reliable ( $\alpha = .930$ ).

**Attitude toward associated content.** To measure participants' attitude toward associated content, such as animal conservation, the Animal Attitude Scale (AAS) (Herzog, Betchart, & Pittman, 1991) was used as a post-test measure. The original form of the AAS had 20 statements that covered a variety of animal related issues including hunting for sport, consumption of animal products, and animal use for research purposes. The scale was developed to detect "pro-animal attitudes" among research participants (Herzog, Betchart, & Pittman, 1991). Since its inception the scale has been utilized many times, and the developers encourage investigators to modify the scale to meet specific needs. Thus, the scale has been adapted to best fit the goals of this research by keeping some of the original statements and adding additional statements related more specifically to environmental conservation. The final adjusted scale is a 10-item measure composed of broad statements such as, "I support animal rights," as well as more direct statements such as, "People should do more to help endangered species." Responses to this measure were collected on a 7-point Likert-type scale, where 1 represented "strongly disagree," 4 represented "neutral/don't know," and 7 represented "strongly agree."

Again, an EFA utilizing Promax rotation was conducted to ensure the customization of the AAS was valid. Initially, two factors emerged, which explained 53.7 percent of the variance. However, of the four statements that composed the second

factor only one loaded higher than .5, and the sub-scale failed to reach sufficient reliability ( $\alpha=.569$ ), therefore those four items were eliminated. A revised scale was created from the first 6-item factor, which proved reliable,  $\alpha=.823$  (see Table 6.1).

**Cognitive appraisal of the message.** To measure participants' evaluation of the message itself a series of 23 cognitive appraisals based on the work of Dillard, Kinney, and Cruz (1996) were used. Together the appraisals cover ten areas of cognition: (1) attentional activity; (2) valence; (3) relevance; (4) predictability; (5) self-attribution; (6) other-attribution; (7) obstacle; (8) effort; (9) power; and (10) legitimacy. Responses to this measure were collected on a 7-point Likert-type scale, where 1 represented "strongly disagree," 4 represented "neutral/don't know," and 7 represented "strongly agree."

Table 6.1  
Factor loadings and communalities based on an exploratory factor analysis with Promax rotation for 6 items from the Animal Attitude Scale (AAS). ( $N = 226$ )

Items	Factor Loadings	Communalities
Too much fuss is made over the welfare of animals these days when there are many human problems that need to be solved. (RC)	.830	.551
People should do more to help endangered species.	.727	.494
In general, I think that human economic gain is more important than setting aside more land for wildlife. (RC)	.722	.492
Basically, humans have the right to use animals as we see fit. (RC)	.658	.417
I do not think that there is anything wrong with using animals in medical research. (RC)	.623	.400
Humans should protect the habitats of other animals.	.501	.270

Note. RC=Reverse coded;  $\alpha=.823$

Cognitive appraisals are critical to understanding the communication process, especially where emotion is involved like in this narrative concerning the polar bear and her cub (Dillard, Kinney, & Cruz, 1996). The importance of measuring cognitive appraisals is in line with the communication research approach that posits emotional or persuasive messages cannot have a direct effect on an individual’s attitude, rather “any change experienced by the individual is due to the appraisal of the message and the resulting judgment about the potential harms or benefits confronting the receiver, not the message itself” (Jorgensen, 1998, p. 411).

A principle components analysis (PCA) with Varimax, or orthogonal, rotation was chosen as the variable reduction technique for this measure because the variables within the scale are highly correlated (Dillard, Kinney, & Cruz, 1996; Tabachnick & Fidell, 2007). The PCA identified six factors that cumulatively explained 67.9 percent of the variance (see Table 6.2).

Table 6.2  
Factor loadings based on a principle components analysis with Varimax rotation for the 23 cognitive appraisal items. ( $N = 226$ )

Items	F1	F2	F3	F4	F5	F6
<b>F1: Focus (<math>\alpha=.881</math>)</b>						
The news story made me want to focus on the information provided.	<b>.799</b>	.180	.151	.059	.012	.052
The news story made me want to direct my attention to understanding the topic.	<b>.773</b>	.279	.113	.078	.047	.092
The news story mattered to me.	<b>.769</b>	.227	.095	.224	-.111	.197
I wanted to give all my attention to comprehending the news story.	<b>.765</b>	-.038	.102	.167	.100	-.151

The news story was important to me.	<b>.757</b>	.255	.137	.191	-.106	.196
The news story was interesting.	<b>.662</b>	.209	-.042	.184	.081	-.074
The news story does not reflect my own attitudes. (RC)	<b>.453</b>	.416	-.018	.321	-.102	.323
The news story influenced the conclusions I drew.	<b>.431</b>	.347	.006	-.122	-.082	-.098
<b>F2: Credibility (<math>\alpha=.857</math>)</b>						
The news story was reasonable.	.176	<b>.789</b>	.055	.260	.032	-.176
The news story was fair.	.035	<b>.773</b>	.070	.229	.131	-.200
I found the content to be reliable.	.372	<b>.735</b>	-.009	.050	.055	.120
I found the content to be accurate.	.368	<b>.702</b>	.030	-.011	.084	.213
I found the content to be exaggerated. (RC)	.284	<b>.671</b>	-.068	.241	-.054	.312
<b>F3: Effort &amp; Power (<math>\alpha=.759</math>)</b>						
The news story made me feel powerful.	.023	.068	<b>.786</b>	.026	.458	.141
The news story made me think that effort would be required of me.	.232	.086	<b>.759</b>	-.076	-.238	-.067
The news story made me feel strong.	.013	.035	<b>.735</b>	.036	.501	.166
The news story made me think that I would have to exert myself.	.159	-.087	<b>.685</b>	-.174	-.256	-.145
<b>F4: Predictability (<math>\alpha=.763</math>)</b>						
The news story made it hard to understand what was happening.	.187	.140	-.067	<b>.825</b>	-.059	.009
The news story was difficult to understand. (RC)	-.307	-.179	.027	<b>.759</b>	.000	.124
The news story made it hard to predict what would happen next.	.063	.135	-.068	<b>.724</b>	-.094	.103

<b>F5: Pleasant (R=.56) (<math>\alpha</math>=.713)</b>						
The news story was enjoyable.	.109	.130	-.124	-.007	<b>.796</b>	-.005
The news story was pleasant.	-.081	-.014	.108	-.173	<b>.786</b>	-.091
<b>F6: Autonomy</b>						
I drew my own conclusions about the news story.	-.047	.001	-.009	.007	.027	<b>-.808</b>
<b>Eigenvalue</b>	4.44	3.38	2.33	2.31	1.94	1.22
<b>Percent of variance explained</b>	30.4	11.8	8.8	6.2	5.8	4.9
<b>Cumulative percent of variance</b>	30.4	42.2	51.0	57.1	63.0	67.9

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*Note.* RC=Reverse coded

Factor 1 was composed of eight items and explained 30.4 percent of the variance. This factor was labeled Focus as three of the four highest loading items dealt directly with attentional activity. As a subscale these eight items were reliable ( $\alpha$ =.881). Factor 2, labeled credibility, addressed assessments of fairness, accuracy, and reliability of the message. This factor included five items and explained 11.8 percent of the variance. These five items were also reliable ( $\alpha$ =.857). Factor 3 was titled effort and power and was composed of four items, which addressed affective notions and ease of navigation of the message. These four items were also reliable as a scale ( $\alpha$ =.759). Factor 4, labeled predictability, was a three-item factor that addressed the expectation confirmation with in the story. These three items also returned an acceptable alpha ( $\alpha$ =.763). Factor 5 was composed of only two items and was labeled pleasant, as both items dealt with preferential assessment of the message. These two items were reliable ( $r$  =.56;  $\alpha$ =.713). Finally, Factor 6 was a single item factor and was labeled autonomy, as the singular item here addressed self-attribution and freedom.



**Information retention.** To measure information retention, participants' answered a series of multiple-choice questions immediately following the stimulus. This post-test measure was specifically designed to adhere to the stimulus. Participants were asked to answer six questions about factual information taken from the news article (see Appendix C). For example, participants were presented the following question and choice rubric: "There is a \_\_\_\_ percent agreement among climate scientists that global warming is caused by human activity. (A) 97, (B) 89, (C) 50, (D) 46." On this measure participants could score between a zero and a six. Composite scores were based on the number of correct answers.

**Covariates.** There were two covariates used in this study. The first was pre-test measure to gauge participants pre-existing attitude toward climate change, and the second was an Anthropomorphism Questionnaire designed to determine an individual's predisposition to anthropomorphize.

**Pre-existing attitude toward climate change.** To control for participants' pre-existing attitudes toward climate change the Climate Change Attitude Scale adopted from Christensen and Knezek (2015) was used. Composed of 12 items, this pretest measured participants' beliefs toward climate change. It included statements such as "I believe our climate is changing" and "I am concerned about global climate change." In order to dilute predispositions toward the stimulus, 12 additional questions regarding the scientific debate behind childhood vaccines were intermingled with the climate questions. Additionally, the delivery was randomized for all 24 items in this measure. Responses to this measure were collected on a 7-point Likert-type scale, where 1

represented “strongly disagree,” 4 represented “neutral/don’t know,” and 7 represented “strongly agree.”

An EFA was conducted using maximum likelihood extraction and Promax rotation. A single factor emerged from the EFA procedure, which accounted for 64.6 percent of the variance (see Appendix D). The scale was reliable ( $\alpha = .947$ ).

**Anthropomorphism Questionnaire.** To control for participants’ predisposition to anthropomorphize as 20-item assessment was used. Created by Neave, Jackson, Saxton, and Honekopp (2015), the 20-item Anthropomorphism Questionnaire (AQ) addresses an individual’s tendency to anthropomorphize a variety of non-human agents, including weather, animals, technology, and mechanical items. The questionnaire presents a number of statements including, “I sometimes feel that the sea can be angry,” “As a child, I felt that some of my toys had become ill,” and “I sometimes wonder if my computer deliberately runs more slowly after I have shouted at it.”

The AQ is important in controlling for individual differences associated with anthropomorphizing as explicated by Waytz, Epley, and Cacioppo (2010). In addition, the same scale was utilized by Tam (2014), who forwarded evidence that individuals who are predisposed to anthropomorphism exhibit stronger beliefs in their ability to affect positive environmental change. Responses to this measure were collected on a 7-point Likert-type scale, where 1 represented “strongly disagree,” 4 represented “neutral/don’t know,” and 7 represented “strongly agree.”

An EFA using Promax rotation and maximum likelihood extraction was conducted on this measure. The analysis produced two factors, which, together, accounted for 54.1 percent of the variance (see Table 6.3). Factor 1 was labeled

childhood, as all statements within this factor were related to actions or intentions from that period. This factor was composed of 10 items, and was found to be reliable ( $\alpha = .914$ ). Factor 2 was labeled, general as it addressed tendencies to anthropomorphize inanimate objects without a specific time period association. This factor accounted for the other 10 original scale items. It was also found to be reliable ( $\alpha = .882$ ).

Table 6.3

Factor loadings based on an exploratory factor analysis with Promax rotation for the 20-item Anthropomorphism Questionnaire. ( $N = 226$ )

Items	F1	F2
<b>F1: <i>Childhood</i> (<math>\alpha=.914</math>)</b>		
When I was a child, I made sure when I put my toys away the ones who were friends were placed side by side.	<b>.875</b>	.541
As a child, when I put away my toys I made sure that odd ones lying around were placed with the others so that they wouldn't feel lonely.	<b>.853</b>	.478
When I was a child I always made sure my favorite toy was comfortable (e.g. sitting up or tucked into bed) when I left the room.	<b>.816</b>	.432
As a child I sometimes said "hello" and "goodnight" to some of my favorite toys.	<b>.757</b>	.441
If I threw out a toy when I was a child I worried that it might think I had rejected it.	<b>.742</b>	.440
I sometimes wonder that if items are stored out of sight in a dark attic or room, they might feel lonely or unloved.	<b>.653</b>	.639
As a child, the thought of how my favorite toys would cope without me if I died was something that I worried about.	<b>.633</b>	.473
As a child I felt at times that some of my toys were in a bad mood.	<b>.631</b>	.495
As a child, I felt that some of my toys had become ill.	<b>.620</b>	.474
When I was a child I held birthday parties for my favorite toys.	<b>.567</b>	.358

**F2: General ( $\alpha=.882$ )**

I sometimes think that if my computer/printer is made to feel happy and/or wanted, then they will be less likely to malfunction.	.449	<b>.725</b>
I sometimes wonder if my computer deliberately runs more slowly after I have shouted at it.	.421	<b>.723</b>
Part of the reason why I picked a new car/electrical item was because when I first saw it I felt it had a friendly personality.	.525	<b>.720</b>
On occasions I feel that my computer/printer is being deliberately awkward.	.352	<b>.712</b>
I sometimes wonder if my personal possessions appreciate it when I have given them a good cleaning.	.575	<b>.707</b>
On occasion I feel that the weather conditions are being deliberately bad in order to ruin a social event.	.387	<b>.629</b>
If I accidentally break one of my favorite possessions I make sure that I apologize to it for my clumsiness.	.578	<b>.616</b>
I think that some trees are friendly while others have an air of menace.	.319	<b>.588</b>
I sometimes feel that the sea can be angry.	.389	<b>.577</b>
I do think that certain cars have a specific personality.	.396	<b>.567</b>
<b>Eigenvalue</b>	8.68	2.14
<b>Percent of variance explained</b>	43.4	10.7
<b>Cumulative percent of variance</b>	43.4	54.1

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**Behavioral intention measures.** Participants completed two behavioral intention measures. The first behavioral intention measure addressed the participant's likelihood to share the news story via social media. Participants were asked to utilize a sliding scale of 0 to 10 to indicate the likelihood that they would share the story with

others on a social media platform. With this measure, zero indicated no intention to share the story and ten indicated the participant was highly likely to share the article with others in their social network.

The second behavioral intention measure was a 10-item scale adapted from a design created by Sinatra, Kardash, Taasoobshirazi, and Lombardi (2011) to measure participants' "willingness to take action" to reduce the effects of climate change (see Appendix E). Instructions provided to participants prior to the scale itself included the following narrative:

*Please let us know your level of willingness to take action regarding climate change. Listed below are several examples of actions that could help to reduce global warming. Please use the rating scale to indicate how willing you would be to take the listed action to reduce global warming.*

Statements included on this scale questioned participants regarding their willingness to engage in a variety of scenarios, including car-pooling, recycling, plastic use, etc.

Responses to this measure were gathered on a 5-point Likert-type scale where 1 represented "not likely," 3 represented "neutral/don't know," and 5 represented "very likely."

Finally, after behavioral intention measures, participant demographics were collected. Because research finds race, gender, political ideology, religious affiliation, and country of origin all play a role in the extent to which an individual believes and understands climate change (Enten, 2014; Pew Research Center, 2015a; Hamilton, 2008; McCright & Dunlap, 2011; Painter, 2011) all were collected in the study. In addition, age and primary language were also collected.

## Chapter 7: Results

### Sample Characteristics

The sample was predominately female (74.8 percent) and the median age was 20.9 years. Ethnically, 73 percent were Caucasian, 8.8 percent were Hispanic, 8 percent were Asian, 4 percent were African American, 1.3 percent identified as other. Political ideological identification was more diverse within the sample 45.1 percent were Republicans, 28.8 percent were Democrats, 18.1 percent were Independents, and 8 percent identified as other. Christianity was the most reported religious affiliation at 75.7 percent followed by Atheism as 11.9 percent, Islam at 2.2 percent, and other at 7 percent. Judaism and Buddhism each accounted for 1.3 percent of the sample. Finally, 93.8 percent of the sample reported English as their first language.

### Findings

Hypotheses H1a through H1c addressed main effects for the first independent variable—language. Three individual analyses of covariance or ANCOVAs were conducted to examine the relationship between the predictor variable, language (anthropomorphized vs. non-anthropomorphized), and the criterion variables (attitudes toward climate change, attitudes toward associated concepts, and information retention) while controlling for both pretest-attitudes toward climate change and predispositions to anthropomorphize (AQChild, and AQGeneral). Although pre-test attitude toward climate change was significant  $F(1, 226) = 909.25, p < .001$ , the two predisposition to anthropomorphize measures were not, AQChild,  $F(1, 226) = .281, p = .596$ ; AQGeneral,  $F(1, 226) = .287, p = .593$ , therefore they were removed as covariates, and

the analyses were re-run with pre-test attitude toward climate change as the only covariate (see Table 7.1).

Hypothesis 1a predicted participants exposed to news articles with anthropomorphic language would report more positive attitudes toward the climate change topic than participants who were exposed to news articles that did not contain anthropomorphic language. Although the relationship was in the predicted direction, with anthropomorphized content producing a higher mean ( $M = 5.79$ ,  $SD = .96$ ) than non-anthropomorphized content ( $M = 5.59$ ,  $SD = .97$ ), the results fell short of the conventional .05 level of probability for a two-tailed test of statistical significance,  $F(1, 221) = 1.95$ ,  $p = .16$ ,  $\eta^2_p = .009$ . However, given that the results were in the hypothesized direction, a one-tailed test would indicate a marginally significant outcome ( $p = .08$ ), providing marginal support for H1a.

Hypothesis 1b predicted, relative to non-anthropomorphic language, participants exposed to news articles with anthropomorphic language would report more positive attitudes toward associated concepts. However, the ANCOVA did not find significance,  $F(1, 221) = .06$ ,  $p = .81$ ,  $\eta^2_p = .000$ ; thus, Hypothesis 1b was not supported.

Hypothesis 1c predicted participants exposed to news articles using anthropomorphic language would report higher retention levels of factual information presented in the news story than those exposed to stories not using anthropomorphic language. Mean differences were in the predicted direction; anthropomorphized content produced a higher mean ( $M = 4.45$ ,  $SD = 1.11$ ) than non-anthropomorphized content ( $M = 4.05$ ,  $SD = 1.33$ ), and the test was significant,  $F(1, 221) = 5.82$ ,  $p = .017$ ,  $\eta^2_p = .026$ . Thus, Hypothesis 1c was supported.

Table 7.1  
Results of language use—with or without anthropomorphism.

Dependent Variable	With ( <i>n</i> = 110) Mean (SD)	Without ( <i>n</i> = 116) Mean (SD)	<i>F</i>	$\eta^2_p$
Climate Change Attitude	5.79 (.96)	5.59 (.97)	1.95	.009
Associated Content	5.69 (.96)	5.65 (1.01)	.060	.000
Information Retention	4.45 (1.11)	4.05 (1.33)	5.82*	.026

Note: \* $p < .05$ .

Hypotheses H2a through H2c addressed main effects for the second independent variable—format. Again, three ANCOVAs were conducted to examine the relationship between the predictor variable, format (traditional vs. alternative), and the criterion variables (attitudes toward climate change, attitudes toward associated concepts, and information retention) while controlling for participants' pretest-attitude toward climate change. The predisposition to anthropomorphize scales were removed due to a lack of significance. The format results were similar to the language findings (see Table 7.2).

Hypothesis 2a predicted participants exposed to news articles presented in alternative formats would report more positive attitudes toward climate change than those participants who were exposed to news articles presented in traditional formats. Although in the predicted direction with alternative formats producing slightly higher mean scores ( $M = 5.70$ ,  $SD = .93$ ) than traditional formats ( $M = 5.68$ ,  $SD = 1.01$ ), the difference was not statistically significant,  $F(1, 221) = .409$ ,  $p = .52$ ,  $\eta^2_p = .002$ . Thus, Hypothesis 2a was not supported.

Hypothesis 2b predicted, compared to stories presented in traditional formats, stories presented in alternative formats would create more positive attitudes toward associated concepts, such as conservation, from participants. Again, the ANCOVA



found no statistically significant difference between formats,  $F(1, 221) = .076, p = .78, \eta^2_p = .000$ . Thus, Hypothesis 2b was also not supported.

Hypothesis 2c predicted participants exposed to news articles presented in alternative formats would retain more factual information from the stories than those participants exposed to news articles presented in traditional formats. Format was significant in relation to information retention,  $F(1, 221) = 8.83, p = .003, \eta^2_p = .038$ . The relationship was also in the predicted direction with alternative formats producing higher levels of retention ( $M = 4.49, SD = 1.18$ ) than traditional formats ( $M = 4.00, SD = 1.25$ ). Thus, H2c was supported.

Table 7.2  
Results of format—traditional vs. alternative.

Dependent Variable	Traditional ( $n = 113$ ) Mean (SD)	Alternative ( $n = 113$ ) Mean (SD)	$F$	$\eta^2_p$
Climate Change	5.68 (1.01)	5.70 (.93)	0.41	.002
Associated Content	5.70 (1.02)	5.65 (.96)	0.76	.000
Information Retention	4.00 (1.25)	4.49 (1.18)	8.83**	.038

Note: \*\*  $p < .01$ .

Hypotheses H3a through H3c addressed the contrast between the two most distinct conditions: participants in the alternative format with anthropomorphic language condition and participants in the traditional format without anthropomorphic language condition. Again, to assess these predictions, three ANCOVAs, one for each dependent variable, were run with pre-attitude toward climate change as the covariate (see Table 7.3).

H3a posited participants exposed to alternative story formats using anthropomorphic language would report more positive attitudes toward climate change

than participants exposed to traditional story formats that did not contain anthropomorphic language. The relationship was in the predicted direction, with alternative formats with anthropomorphized content producing a higher mean ( $M = 5.75$ ,  $SD = .91$ ) than traditional formats with non-anthropomorphized content ( $M = 5.54$ ,  $SD = 1.00$ ), however the difference fell short of statistical significance,  $F(1, 111) = 2.27$ ,  $p = .14$ ,  $\eta^2_p = .020$ . Given that the results were in the hypothesized direction, a one-tailed test would indicate a marginally significant outcome ( $p = .07$ ), suggesting marginal support for H3a.

Hypothesis 3b predicted, compared to stories presented in traditional formats without anthropomorphic language, stories presented in alternative formats with anthropomorphic language would provoke more positive attitudes toward associated content from participants. The results were statistically significant between the two conditions,  $F(1, 111) = 0.64$ ,  $p = .80$ ,  $\eta^2_p = .001$ . H3b was not supported.

Table 7.3  
Results contrasting conditions—alternative format with anthropomorphic language v. traditional format without anthropomorphic language.

Dependent Variable	Alternative With ( $n = 56$ ) Mean (SD)	Traditional Without ( $n = 58$ ) Mean (SD)	$F$	$\eta^2_p$
Climate Change	5.75 (.91)	5.54 (1.00)	2.27	.020
Associated Content	5.69 (.87)	5.68 (.99)	0.064	.001
Information Retention	4.68 (1.01)	3.83 (1.33)	14.23***	.114

Note: \*\*\*  $p < .001$ .

Finally, hypothesis 3c predicted those exposed to alternative story formats using anthropomorphic language would report higher retention levels of factual information than those exposed to traditional story formats that did not contain anthropomorphic

language. Mean differences were in the predicted direction alternative formats with anthropomorphized content produced a higher mean ( $M = 4.68$ ,  $SD = 1.01$ ) than traditional formats without anthropomorphized content ( $M = 3.83$ ,  $SD = 1.33$ ), and the difference was significant,  $F(1, 111) = 14.23$ ,  $p < .001$ ,  $\eta^2_p = .114$ . Thus, Hypothesis 3c was supported.

Research Question 1 addressed the first to two behavioral intention measures, which asked if participants exposed to certain conditions would be more likely to share the story they read on social media. To measure this participants were asked the likelihood that they would share the story via a sliding scale with zero representing “would not share” and ten representing “would definitely share.”

An ANCOVA was performed to examine the effect of language and format on participants’ likelihood to share as the dependent variable and the pretest attitude toward climate change as the covariate. The pretest was significant as a control variable,  $F(1, 221) = 59.68$ ,  $p \leq .001$ ,  $\eta^2_p = .213$ . Similar to the hypothesized results, anthropomorphized content produced a higher mean ( $M = 5.16$ ,  $SD = 2.77$ ) than non-anthropomorphized content ( $M = 4.80$ ,  $SD = 2.95$ ), however the difference was not statistically significant  $F(1, 221) = .236$ ,  $p = .628$ ,  $\eta^2_p = .001$ . For format, the mean difference also mirrored previous results with alternative story forms producing a higher mean ( $M = 5.12$ ,  $SD = 2.83$ ) than traditional story forms ( $M = 4.84$ ,  $SD = 2.90$ ), however the difference was not significant  $F(1, 221) = .868$ ,  $p = .353$ ,  $\eta^2_p = .004$ .

A second ANCOVA was conducted to examine participants likelihood to share based on the same contrast conditions used in H3a through H3c (alternative format with anthropomorphic language v. traditional format without anthropomorphic language).

Again, the attitude toward climate change pretest was used as the covariate variable.

Means were the hypothesized directions, however the difference was not significant,  $F(1, 111) = .985$ ,  $p = .323$ ,  $\eta^2_p = .009$ .

Research Question 2 addressed the second behavioral intention measure, participants' willingness to take action to help thwart climate change. This measure assessed responses to a series of questions regarding activities one could engage in to help limit the detrimental environmental effects.

Two ANCOVAs were run to examine participants' willingness to take action as the dependent variable and attitude toward climate change as the covariate. The first ANCOVA looked for main effects with language and format as the independent variables. The second ANCOVA used the contrast condition variable (alternative format with anthropomorphic language v. traditional format without anthropomorphic language) and the independent variable. For the willingness to action measure no statistical significance was found for the main effects of language,  $F(1, 221) = .047$ ,  $p = .829$ ,  $\eta^2_p = .000$ , or format  $F(1, 221) = .025$ ,  $p = .875$ ,  $\eta^2_p = .000$ . The contrast condition also failed to produce statistically significant differences between the two groups,  $F(1, 111) = .013$ ,  $p = .909$ ,  $\eta^2_p = .000$ .

Research Question 3 asked if participants exposed to certain language or format conditions would show differences in their cognitive appraisals of the story. To address this question a MANCOVA was performed with language and format as the predictor variables, the six cognitive appraisal subscales (Focus, Credibility, Effort & Power, Predictability, Pleasant, and Autonomy) as the criterion variables, and the attitude toward climate change pretest measure as the covariate. Other than the pretest measure

for climate change  $F(6, 216) = 22.27, p \leq .001, \eta^2_p = .382$ ), neither the multivariate tests, nor the univariate analyses found any statistically significant differences between language and format conditions in relation to participants' cognitive appraisals of the material.

Research Question 4 asked if there were significant differences by gender or political affiliation in participants' attitude toward climate change, attitude toward associated content, and information retention (see Table 7.4). To test this, three ANCOVAs were performed, one for each dependent variable, with the attitude toward climate change pretest as the covariate. As predictor variables gender was dichotomous (male or female) and political affiliation was composed of three dimensions: Republican, Democrat, or Other.

For the first criterion variable, attitude toward climate change, the pretest was significant as a covariate  $F(1, 219) = 41.91, p \leq .001, \eta^2_p = .741$ , and gender was also statistically significant  $F(1, 219) = 6.63, p = .011, \eta^2_p = .029$ . The relationship between gender and attitude toward climate change revealed women ( $M = 5.80, SD = .901$ ) held more positive attitudes toward climate change than men ( $M = 5.34, SD = 1.08$ ),  $t(224) = -3.21, p = .002, d = .43$ . Political affiliation did not produce a significant difference  $F(1, 219) = .830, p = .437, \eta^2_p = .008$ .

The pretest as a covariate was also significant for attitude toward associated content  $F(1, 219) = 34.37, p \leq .001, \eta^2_p = .136$ . For associated content, both gender,  $F(1, 219) = 15.22, p \leq .001, \eta^2_p = .065$ , and political affiliation were significant  $F(1, 219) = 6.42, p = .002, \eta^2_p = .055$ .

Further analysis indicated, as it relates to gender, women ( $M = 5.81, SD = .932$ ) held more positive attitudes toward associated content than men ( $M = 5.28, SD = 1.04$ ),  $t(224) = -3.59, p < .001, d = .48$ . In terms of political affiliation, there was a significant effect for political affiliation for all three ideologies,  $F(2, 223) = 24.67, p < .001$ . Post hoc comparisons using Tukey HSD test indicated that the mean score for Democrats ( $M = 6.15, SD = .825$ ), was significantly different than that of Republicans ( $M = 5.22, SD = .977$ ), but not significantly different than Others ( $M = 5.94, SD = .828$ ). However, Others' mean scores were significantly different than Republicans' mean scores. In sum, both Democrats and Others held more positive attitudes toward associated content than Republicans.

For the final criterion variable, information retention, the results were not significant, providing no support for previous findings suggesting extraneous differences in gender or political affiliation.

Table 7.4  
ANCOVAs for dependent variables by gender and political affiliation

Dependent Variable	Mean (SD)		<i>F</i>	$\eta^2_p$
	Gender			
	Male ( <i>n</i> = 57)	Female ( <i>n</i> = 169)		
Climate Change	5.34 (1.08)	5.80 (.902)	6.63*	.029
Associated Content	5.08 (.894)	5.61 (.881)	15.22***	.065
Retention	4.35 (1.23)	4.21 (1.24)	0.470	.002
	Political Affiliation			
	Dem. ( <i>n</i> = 65)	Other ( <i>n</i> = 59)	Rep. ( <i>n</i> = 102)	
Climate Change	6.27 (.646)	5.91 (.774)	5.18 (.986)	0.830
Associated Content	5.96 (.693)	5.77 (.796)	4.99 (.863)	6.42*
Retention	4.22 (1.27)	4.15 (1.20)	4.31 (1.25)	0.486

Note: \*  $p \leq .05$ ; \*\*  $p < .01$ , \*\*\*  $p < .001$

Research Question 5 asked if there were significant differences by gender or political affiliation in participants' cognitive appraisals of the story and behavioral intentions. A MANCOVA was run with political affiliation and gender as the predictor variables, the six cognitive appraisal subscales and the two behavioral intention measures as criterion variables, and the attitude toward climate change pretest measure as the covariate (see Table 7.5).

The multivariate tests showed, once again, that the pretest on climate was a significant as a control variable,  $F(8, 212) = 16.96, p \leq .001, \eta^2_p = .055$ . Multivariate analysis also found a significant main effect for political affiliation,  $F(16, 426) = 2.57, p = .001, \eta^2_p = .088$ . The univariate analysis also found significance on a number of variables.

In regard to the relationship between political affiliation and cognitive appraisals two subscales were significant. "Effort and Power" was significant,  $F(2, 219) = 4.18, p = .017, \eta^2_p = .037$  within the MANCOVA model, but did not reach significance in the post hoc ANOVA analysis. "Pleasant" was significant in both the initial model,  $F(2, 219) = 3.70, p = .026, \eta^2_p = .033$ , and the subsequent ANOVA,  $F(2, 223) = 3.13, p = .046$ . Post hoc comparisons using Tukey HSD test indicated that the mean score for Others ( $M = 3.39, SD = 1.28$ ), was significantly different than that of Republicans ( $M = 3.93, SD = 1.35$ ), but not significantly different than Democrats ( $M = 3.61, SD = 1.36$ ). In sum, participants who identified as Republicans found the content to be more pleasant than participants who identified as Others. Political affiliation was also significant in relation to willingness to take action,  $F(2, 219) = 7.14, p \leq .001, \eta^2_p = .061$ . Post hoc test statistics,  $F(2, 223) = 40.54, p < .001$ , revealed significant

differences between ideologies. Democrats ( $M = 3.54$ ,  $SD = .762$ ) were more willing to take action to thwart the effects of climate change than Republicans ( $M = 2.57$ ,  $SD = .067$ ).

Gender also produced significant univariate results for focus, credibility and likelihood to share the news story on social media. Focus was significant,  $F(1, 219) = 6.50$ ,  $p = .011$ ,  $\eta^2_p = .029$ . A t-test,  $t(224) = -3.59$ ,  $p < .001$ , found women ( $M = 5.29$ ,  $SD = .898$ ) found it easier to focus on the story content than men ( $M = 4.76$ ,  $SD = 1.06$ ).

Credibility was also significant,  $F(1, 219) = 8.19$ ,  $p = .005$ ,  $\eta^2_p = .036$ . A t-test,  $t(224) = -3.85$ ,  $p < .001$ ,  $d = .51$  identified that women ( $M = 5.50$ ,  $SD = .829$ ) found the story to be more credible than men did ( $M = 4.98$ ,  $SD = 1.08$ ).

The first behavioral intention measure, participants' likelihood to share the story on social media, was also significant within the gender condition,  $F(1, 219) = 4.795$ ,  $p = .027$ ,  $\eta^2_p = .022$ . A t-test,  $t(224) = -2.87$ ,  $p = .005$ ,  $d = .38$  revealed women ( $M = 5.29$ ,  $SD = 2.74$ ) to be more likely to share the story than men ( $M = 4.05$ ,  $SD = 3.06$ ).

Table 7.5  
Results for gender and political affiliation on cognitive appraisals and behavioral intention.

Dependent Variable	Mean (SD)		F	$\eta^2_p$
	Male (n = 57)	Female (n = 169)		
<b>Gender</b>				
<b>Cognitive Appraisals</b>				
Focus	4.76 (1.06)	5.29 (.898)	6.50*	.029
Credibility	4.97 (1.08)	5.50 (.829)	8.19**	.036
Effort & Power	3.43 (1.15)	3.58 (1.09)	.362	.002
Predictability	5.44 (.885)	5.65 (.831)	1.24	.006
Pleasant	4.08 (1.32)	3.88 (1.37)	.042	.000
Autonomy	4.47 (1.73)	4.50 (1.51)	.037	.000
<b>Behavioral Intentions</b>				
Likelihood to share	4.05 (3.06)	5.29 (2.74)	4.79*	.022
Willingness to act	2.86 (.893)	3.09 (.823)	.184	.008



	Political Affiliation				
	Dem. ( <i>n</i> = 65)	Other ( <i>n</i> = 59)	Rep. ( <i>n</i> = 102)		
<b>Cognitive Appraisals</b>					
Focus	5.52 (.943)	5.15 (.899)	5.16 (.968)	2.19	.020
Credibility	5.64 (.838)	5.43 (.759)	5.16 (1.02)	.861	.008
Effort & Power	3.43 (1.14)	3.42 (1.01)	3.69 (1.14)	4.18*	.037
Predictability	5.82 (.911)	5.67 (.748)	5.40 (.824)	.144	.001
Pleasant	3.61 (1.36)	3.39 (1.28)	3.93 (1.35)	3.70*	.033
Autonomy	4.68 (1.58)	4.31 (1.60)	4.48 (1.53)	1.69	.015
<b>Behavioral Intentions</b>					
Likelihood to share	5.69 (2.82)	5.12 (2.98)	4.44 (2.74)	1.85	.017
Willingness to act	3.54 (.762)	3.29 (.777)	2.57 (.672)	7.14*	.061

*Note:* \*  $p < .05$ , \*\*  $p < .01$

## **Chapter 8: Discussion**

The goal of this dissertation is to advance the understanding of anthropomorphic language and alternative story formats as tools and concepts journalists can employ to help convey the climate change crisis more effectively to the public. The results suggest the relationship between anthropomorphic language and story formats and journalism is multifaceted and complex. And, while not all hypotheses were supported in this study, the data did reveal a number of interesting elements.

This chapter will begin with a review of the problem presented in this study. Following the introductory review, the main findings will be discussed in a theoretical context. Next, limitations and future research directions will be addressed. Finally, this chapter will conclude with an overview of key findings and a discussion regarding the value and contribution of this dissertation.

### **Problem Review**

While climate scientists share a near consensus on the reality and causality of climate change, there are segments within scholarship, politics, and citizenship that deny or contest the existence and catalysts of the climate crisis. The controversial and somewhat contested nature of climate change makes covering it via traditional journalistic approaches a difficult endeavor. However, despite these difficulties journalists play a critical role in the climate change conversation. As an institution, news media remain the predominant source for the public's exposure to and understanding of both general environmental issues, as well as more specific concerns such as the global climate crisis (Wilson, 2000; Boykoff & Boykoff, 2007; Hansen, 2010; Moser, 2010).

However, despite the importance of their role, journalists still struggle to tell story of climate change in an effective and meaningful way (Moser, 2010; Cox, 2013; Boykoff & Boykoff, 2007; Hansen, 2010). Complexity and lack of visibility are key issues that contribute to the difficulty of conveying the climate change story (Hansen, 2010; Boykoff 2008). Additionally, while climate science is sound, there are many aspects of the climate crisis that remain uncertain, which leads to continued denialism and misconceptions among the public (Moser, 2010; Boykoff, 2008). In addition, the news media's own values and norms can also function as a hurdle to overcome when addressing climate change. Often objectivity and "balancing" norms can lead to misrepresentation of the crisis (Oreskes, 2004; Hansen, 2010; Boykoff & Boykoff, 2007), and selective "framing" can act to politicize environmental issues, such as the climate change crisis (Cox, 2013; Belkin, 1987).

Uncertainty and disruption in the media landscape have also added new obstacles to the path of effective climate change communication. The shift to the digital edge changed the communication process distinctly by eroding the lines of professional news production and fostering an on-demand media marketplace (Singer, 2011; Picard, 2010). Additionally, postmodern idealism has promoted an erosion of professional authority for journalists, which makes their claims to credibility more difficult and provides further support for denial of the stories they forward regarding controversial social issues, like climate change. In conjunction, today's citizens have nearly unlimited media choices, which has allowed them to insulate themselves and their beliefs, often ignoring content that conflicts with their predisposition or pre-existing beliefs (Lowrey & Gade, 2011; Picard, 2010).

Through the process of adapting to social and professional changes, new opportunities have emerged in the news industry that could provide journalists with new ways to approach climate change coverage.

Innovation in the area of storytelling capability and technique may provide a means to advance the clarity of the climate change narrative (Quinn, 2007; Ma et al, 2012; Pfeifer, Groeppel-Klein, & Helfgen, 2013). One such approach, alternative or non-linear story formatting, may offer a means for news consumers to better understand and more positively appraise the concepts associated with the global climate crisis. In addition, previous research also indicates that the employ of certain types literary devices, like anthropomorphism, may also help to bridge communication barriers to public comprehension of complex and controversial topics, like climate change (Nan et al, 2006).

To test the extent to which story format and language can impact audience responses to climate change news coverage, this study utilized a 2x2 between subjects experimental design. This study tested the effects of format and language on three dependent variables, attitude toward climate change, attitude toward associated content, and information retention. In addition, this study also advanced a number of research questions that addresses behavioral intentions, cognitive assessments of the story content, and demographics.

## **Findings**

**Retention.** As hypothesized, and in support of previous findings (Quinn, 2007; Ma et al, 2012), both main effects (language and format), and the contrast condition

(alternative format with anthropomorphic language v. traditional format without anthropomorphic language) were significant in relation to information retention.

This is an important finding as it can advance one of the biggest hurdles faced in the area of public communication of the climate crisis—understanding and comprehension of the issue itself (Moser, 2010; Boykoff & Boykoff, 2007). And, while retention and comprehension are distinctly different cognitive processes, they often occur simultaneously and operate symbiotically (Goldentouch, 2015). For example, retaining a mathematical formula is a retention exercise, while applying that formula to a problem is a comprehension application.

According to the revised Bloom’s Taxonomy, restructured in the early 1990s, there are six levels of learning and application ranked in a hierarchal structure (Krathwohl, 2002). The base, or foundation, of the model is “remembering.” The base from which the five other learning levels are achieved, “remembering” is defined as the ability to retrieve, recognize, and recall relevant knowledge from memory (Krathwohl, 2002). Without this ability, “learners” will struggle to advance through the higher levels of the model, which include: understanding, applying, analyzing, evaluating, and creating (Noble, 2004). Thus, retention is a critical foundation to building a more comprehensive public understanding of the climate crisis.

This finding is also especially relevant to the normative constructs of journalism. According to Kovach and Rosenstiel (2001) the “primary purpose of journalism is to provide citizens with the information they need to be free and self-governing” (p. 12). This basic notion is reiterated in the social responsibility theory of the press, which states, as two of its six pillars, that the press should engage in the following tasks:

“servicing the political system by providing information, discussion, and debate on public affairs,” and “enlightening the public so as to make it capable of self-government” (Peterson, 1956, p. 74).

Based on the basic values and ideals of journalism as a profession, it is critical that the press find ways to further the public’s knowledge and understanding of important social issues, such as climate change. Thus, if retention can be improved through the use of story format and language, by employing them as tools, journalists have an opportunity to help people make better choices and decisions associated with the climate crisis, which in turn fulfills journalists’ moral and professional obligation to the truth.

**Attitude toward climate change.** The second primary dependent variable, attitude toward climate change, produced marginally significant results for both the language and the contrast condition, indicating that further research is needed. However, format did not prove significant in this regard.

These findings largely move in the direction of existing literature. While no studies have reviewed attitudinal outcomes associated specifically to exposure of non-linear news narratives, ample support has been found for anthropomorphism as a tool to increase positive attitudes toward topics, brands, and concepts (see Delbaere, McQuarrie, & Phillips, 2011; Butterfield, Hill, & Lord, 2012; Pfeifer, Groeppel-Klein, & Helfgen, 2013; Nan et al, 2006; Nowak & Rauh, 2005).

This study found marginal significance that anthropomorphic language fosters more positive attitudes toward climate change, again, indicating further study is warranted. This fits with previous research that suggests anthropomorphized non-human

agents become more relevant to subjects, because they are more likely to associate with language that places the animals within the context of human experience. In other words, anthropomorphism made the plight of the animal agents in these stories more relevant to the human experience. This concept is a well-established motivation behind why humans anthropomorphize non-human entities (Epley, Waytz, Akalis, & Cacioppo, 2008; Epley, Waytz, & Cacioppo, 2007; White, 1959).

In addition, anthropomorphism is motivated by three key psychological determinants, elicited agent knowledge, effectance motivation, and sociality motivation (Epley, Waytz, & Cacioppo, 2007). While each of these elements is a distinct practice, they all draw upon the idea of increasing familiarity to the human condition as a means to foster understanding and social inclusivity (Epley, Waytz, & Cacioppo, 2007). In sum, anthropomorphized agents, like Nora and Charlie, are more likely to be considered part of the human grouping in comparison to the non-anthropomorphized polar bear characters. Group identity research has established such associations are significant in relation to attitudinal assessment of content. Previous research has found in-group and out-group associations can shape both subsequent attitudes toward topics and related behavioral outcomes (Gaertner & Dovidio, 2000; Korchmaros, & Kenny, 2001; Mullen, Brown, & Smith, 1992).

The use of anthropomorphic language may have also allowed participants to experience increased identification with the anthropomorphized animal characters in the news stories. The concept of identification has deep roots in psychological concepts that parallel the elements of group association and identity (see Freud, 1970/1940; Wollheim, 1974; Erikson, 1968; Mead, 1934). Identification occurs when individuals

“identify” with “characters” in narratives, thus increasing relevance to themselves and/or their condition (Cohen, 2001). As such, the use of anthropomorphic language may have increased the ability for participants to identify with the animal agents, Nora and Charlie. However, since identification was not specifically measured in this experiment, it would be beneficial for future studies to directly explore the relationship between anthropomorphized entities and audience identification in news content.

Based on the marginal significance found for attitude toward climate change, this study cannot definitively claim full support for hypotheses H1b, which stated stories containing anthropomorphic language would produce more positive attitudes toward climate change, and H3b, which contended stories using anthropomorphic language and alternative formatting would produce more positive attitudes. However, the marginal support may be a product of research design and sample size.

Effect size refers to indices that measure the magnitude of a treatment effects (Lipsey & Wilson, 1993). Put more simply, effect size is the capacity of difference between two groups (Tabachnick & Fidell, 2007). According to Cohen (1969), effect sizes can be generally interpreted as follows: .2 is small, .5 is medium, and .8 is large. Relative to effect size is statistical power, or the likelihood that a study will detect significance if it is present (Ellis, 2010). Statistical power is affected by sample size relative to effect size (Ellis, 2010).

The effect sizes for both the language (.009) and the contrast condition (.02) in this study would be considered small. The size of the effects, coupled with the near significance of these findings, suggests this study may have been underpowered. Thus, exposure to the same stimulus in real world conditions, where many more people would



be exposed to the news content, may produce significant results. Additionally, given that the means were in the hypothesized direction, and considering the fact that the framing treatments in this study were purposely subtle as to mimic the reality of news writing, one could make the argument that the data support the logic of the hypotheses and would likely be supported in future studies on similar concepts.

In sum, these findings warrant serious consideration. The ability to employ language and digital tools to foster more positive attitudes toward highly politicized and controversial issues, like climate change, could prove beneficial to journalists in their attempts to communicate important social topics.

**Attitude toward associated content.** The third primary dependent variable in this study, attitude toward associated content, such as conservation and general animal welfare, failed to produce significant results for any of the three conditions (language, format, or contrast). While no previous research in this area has been conducted in relation to the use of non-linear narratives, a prior study did find significance between the use of anthropomorphized language and attitude toward associated content.

Butterfield, Hill, and Lord (2012) found messages containing anthropomorphic language not only increased participants' beneficence toward anthropomorphized entities, but also encouraged more pro-animal behaviors such as increased support for animal welfare, advocacy, and veganism. Much like the current study, Butterfield, Hill, and Lord (2012) also had a population composed of primarily female participants, however, despite the similarities in both sample characteristics and experimental design, their findings were not replicated here.

As noted in the previous discussion regarding attitude toward climate change, anthropomorphism can arouse inferences of group membership or inclusivity, as well as offer opportunities for increased character identification and association (Waytz et al, 2010; Gray, Gray, & Wegner, 2007; Ahn, Kim, & Aggarwal, 2013; Cohen, 2001, 2008), however those effects tend to be subtle. Thus, while participants may have had increased levels of group inclusivity or character identification with the anthropomorphized agents in the news stories, those associations may not have been strong enough to establish transference of “care” or “regard” to other similar beings.

Essentially, the relationship between anthropomorphic language and participants’ attitude toward associated content is an area of study that could benefit from further examination.

**Behavioral intentions.** Research Questions 1 and 2 addressed this study’s two behavioral intention measures: participants’ likelihood to share the story they read via social media and their willingness to take action to thwart the effects of climate change. In both instances statistical analysis failed to find significance for any of the three primary conditions (language, format, and contrast).

**Cognitive appraisals.** Research Question 3 addressed participants’ cognitive appraisals of the content based on the three primary conditions (language, format, and contrast). The cognitive appraisals used in this research were developed by Dillard, Kinney, and Cruz (1996), and were designed to measure distinct areas of cognition. Scale analysis for this research categorized the 23 statements into to six distinct factors, or subscales: (1) Focus; (2) Credibility; (3) Effort & Power; (4) Predictability; (5) Pleasant; (6) Autonomy.

While no significant differences were found between any conditions, the data still yielded interesting aspects. A lack of significant findings in this area hints at excellent avenues for future research. This is particularly relevant to the concept of credibility. In a time when institutional control is limited and professional boundaries are eroding (Gade, 2011; Singer, 2011), journalists need to be able to tell stories that differentiate them from “citizen” reporters, advocacy groups, think tanks, and political and ideological “media” presentations. A lack of significant findings on the credibility subscale suggests that participants did not infer a difference in the article’s credibility based on format or language, which is itself a meaningful discovery. More research should be conducted to build off this preliminary finding.

**Gender and political affiliation.** The final two research questions (4 and 5) explored gender and political affiliation in relation to the three primary dependent variables, the two behavioral intention measures, and the cognitive appraisals. Religion and ethnicity were not included because the sample was largely Caucasian and Christian, eliminating the ability for statistical analysis.

In the gender condition, women were found to have significantly more positive attitudes toward climate change than men. This largely follows prior research, which has consistently identified that women, in general, hold more positive attitudes toward climate change than men do (McCright, 2010; McCright & Dunlap, 2011). Current Pew research also shows women more firmly believe in the existence and potential impact of climate change (Zainulbhai, 2015). The findings from this research question offer further support for existing literature in this area.

Both the gender and political affiliation conditions were significant for attitude toward associated content. In the gender condition, women held more positive attitudes toward associated content, such as conservation and animal welfare, than men did. This finding has also been established. A number of scholarly works reveal women are more likely than men to hold and exhibit concerns regarding animal welfare (Driscoll, 1992; Herzog, Betchart, & Pittman, 1991; Kellert, 1996). Women are also more likely to support animal rights campaigns (Peek, Bell, & Dunham, 1996). Again, this finding serves as added support for an established relationship.

The political affiliation condition also produced significant findings for attitude toward associated content. In brief, individuals who identified as Democrats or Others reported more positive attitudes toward associated content than those who identified as Republicans. While there is limited research in the area of U.S. political ideology and animal welfare and conservation (see Garner, 2002; Heleski, Mertig, & Zanella, 2004), previous studies find Democrats are more likely to support an environmentally beneficial agenda than Republicans (Funk & Kennedy, 2015; Guber, 2001). Thus, this finding supports prior work in this area.

Gender and political ideology were not significant in relation to retention. However, the study's broader findings that both language and format increase retention are further reinforced by these findings, which reveal no significant differences by gender and ideology on retention

In terms of behavioral intentions, gender had a significant impact on likelihood to share the story, with women being more likely than men. Previous research in the area of gender and social media use confirms these findings (Lee & Ma, 2012),

especially in relation to the sharing of news content on social media platforms (Hermida, Fletcher, Korell, & Logan, 2012).

In regard to political ideology, there were significant differences between each party grouping. Democrats were more willing to take action to thwart the effects of climate change than both Others and Republicans. Others were also more willing to take action than Republicans. However, starkest contrast was between Democrats and Republicans. This finding supports a consistent partisan trend that finds Democrats show consistently higher levels of willingness to engage in environmental action. Similar to questions posed in this study's willingness to take action scale, prior research has found Democrats are more willing to pay higher prices on items that protect the environment (Pew Research Center, 2009), join environmental groups (Carter, 2001), and drive "eco-friendly" cars (Berk, 2012).

Gender and political affiliation found significance on two of the cognitive appraisal subscales as well. Both "Focus" and "Credibility" were significant in the gender condition. Women found it easier to focus on the story content than men did, while at the same time women also appraised the story as more credible than men. These findings suggest, as they relate to earlier findings, that some subscales may be mediated by gender. Previous research in the area of gender and news source credibility has produced mixed results. Cassidy (2007) found gender was not a significant predictor of source credibility for online news content, while Johnson and Kaye (1998) found gender to be a highly significant in association to perceptions of news content in online spaces. As such, this relationship would benefit from further analysis.

In an interesting finding, political affiliation was significant on one subscale—“Pleasant.” There was no significant difference between Republicans and Democrats in regard to the perceived “pleasantness” of the news story. However, Republicans did find the story more pleasing than those who identified as Others. While Republicans did find the story to be more pleasing, the more positive appraisal of the content did not translate to increased positivity in attitude or willingness to engage in a behavior.

### **Limitations & Future Research**

While experimental studies offer excellent internal validity, achieving similar external validity can be a challenge (Wimmer & Dominick, 2011). In this experimental design, steps were taken to balance internal and external validity to offer the best possible approach to evaluation of news content outside its natural environment. While the design was viable given it did find significance in some areas, the subtlety of the treatments can be viewed as limitations.

The intention of this research was to keep the content as close to actual news coverage as possible. The formatting of the story followed a typical feature news approach that combined elements of literary storytelling such as narrative form and character development with journalistic conventions like objectivity, reliance on factual material, and, in the traditional format, a hierarchical ordering of information. Additionally, in regard to formatting, participants were limited to staying on the story page provided; they did not have the opportunity to navigate through an interactive website or utilize hyperlinks like most news stories now contain.

The language was also adjusted to fit journalistic style and expectations. Thus, the language used was more limited than in other types of anthropomorphic research such as advertising or persuasive public communication.

In sum, the manipulations used in this study stayed true to journalistic form, which increased external validity, however as such, they were more subtle than similar treatments used in previous research in this area.

This study also has limitation in regard to generalizability. First, the sample was not randomly chosen, and was composed almost exclusively of undergraduate college students, who all had similar ages. In addition to age, other demographic categories, such as gender (74.8 percent female), race (73 percent Caucasian), and religion (75.7 percent Christian), were also highly homogeneous. And, finally, despite the utilization of an a priori power analysis, the sample size could be viewed as a limitation as well. A number of effects sizes found in this study were small (.01 to .06) (Cohen, 1969), which could hint at the possibility that this study was underpowered due to an insufficient *N* size and thus less sensitive to detecting significant results. While this may be somewhat anticipated given the subtle nature of the experimental treatments, it is nonetheless a limitation of this research.

The relationship between story format, language, and climate change coverage is relatively uncharted territory. While some studies exist that explore content and coverage of the crisis, the opportunities for future research in this area are ample. The findings from this dissertation are used as building blocks for the suggested future study directions outlined below.

Just as increased exposure to the content could impact the significance of some findings in this study, the incorporation of choice into the experimental design could also have an impact on both outcomes and applications of this research. According to Ostrom (1998) “general fit models” of experimental design may not work for all disciplines or research topics. While there are a number of theoretical underpinnings related to increasing choice in experimental design, the central concept is based on the idea that participants draw from their own values and lived experiences to form responses to stimuli (Ostrom, 1998; Tversky, & Kahneman, 1986). Thus, incorporating choice into a design could not only increase external validity, but also provide better analysis of attitudinal and behavioral outcomes within a variety of conditions and settings (Plott, 1979; Smith, 1982).

The incorporation of choice into experimental designs studying navigation of news content has already produced interesting results. Borrowing from medical research models known as “patient preference designs” (Torgerson & Sibbald 1998), political scientists Arceneaux and Johnson (2013) created a choice-based political news content experiment that asked participants which treatment they preferred before randomly assigning them to a condition. While some of their findings follow previous research, such as participants were more likely to choose the treatment that aligned with their existing political beliefs, subsequent outcomes from the study were unique. In part, the duo found that exposure to crosscutting political beliefs decreased retention of information and that participants who identified as “entertainment-seekers” were more likely to retain information from counter perspectives than participants who identified as “information-seekers” (Arceneaux & Johnson, 2013).



Incorporating choice to experimental research in the area of climate change coverage could prove to be especially relevant. Increased choice could be utilized to advance the current study by allowing participants to have increased autonomy over story navigation by creating an interactive web-based platform through which the stimulus could be delivered. Such a study could offer valuable insights into how news consumers approach climate change content. For example, such research could examine where consumers go on an interactive site, what paths they take to get there, how long they stay on certain topics, and which content areas they avoid. Additionally, such a study would better reflect the multi-media nature of real-world news delivery systems where consumers have choices and options in terms of how they peruse content.

It is widely acknowledged that media coverage is selective (McCombs & Shaw, 1972), and that the news media are the main source of knowledge regarding events and issues, especially those within the scientific realm that most people cannot experience firsthand (Lowery & DeFleur, 1988; Boykoff & Boykoff, 2007). Selective coverage is the tool for salience transference between the media and the audience; in other words, agenda setting posits that the media may not tell people what to think, but it can tell people what to think about (McCombs & Shaw, 1972). McCombs and Shaw (as cited in Lowery & DeFleur, 1988) also concluded there was a distinct sequence of effects in regard to media exposure:

First, the media provoked among its audiences an awareness of the issues. Second, it provided a body of information to the members of that audience. Third, this information provided the basis for attitude formation or change on the part of those who acquired it. And fourth, the attitudes shaped behavior among those involved in the sequence. (p. 275)

Thus, applying these understandings to climate change communication could advance the research in this area in a number of ways. A content analysis of news content could begin to identify find what issues are currently on the “climate agenda.” Through the theoretical approach of agenda setting future research could look at how environmental and climate issues are framed, who the primary sources are, and what languages and formats are currently employed in climate change news content. Such insights could provide the foundational concepts needed to create treatments and stimulus that more clearly mirror real world news coverage of the climate crisis. And, in line with agenda-setting research, explore the extent to which the media’s agenda is transferred to the public’s understanding of the issue. In addition, such studies could offer insight into how news media could formulate better stories, which, in turn, could help overcome what Moser (2010) has identified as a significant hurdle to climate change coverage—a lack of clear and unified directives for citizens to follow.

A second avenue of exploration that also builds off this study’s retention findings is the relationship between retention and comprehension. As previously discussed, while retention is needed for comprehension the two concepts are distinctly different (Goldentouch, 2015). Future studies could re-examine the relationships found here between language, format and increased retention in relation to comprehension. Research in this area could extend the current findings and further test the relationships asserted in Bloom’s Taxonomy.

The exploration of comprehension could be enhanced through increased attention toward the theoretical understandings of narrative form and function (see Gerrig, 1993; Green & Brock, 2000, 2002; Green et al, 2008). Narrative form as it

applies to increased comprehension could be especially useful if examined in conjunction with participants' mental constructions, or situation-model evaluations, of the content (see Zwaan, & Radvansky, 1998; Bos et al, 2015; Zwaan, Langston, & Graesser, 1995). The application of standard comprehension measures such as Reading Comprehension Tasks (RCTs) administered after stimulus exposure could prove useful, as well (Foroughi, Werner, Barragan, & Boehm-Davis, 2015).

In addition, measuring eye movements during reading has been shown to be one of “the most precise methods for measuring moment-by-moment (online) processing demands during text comprehension” (Raney, Campbell, & Bovee, 2014, p. 1). Thus, the employ of eye-tracking software could be highly useful for further research in this area.

Some approaches rooted in social psychology could also offer excellent avenues to advance this research; two in particular are the concept of anticipatory guilt and Crano's (1983) vested interest theory.

Currently, there is a growing area of study regarding anticipatory guilt as a mechanism for facilitating pro-social behavior (Ahn, Kim, & Aggarwal, 2013; Baumeister, Vohs, DeWall, & Zhang, 2007). In brief, this theoretical approach states an individual is more likely to engage in a pro-social behavior if they anticipate they may feel guilty for not helping another person or symbolic “entity” that is familiar to one's conception of self (i.e., an anthropomorphized agent) (Ahn, Kim, & Aggarwal, 2013).

To date these concepts have only been studied in conjunction with public advocacy campaigns. It could be insightful to explore if news stories induce similar attitudinal and behavioral outcomes associated with anticipatory guilt. A starting point

would be to examine if the nature of the relationship between the individual and an anthropomorphized entity in news content could potentially moderate the effects of anthropomorphism on positive appraisals of certain environmental news articles.

Vested interest theory could also provide valuable insight into audience assessment of news content as well as subsequent behavioral intentions. In brief, vested interest theory is based on the idea that attitude moderates behavior. According to Crano (1995), the level of “vestedness” an individual has toward an object or idea is a direct function of how hedonically relevant it is to the beholder. In essence, if something has important personal consequences for an individual that individual will be highly vested in that object or issue. There are five key facets that contribute to an individuals’ level of vested interest: stake, salience, certainty, immediacy, and self-efficacy (Crano, 1983).

Exploring how language and format could interact or serve to emphasize or diminish the components of vested interested would be an excellent option for future research. Additionally, examining how hyper-local or regional specific models of journalism could be used in conjunction with format and language to increase an individual’s vested interest in the climate change narrative could also be insightful.

Finally, in the course of writing this dissertation, it became apparent that not only audience assessment of story forms and language should be addressed; environmental journalists themselves are a highly valuable piece of this puzzle. The last survey of environmental journalists was published nearly a decade ago (Sachsman, Simon, & Valenti, 2008). Since that study was published, the digital age has had a profound impact on journalism and journalist’s work, providing many more tools (Singer, 2011; Lowrey & Gade, 2011), access to scientific research, information and

government reports (Friedman, 1991, 2004). As such, the ways that environmental journalists approach their work in the digital age has likely changed, both as the digital media have changed journalism and the issues have become more politicized in a more socially fragmented and polarized environment. Thus, it would be highly beneficial to re-examine environmental journalists' perspectives of content, production, and dissemination, especially into today's more digitally driven news industry.

Such future research should also explore how environmental journalists utilize their time, what sources they turn to most often, what constraints they perceive exist, both internal and external to the narrative, and what professional pressures they feel are specific to reporting on environmental content. Such research should also look at the data in a comparative sense to form a more comprehensive picture of the evolution environmental reporting, in essence what has changed, improved, or worsened in the decade since the last survey was conducted. In direct relation to the current research, it would be valuable to learn what forms and devices environmental reporters are currently employing in their work, as well as their opinions or anthropomorphized story content and non-linear narrative form.

## **Conclusion**

The goal of this study was to examine how language and story format affect individual perceptions and retention of climate change news content. While some of the hypotheses in this study went unsupported, important findings did emerge that highlight the value that language use and story formatting can bring to news coverage of the climate change crisis.

This research found both language and format to be significant predictors of increased information retention. This finding begins to chip away at a primary obstacle inherent in climate change story—public comprehension (Moser, 2010). Retention of information is needed for comprehension to occur, thus it is critical that journalists seek ways to assist in this process. This finding also adds to an area of knowledge regarding digital storytelling that is only beginning to be explored in contemporary research.

Partial support for more positive attitudes toward climate change was also found in the language and contrast condition, which was constructed as anthropomorphic language and with alternative story formatting. While, only nearing significance, these findings offer an excellent platform from which to launch future research. Additionally, these findings supply an inlet into an area where little to no previous research has explored the relationship between anthropomorphic language and news content, and even more specifically the relationship between such language and news content regarding environmental or climate issues.

Analysis of relationships between demographic data and outcomes also yielded interesting findings and viable avenues for future exploration. Most notably gender produced interesting outcomes for both behavioral intentions and credibility assessments of online news content. Both of these findings support previous works, but they add to the understanding of climate change news coverage specifically; an area where research is limited regarding such relationships. Similarly, while the findings associated with political affiliation also tend to follow previous outcomes, they aid the understanding of the relationship between ideological identity and citizens' processing of news content.

In sum, this dissertation provides some evidence for how journalists might use literary tools, such as anthropomorphic language, and emerging digital functionalities to more effectively communicate important and controversial social issues such as climate change. Additionally, this study supports the need for continued research in the area of story forms and language, especially in relation to climate change news coverage.

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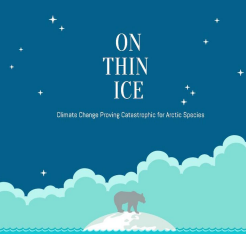


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# Appendix A: Stimulus: Alternative v. Traditional Story Formats

## ON THIN ICE

Climate Change Proving Catastrophic for Arctic Species



"This is a do or die moment. If we want to save this species, global action needs to begin now."

—David Douglas, U.S. Geological Survey Researcher

**ALASKA** — Through the long, dark Arctic winter, Nora sat quietly in her den. She had waited long enough. It was time to go out to find food. For Nora and Charlie, the ice pack that kept them warm and safe was melting. The snows of the Earth's northern pole were melting faster than ever before. The ice was thinning, and Nora and Charlie were in danger. They had to find food, and they had to find it fast.

After months of waiting, Nora leaves her den. Weak and starving, she ambles out, her tiny cub, Charlie, toddling close by her side. She's much thinner than a few months ago; there's not a moment to lose, she needs to find food now. Nora and Charlie will need to swim to the edge of the ice cap to hunt for food, and although Nora's a good swimmer, a hungry and weak mama bear can only go so far.

Together Nora and Charlie cautiously head for the water's edge. But, Nora senses something isn't right. The ice feels more unstable with each step. Suddenly, a small noise emerges from beneath Nora's massive paws, then a large snap echoes through the frigid landscape. As if in slow motion, the ice cracks beneath her and Charlie's small bodies plunging into the Arctic water. Surprised and scared, the startled baby starts swimming toward the nearest piece of ice. Charlie struggles time and again to cling to floating ice blocks, only to fall back on the icy water moments later. After a long struggle, the exhausted baby begins drifting away into open water, moving farther and farther until he is no longer visible.

Nora watches her precious child helplessly from her precarious perch on the main ice. She is too weak to help him. When he drifts completely out of sight, Nora sits staring into the still water, waiting and watching, watching and waiting, but Charlie never re-emerges.

More than two-thirds of the world's polar bears will be killed off by 2050 — the species is rapidly going from stable to because of thinning sea ice from global warming that the Arctic government scientists forecast.

—National Geographic

According to experts, stories like Nora's are becoming commonplace in the Arctic. Air temperatures at the top of the world are rising twice as fast as temperatures at lower latitudes, resulting in significant ice loss.

On Monday, the National Oceanic and Atmospheric Administration (NOAA) released its most recent Arctic analysis, which states as of January 2017, total Arctic sea ice cover is at its lowest level since satellite records began in 1978.

**Current Temperatures 97%**

According to the NOAA report, under the effects of global warming, this week's temperatures are nearly 20 degrees higher than the average January average.

97% have seen an increase in temperature in the last 100 years.

**GLOBAL WARMING**

According to NOAA scientists and climate experts, human-induced global warming is the main cause of the greenhouse effect. Burning the Earth's resources produces a waste of energy into the atmosphere, which traps Earth's heat, making it a runaway greenhouse effect. Global warming is the result of the greenhouse effect, which causes energy to be trapped on Earth more quickly, so that the Earth's temperature rises more quickly.

We're quite confident that without action to address climate change, there will be a very significant reduction in the range of polar bears.

—According to the U.S. Fish and Wildlife Service, the Canadian Wildlife Service, and the U.S. Environmental Protection Agency to take action.

"The plight of the bears face due to climate change is really heartbreaking," Carl Anderson, executive director of U.S. Wildlife Services, said. "Every March, mother bears and their cubs swim from inland locations to the edge of the polar ice cap to find food. Normally, this is a short swim, however in recent years, the polar cap has really shrunk in size due to melt-down from global warming. This means the ice is becoming more and more unstable and the distances bears must swim for food is increasing with each season. Unfortunately, this is a daily combination for the bears and their cubs, many are dying due to drowning and starvation."

According to U.S. Wildlife Services, there are only an estimated 28,000 polar bears, like Nora, left in the world. The most population decline has prompted a number of organizations such as the U.S. Fish and Wildlife Service, the Canadian Wildlife Service, and the U.S. Environmental Protection Agency to take action.

"We're quite confident that without action to address climate change, there will be a very significant reduction in the range of polar bears," said Michael Runge, a U.S. Geological Survey research ecologist, and co-chairman of the U.S. Fish and Wildlife Service's Polar Bear Recovery Team.

**"This is a do or die moment. If we want to save this species, global action needs to begin now."**

According to the NOAA report, under the effects of global warming, this year Arctic regions recorded temperatures nearly 20 degrees higher than the typical January average. David Douglas, another USGS researcher, said with these rising temperatures the outlook is grim for polar bears if international governments do nothing to address climate change.

"This is a do or die moment," he said. "If we want to save this species, global action needs to begin now."

Savage Wolf, climate science director for the Center for Biological Diversity, shared Douglas's sentiments, and said without an aggressive call to address climate change any salvation plan for Nora and her counterparts would be foolhardy.

"This is a critical time for polar bears," she said. "A recovery plan can work, but only if it truly addresses the main threat to the species, and that threat is climate change."

According to NASA scientists and climate experts, human-induced global warming is due to a process known as the greenhouse effect. Normally the Earth transforms sunlight's visible light energy into infrared light energy, which leaves Earth slowly because it is absorbed by greenhouse gases. However, since the industrial revolution, humans have continued to add exponentially to the production of greenhouse gases, which causes energy to leave Earth more slowly, in turn making the Earth's temperature more quickly. Current research finds 2017 is on pace to break all previous heat records, which will make this year the hottest ever recorded.


Sea ice stability is critically important for the survival of Arctic species because it provides the platform from which polar bears hunt, and it links communities of land animals such as foxes and walrus.

—All Lives Matter

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**80%** of the polar bear population will collapse due to the continuing loss to global temperatures and subsequent Arctic ice loss.

**Appendix B: Factor loadings based on an exploratory factor analysis with Promax rotation for the 12-item Attitude Toward Climate Post-test Scale (N = 226)**

Items	Factor Loadings	Communalities
Climate change is caused by human activity.	.873	.742
Future generations will be impacted by climate change.	.870	.729
I am worried about climate change.	.842	.715
Climate change will impact our environment in the coming decade.	.825	.663
I believe the climate is changing.	.823	.691
There is no verifiable evidence that climate change exists. (RC)	.738	.555
Nothing can be done to stop climate change. (RC)	.726	.567
People's lives are negatively affected by the changing climate.	.705	.539
I think concerns about climate change are inflated. (RC)	.704	.536
People's actions can help stop the effects of climate change.	.685	.518
The issue of climate change is too complex to comprehend. (RC)	.556	.399
There is evidence of climate change.	.525	.316

## Appendix C: Post-test Information Retention Questions

1. There is a \_\_\_\_ percent agreement among climate scientists that global warming is caused by human activity.  
**(A) 97**  
(B) 89  
(C) 50  
(D) 46
2. According to the Executive Director of U.S. Wildlife Services, the number of polar bears is declining due to \_\_\_\_\_ and \_\_\_\_\_.  
(A) hunting and disease  
**(B) starvation and drowning**  
(C) old age and infertility  
(D) radiation and hypothermia
3. Global warming is due to the \_\_\_\_\_ effect.  
(A) solar flare  
(B) greenland  
(C) arctic variable  
**(D) greenhouse**
4. This January temperatures in the Arctic were \_\_\_\_\_ degrees warmer than the usual January average.  
(A) 2  
(B) 5  
(C) 10  
**(D) 20**
5. Government scientists forecast by year \_\_\_\_\_ more than two-thirds of the polar bear population will be gone.  
(A) 2020  
(B) 2035  
**(C) 2050**  
(D) 2075
6. The Earth transforms sunlight's visible light energy into \_\_\_\_\_ energy.  
**(A) infrared light**  
(B) ultraviolet light  
(C) gamma ray  
(D) micro ray

**Appendix D: Factor loadings and communalities based on an exploratory factor analysis with Promax rotation for the 12-item Attitude Toward Climate Pre-test Scale (N = 226)**

Items	Factor Loadings	Communalities
I believe there is evidence of climate change.	.894	.823
Climate change will impact future generations.	.855	.735
I am concerned about climate change.	.850	.743
I believe our climate is changing.	.834	.738
I think concerns about the Earth's changing climate have been overstated. (RC)	.833	.729
Climate change will impact our environment in the next 10 years.	.815	.676
No evidence exists to verify climate change is really occurring. (RC)	.809	.697
Climate change has a negative effect on our lives.	.798	.646
Human activities cause global climate change.	.743	.582
The actions of individuals can make a positive difference in global climate change.	.689	.511
We cannot do anything to stop climate change. (RC)	.637	.463
Climate change is too complicated to understand. (RC)	.595	.420

## Appendix E: Behavioral Intention: Likelihood to Take Action

Instructions: Please let us know your level of willingness to take action regarding climate change.

Listed below are several examples of actions that could help to reduce global warming. Please use the rating scale to indicate how willing you would be to take the listed action to reduce global warming.

*To reduce global warming I am willing to:*

	Not likely	Somewhat not likely	Neutral	Somewhat likely	Very likely
Use reusable bags when grocery shopping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Purchase reusable water bottles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Carpool to work and/or school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Purchase an electric car	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Replace the light bulbs in my home with energy efficient fluorescent bulbs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pay a .50 cent surcharge on gasoline	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Keep my home air conditioner at 75 degrees in the summer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pay more for a car that is fuel efficient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduce the numbers of hours a week I use electronic devices (computer, phone, TV, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduce the amount of meat I consume	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>