

COMMUNICATING ABOUT CLIMATE SCIENCE USING SOCIAL MEDIA: EXPLORING  
DISCOURSE, INFORMATION SEEKING AND CLIMATE CHANGE KNOWLEDGE

by

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(Under the Direction of Alexa Lamm)

ABSTRACT

Social media provides platforms for users to engage in different conversations. Access to any internet-based communication tool is all it takes to share information on social media. Once information is shared people engage in various conversations on the topic or event. However, the extent to which conversations trend on social media can depend on the controversial nature of the topic. More controversial topics tend to obtain greater user engagement. Topics related to climate change are among the most trending topics discussed on social media. However, what triggers climate change conversations and why users share or engage with others about climate change is largely unknown. This study employed a mixed methods approach to determine current public attitudes towards climate change, factual climate knowledge, and internet connectivity habits to better understand where users are getting their climate information and how scientists can use influential social media

INDEX WORDS: climate change, Twitter, public engagement, argumentation theory, climate communication, information sources, information seeking behaviors, internet interactions, science communication, public engagement, climate knowledge.

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## TABLE OF CONTENTS

CHAPTER	Page
1 INTRODUCTION .....	1
Emergence Of Social Media .....	2
Social Media Platform Usage .....	3
Twitter As A Primary News Source .....	4
Climate Discussions On Social Media.....	5
Climate Change Knowledge And Pro-Environmental Behavior .....	6
Statement Of Problem.....	7
Purpose And Research Objectives .....	8
Definition Of Terms.....	9
Study Limitations.....	10
Assumptions.....	11
2 REVIEW OF LITERATURE .....	12
Media Dependency and Information Seeking Behaviors .....	12
Uses and Gratifications.....	14
Theory of Argumentation .....	16
The Current Knowledge Gap.....	17

3 ARGUING FOR ARGUMENT’S SAKE? EXPLORING PUBLIC CONVERSATIONS AROUND CLIMATE CHANGE ON TWITTER.....	19
Introduction.....	21
Theoretical Framework.....	24
Purpose and Research Objectives .....	27
Methods.....	27
Results.....	30
Discussion.....	48
Conclusions and Implications.....	50
4 DETERMINING HOW CHOSEN ONLINE CONNECTIONS AND INFORMATION SEEKING BEHAVIORS ON SOCIAL MEDIA INFLUENCE CLIMATE BELIEFS AND KNOWLEDGE.....	53
Abstract.....	54
Introduction.....	55
Conceptual Framework.....	59
Purpose and Objectives.....	62
Methods.....	62
Results.....	67
Discussion and Conclusions .....	73
Recommendations.....	76
5 DISCUSSION AND RECOMMENDATIONS.....	78
Interpretation of Findings .....	79

Point to Prove.....	79
Increases in Climate Knowledge .....	81
Social Media Connectivity and Influence.....	82
Recommendations.....	83
Conclusions.....	84
References.....	86

## LIST OF TABLES

Table 1.1 .....	30
Table 1.2 .....	33
Table 1.3 .....	34
Table 1.4 .....	37
Table 1.5 .....	39
Table 1.6 .....	43
Table 1.7 .....	45
Table 2.1 .....	66
Table 2.2 .....	68
Table 2.3 .....	68
Table 2.4 .....	69
Table 2.5 .....	70
Table 2.6 .....	70
Table 2.7 .....	70
Table 2.8 .....	71
Table 2.9 .....	72
Table 2.10 .....	73

## LIST OF FIGURES

	Page
Figure 1.1 .....	36

## CHAPTER 1

### INTRODUCTION

Mediated communication has been a one-way street historically, consigning those without experience, or nonspecialists, to a strict consumer only role (Sheridan et al., 2012). Rises in technology use and technological advancements have changed consumer roles in the flow of information. While formerly just a point-to-point medium, advancements in mobile technology and social media have supported the accessibility and sharing of information from both specialists and users without the required skills or qualifications about public affairs, current events and breaking news through data services (Campbell & Kwak, 2011). Mainstream media was once a primary focal point for information sharing but the attention has shifted to mobile devices and the internet (Treré, 2012), with the internet now the fastest communication technology diffuser on the planet (Campbell & Kwak, 2011). The internet, a primary source of information, also works as a connectivity highway. The “Internet of Things” is a concept that states that any device with an on and off switch that can connect to the internet or each other can be considered as a giant network of connected people or items with connections being categorized as device-to-device, person-to-device or person-to-person (Attaran, 2017). Technological advancements have led to new and creative ways for nonstandard communities to form and share information. According to a 2017 report by We Are Social and Hootsuite, half of the global population uses the internet with 3.75 billion people being online at any given time (Huseyinzade Simsek & Okray, 2018). The same report stated that two thirds of the world’s population has a smart phone (Huseyinzade Simsek & Okray, 2018). Increased technological use

coupled with changes in media trends promotes active interaction among users and democratization of knowledge sharing.

### **Emergence of Social Media**

Advancements in technology allowed a new form of community building to arise in the form of social media. Mobile communication creates dialogue by fostering the joint flow of interaction. These joint flows of interactions allowed for the creation of public forums where individuals were provided with new opportunities to connect with others who were previously deemed unreachable or absent (Campbell & Kwak, 2011). The shift from traditional news media was mirrored by shifts in communication and community formation because of social media emergence and formation. Social media can be defined as a set of internet applications that promote interactivity through the facilitation, curation, creation, and consumption of user-generated content (Schneider, 2012). New media is not simply a one way pipeline of standard content from a centralized location to unlinked individuals, rather, it has morphed into a web or network in which people and media are joined through hyperlinks (Sheridan et al., 2012).

Everyday interaction among audiences on social media allows for the creation of new public engagement structures that are no longer hindered by the need to procure organizational resources. Instead, organizations have been replaced by flexible issue networks where users with common interest form alliances that address local and global concerns (Skoric et al., 2016). Since there is no need for specific organizational resources, social media has become an easily accessible communication tool. Users can communicate through a variety of tools within one website including sending private messaging, linking to outside content, and sharing their own content (Gil de Zúñiga et al., 2012). The Pew Research Center (2016) determined that once users

were online, about 76% of the internet population across 40 countries used social networking sites such as Facebook or Twitter.

### **Social Media Platform Usage**

Changes in technology and the emergence of social media have allowed users to tailor social media platforms to fit their primary or preferred needs. The main motivations for using social networking sites includes establishing new relations, connecting with friends or socializing, getting information, debating, sharing, and consuming content or simply for fun (Brandtzæg & Heim, 2009). The interconnectivity obtained from social media use is a highly attractive pull for media consumers. Stutzman (2006) stated that shareability itself is why so many people engage on social media platforms. Social media works as a communication tool for transferring content by enabling users to intensify meaningful interactions with both online and offline contacts. This creates a network society in which users have the ability to communicate and organize freely (Castells, 2004). While these networking platforms were intended to simply be a new form of socialization, there has been a shift in the ways that the public uses them to communicate.

People use Twitter to reach broad networks when asking for information, opinions, and opportunities; motivated in part by the belief that these networks are more beneficial than a generic search engine inquiry (Davis & Jurgenson, 2014). Increased social media usage can create a new lane for scientific communication where public participation allows audiences to shape their own narratives and provide information for scientific discussion. This new mode of science communication can lead to better decisions by addressing both facts and personal values (Davis & Jurgenson, 2014). Using public participation on social media as a new form of scientific communication can also increase the public's trust in science. Trust and civic

engagement work as mutual reinforcers—those who trust their fellow citizens volunteer and participate more often in community activities (Skoric et al., 2016). Based on this reasoning, by increasing trust through communities that mirror the ideologies held by audiences, civic engagement and participation can be boosted.

### **Twitter as a Primary News Source**

Twitter is a microblogging service that began in early 2006 (Westerman et al., 2012). In the beginning, users were restricted to posts only containing 140 characters (this limit has recently been increased to 280 characters) forcing audiences to develop the tools needed to condense information into speedy shorthand messages. Twitter is one of the most frequently used social media applications for sharing news (Kwak et al., 2010) making it a perfect candidate for the publication of breaking scientific news.

While originally intended for networking and social connections, previous studies highlighted the fact that news makes up a primary portion of retweeted tweets causing researchers to conclude that Twitter may be classified as a news medium (Rudat & Buder, 2015). While considered a news medium, the lax restrictions on Twitter allow for the dissemination of information from point to point with minimal interruption. The platform is currently defined as an easily accessible information seeking medium considering tweets are unrestricted, available for public dissemination and allow for two-way communication (Westerman et al., 2014). The unrestricted information processes on Twitter also lends itself to questioning the credibility of information sources. Since many individuals have limited direct experience with some science communication topics, their scientific trust may be strongly influenced by messages containing fast thinking contextual cues instead of careful considerations (Dietz, 2013).

The content of news or rather its information value is the primary influence for audience's determination of whether news is "share worthy" (Rudat & Buder, 2015). While the content of a tweet itself impacts the determination of source credibility, audience demographics may also play a role. The way the author of a tweet frames or phrases their message may give different credibility impressions to audiences with different demographic backgrounds (Shariff et al., 2017). In addition, audience educational backgrounds, and even their geographic location, can have a significant impact on how they determine an author's credibility (Shariff et al., 2017). These differing sociodemographic traits all influence how readers view different news sources and represent the communicative challenges posed to science communicators.

Twitter feeds are also highly personalized which provides users with the ability to be selective in the news that they receive (Campbell & Kwak, 2011). A study done by Johnson, Bichard, and Zhang (2009) determined that blog and microblog users tended to avoid information that may challenge their personal points of view. These users may also only seek out information that supports their personal and political beliefs. While various traits pose a challenge to communicators, it is worth noting that regardless of background, tweets containing trending or breaking news are often deemed very credible by audiences (Shariff et al., 2017). Tweets from nonbiased news agencies and authors who audiences deem universally reputable are often accepted as trustworthy (Shariff et al., 2017) and previous research has determined that tweets with high informational value led to more audience interaction than those without (Rudat & Buder, 2015).

### **Climate Discussions on Social Media**

Recognition of climate change as a societal and political issue has made it one of the most discussed topics on social media (Pearce et al., 2014). While highly contested the lack of

scientific transparency along with a wealth of misinformation has shifted the focus away from climate change and mediation to arguments about whether it actually exists. Climate change deniers raise issues of scientific uncertainty as a conscious strategy to influence societal decision especially when audiences have had limited experience with a concept (Dietz, 2013). The large amount of climate information, with little interpretation, leads to an increased flow of information from various sources providing audiences with exposure to diverse and sometimes conflicting information about current scientific events (Kim & Dennis, 2019). In addition, personal values shape the interpretation of climate information being communicated causing audiences to quickly interpret information using their values and general beliefs as a guide (Yuan & Gao, 2016).

When Twitter users participate in climate discussions or search for climate news communication, the returned messages call on the readers themselves to discern whether the communicators are trustworthy climate information sources. For most people this causes them to view climate change as a surface-level problem that is quickly incorporated into cognition due to short cuts and contextual cues (Yaun & Gao, 2016). While traditional news media is overwhelmingly accepting of climate change and politicians are actively working toward climate mitigation policies, the community arguments on Twitter tell a different story. Pushing audiences to believe that there is scientific disagreement on the existence of climate change is strongly linked to audience rejection of policies needed to mitigate climate change and increase acceptable environmental behaviors (Dietz, 2013).

### **Climate Change Knowledge and Pro-Environmental Behavior**

In a previous study done by Skoric et al. (2016) researchers agreed that the use of social media has a significant positive relationship with civic participation. While increased factual

climate knowledge is a worthwhile goal, the primary focus is using this climate knowledge to influence and encourage pro environmental behaviors. Climate knowledge and environmental behaviors are inextricably linked (Huang, 2015). To target and change environmental behaviors an understanding of what influences climate knowledge must be analyzed. Individuals' information media use has a direct effect on their pro environmental behaviors while also functioning as a mediating variable in the relationship between audiences' environmental beliefs, self-efficacy and behavior (Huang, 2015). Users' offline mobilization and in person environmental engagement is typically preceded by attempts to mobilize through social networks (Skoric et al., 2016). To target and change offline behaviors, online behaviors and perceptions of climate activism must be analyzed.

### **Statement of Problem**

The instantaneous delivery of information facilitated by technological advances can work both for and against science communicators. Live feeds and breaking news features on Twitter allow users real-time access to first-person accounts, videos, and news coverage of natural disasters and climate events before traditional information media sources have released information. This has caused social media to become a more attractive news source because of its relative speed advantage (Westerman, Spence, & Van Der Heide, 2014). With a wildfire-like spread of information, a major question surrounding the use of social media as an information source is how people assess the source credibility of this information (Westerman, Spence, & Van Der Heide, 2012). Because individuals have limited direct experience with certain topics, public trust may be strongly influenced by fast-thinking, contextual cues, and other short-cuts, rather than careful consideration (Abrams, Zimbres, & Carr, 2015). While there are large amounts of

in-depth information available for most people, the headline is often more interesting than the article content leading to audience consumption of half-truths (Yuan & Gao, 2016).

Previously miscommunicated science and public distrust of traditional media coverage of topics has inevitably led to hashtags such as the popular “#FakeNews.” This combined with the lack of deep evaluation of online message content (Pjesivac et al., 2018) has caused social media news consumers to become more suspicious of science communication while also adopting a position of skepticism towards news media (Fletcher & Nielsen, 2019). A wide range of theories in relation to social media use and technological advancement are available; however, the relationships between how media dependency, media trust, and social media are used and current information seeking behaviors and climate change knowledge are largely unexplored. While the nature of social media use is hard to predict, the communities it creates and news networking systems it upholds will play an important role in influencing public engagement.

### **Purpose and Research Objectives**

The purpose of this study was to explore climate change dialogue on social media and how science communicators can capitalize on social media dependency to promote climate change awareness, increase factual climate change knowledge and encourage behavioral change.

The following research objectives guided the study:

- RO1. Identify what triggers conversations about climate change on Twitter.
- RO2. Describe public comments and reactions toward climate change on Twitter.
- RO3. Examine the relationship between the triggers of conversations about climate change and public comments toward climate change on Twitter.

RO4. Describe public attitudes toward climate change, level of climate change knowledge, online information seeking behaviors, and interactions on social media platforms.

RO5. Determine if public online information seeking behaviors and interactions on social media platforms predict attitudes toward climate change.

RO6. Determine if public online information seeking behaviors, and interactions on social media platforms predict level of climate change knowledge.

### Definition of Terms

1. Attitude: Respondents stance toward the conservation and protection of natural resources and the ecosystem in relation to climate change (Nelms et al., 2017).
2. Climate Change: The variability of the climate system that includes the atmosphere, the biogeochemical cycles, the land surface, ice and the biotic and abiotic components of the planet earth (Ahmed, 2020).
3. Interactions on Social Media Platforms: Communication between audience members in the form of comments, retweets and likes.
4. Information Seeking Behaviors: Using social media as a tool to seek out information or to self-educate (Whiting & Williams, 2013).
5. Media: A culmination of social platforms used to find information, network, and express opinions or ideas.

6. Pro-Environmental Behavior: Behavior that could make a considerable difference or impact on the environment by either minimizing damages or maximizing benefits to the environment (Steg & Vlek, 2009).
7. Public Comments: Comments made by users on the public social media platform Twitter in response to tweets about climate change.
8. Social Media: Social media are web-based services that allow individuals, communities, and organizations to collaborate, connect, interact, and build community by enabling them to create, co-create, modifies, share, and engage with user-generated content that is easily accessible (McCay-Peet & Quan-Haase, 2017)

## Study Limitations

Self-reported data through survey methods may not truly show the scope and effect of current social media news trends. As self-reporters, respondents may choose answers dissimilar to their current habits, which may influence data trends and frequencies. History at the time of survey distribution may also play a role in changed attitudes and ideals based on the current national and global circumstances. While the qualitative portion of the research was done in 2019, election and campaign advertising in addition to natural disasters may have influenced user perceptions of climate change. During the self-reported survey portion of the study, sheltering-in-place laws due to COVID19 and the downplay of climate issues by government officials may have led to disparities in answers particularly toward environmental concerns, based on the

political leanings of a respondent. A short follow-up survey could be done to determine if environmental and psychological conditions played a role in respondents' answers toward climate-driven and political questions.

While the qualitative portion of the study was done using two coders to establish reliability, tweet themes may vary among coders. During the scope of the study many climate events including political climate meetings and the rise of an election year may have impacted the views and ideologies of tweeters during the time period. For future studies a larger metanalysis of tweets over a longer time period could be used to determine if there were changes over time with who audiences deem trustworthy science communicators and climate conversations have changed.

### **Assumptions**

The following assumptions existed in the study:

1. Respondents were provided with necessary information through survey wording to answer questions as thoroughly as the research intends (Collins, 2003)
2. Respondents understood all survey questions and each question contained readily retrievable information (Collins, 2003)

## CHAPTER 2

### REVIEW OF LITERATURE

This study was guided by the media dependency theory along with the uses and gratification approach. In addition to these theories Walton's theory of argumentation was used to better analyze and interpret conversations on social media. All three theories readily lend themselves to determining how and why the public is using social media sites yet there is a need for more exploration when determining just how much current information seeking behaviors and interactions amongst users on social media can be used to increase factual climate knowledge while encouraging pro environmental behaviors.

#### **Media Dependency and Information Seeking Behaviors**

In 1976, Sandra Ball-Rokeach and Melvin DeFleur introduced media dependency as a theory that became a major part of daily media use. They posited that mass communication is comprised of a set of complex relationships between vast sets of interacting variables that are broadly defined by terms such as "media" and "audience", and in taking these variables into account that an adequate understanding of the effects of mass communication can be gained (Ball-Rokeach & DeFleur, 1976). If people see no alternatives to these methods of mass communication, dependency becomes crucial and mass media becomes the primary provider of information (Jackob, 2010). Media consumers start to become dependent on media when they find the information provided helpful in accomplishing their personal goals. This dependency is stronger when audiences rely on the media to be their primary information source in uncertain or ambiguous situations (Zhang & Zhong, 2020). Regular exposure to mass media as a sole information source also has the ability to influence cognitive and behavioral changes in

audiences (Mafe & Blas, 2006). These cognitive markers become starting points in the journey to initiate environmental protection behaviors (Zhao, 2012).

Advertisements, information specials, and sympathy grabbing documentaries work as mental hooks to bring awareness of the consequences of climate change. These media cues serve as predictors for media use as a critical determinant of environmentalism (Zhang & Zhong, 2020). Individuals' exposure and attention to coverage related to global warming from both traditional media and the internet have direct effects on their intention to adopt environmental behaviors (Huang, 2015).

Previous studies focused primarily on the role knowledge plays in the adoption of pro-environmental behaviors but did not consider how media dependency and mass media use may impact or influence these behaviors (Ho et al., 2015). Attention to pro-environmental messages on the internet predicted civic engagement yet the media dependency theory proposes that people will rely more on the mass media for information under conditions of uncertainty and societal disruptions such as natural disasters (Ho et al., 2015) not just to obtain passive information. Storytelling through film, visual images, celebrities, and other forms of entertainment can be used to convey scientific content and can change minds (Olson, 2009). A 2012 study showed that a significant number of social media users tended to rely on the people around them to tell them what they needed to know rather than relying solely on institutional media (Hermida et al., 2012). Increases in technology and changing communication networks have brought the rise of a new celebrity, the influencer. Influencers work to produce their own form of capital by curating personal brands specific to different social media communities, these personal brands can then be used by companies for consumer education and outreach (Hearn & Schoenhoff, 2016). Social media users become influencers through nomination, recruitment or appointment (Lamm et

al.,2014). These influencers are typically selected by online communities based on what the audience determines to be their primary point of influence. Dubois and Geffney (2014) suggest that there are four primary points of influence: being knowledgeable or having expertise on a subject, having a large following, having enough knowledge or experience to be considered an expert, and maintaining a position to exert social pressure and social support. While previously called opinion leaders, influencers use their visible position in the large network of social media to posit themselves as experts and spread their messages widely (Rogers, 2010). Audiences associate these influencers with different levels of credibility, trust, and authority (Hansen, 2011). While users have deemed influencers credible sources of scientific information, their opinions may reflect their own personal views instead of nonbiased fact and may play a significant role in attempting to change viewer's opinions through misinformation (Apampa, 2019).

The amount of information citizens receive directly from scientists or science educators' pales in comparison to the enormous amount of information received from diverse media sources constructed for intents other than science literacy or public engagement in science (Kennedy & Prat, 2019; McBean & Hengeveld, 2000). With no means of controlling the spread of information, statements presumed to be facts spread like wildfire on each media platform.

### **Uses and Gratifications**

The primary focus of the uses and gratifications theory is to explain or determine how the psychological needs of an audience shape their reasons to use specific mediums (Hsu et al., 2015) Uses and gratification theory has primarily been used to determine the reasons why consumers are motivated to use certain media; these reasons are typically associated with fulfilling the direct needs of a consumer (Luo et al., 2011). Facebook, Instagram, and Pinterest

all satisfy different needs. In other words, each user chooses different mediums to meet their different needs and they acquire certain motives with each use (Eginli & Tas, 2018, Lariscy et al., 2011). The main assumption of the uses and gratification theory is that an audience actively seeks content that gives them the highest level of satisfaction (Windahl et al., 2008).

According to Petric (2011), there are four different communication purposes that describe interpersonal media use: 1) Informational-cooperative use: People get and give information, learn, disseminate information. 2) Relational use: Users develop social relations, execute social norms, sustain relations, gain social support, and make or maintain friends. 3) Expressive use: People express themselves, personal experiences, wishes, beliefs, self-presentation, identity, and presenting internal communication. 4) Strategic use: People have conscious or unconscious personal aims that they can reach by communication.

Through informational-cooperative use social media users act as information consumers who are less obligated to fact check what passes through traditional gatekeepers and are able to bypass gatekeepers altogether and turn directly to primary information sources, many of which are information consumers themselves (Westerman et al., 2014). Through expressive use social media users become part of like-minded communities where news is considered an important shared social experience (Hermida et al., 2012). Social media users focused on information seeking behaviors are the primary targets for science communication. During a study done by Whiting and Williams (2013), 80 percent of respondents reported they use social media to seek out information specifically for self-education, to learn new things, and for how-to instruction. These users were the second largest demographic preceded only by those using social media for social interaction, this highlights how social media use has shifted beyond a simple source of entertainment and relaxation into a trusted news and information medium.

## Theory of Argumentation

Argumentation is viewed as a type of communication aimed at resolving a difference of opinion by critically testing the acceptability of the standpoints of an issue (van Eemeren & Grootendorst, 1992). Walton (1996) created a set of schemas to define and interpret different types of arguments and their goals. Argumentation schemes are structures of inference that represent common types of arguments seen with everyday discourse (Walton et al., 2008). Science is an argument-based discipline, without disagreement there would be no advancement but there has been a paradigm shift in recent years about rational argumentation leading to further audience division in fields where rational argumentation is centrally important (Walton et al., 2008). Therefore, once an idea or issue is presented, an audience analyzes the idea or issue by evaluating the words and expressions used when conveying the idea or issue to identify its goal (Schneider et al., 2012). Climate change is a divisive socio-scientific issue further exacerbated by political affiliations and easily adopted misinformation. An individual's beliefs and standpoint about a specific issue or idea influences their interest and desire to engage in an argument (Visser et al., 2020).

The argumentative scheme most commonly seen surrounding climate conversations is the argument from ignorance. According to Copi and Cohen (1990) the argument from ignorance or argumentum ad ignorantiam is "the mistake that is committed whenever it is argued that a proposition is true simply on the basis that it has not been proved false, or that it is false because it has not been proved true" (p. 93). This argumentative technique can take various forms, including emphasis on uncertainty, attacks on scientists or scientific data/processes, casting doubt on scientific consensus, and conspiracy theories (Cook, 2019). An argument stemming from ignorance is closely related to an argument from the best explanation wherein the non-

existence of an entity can be regarded as the best possible explanation of the lack of evidence or knowledge (Walton & Macagno, 2016). While this argumentative scheme situates ignorance at the forefront, it is a misnomer. Frequently these arguments come from partial ignorance, generally they are presumptive arguments that can be used correctly and appropriately in some cases yet can be misused in a variety of ways in other cases (Walton, 1992). The very structure of the argumentum *ad ignorantiam* is an expression of how presumptive reasoning and burden of proof can function correctly in argumentation to shift a presumption to the other side in a dialogue (Walton, 1992). While numerous studies have been done on the types of arguments and the linkages between each argument, not much is known about what triggers these arguments or even how to effectively distribute rational information that will facilitate engaging yet factual climate conversations.

### The Current Knowledge Gap

Although each theory readily lends itself to the use of media for climate communication and encouragement of pro-environmental behaviors, they both lack in certain areas. Few studies focus on the role of media use, but existing research shows the potential of positive impact. In the context of media coverage of climate change, many news sources have framed the science of climate change as a two-sided debate, creating a bias in the name of media balance, which has greatly over amplified the voices of a relatively small number of climate-change deniers (Boykoff & Boykoff 2004). Feeding off of the media divide, climate deniers have the ability to use media messages to their advantage to create counterarguments and confusion in the hope of swaying the public. When trying to persuade the public, the reasons they use social media also have to be taken into account. Some people pay attention to social media but do not feel that it instructs their behavior (Ho et al., 2015). The challenge for scientists will be getting audiences to

a point where genuine pro-environmental behaviors are triggered by relevant social media communication. While previous studies have started to uncover how social media use can encourage pro-environmental behaviors and why people choose to use social media, little is known about the possible linkage between information-seeking behaviors and what actually triggers these pro-environmental behaviors. Consequently, this research sought to explore the relationship between social media use and information seeking behaviors as triggers for engagement in climate arguments and conversations.

## CHAPTER THREE

### ARGUING FOR ARGUMENT'S SAKE? EXPLORING PUBLIC CONVERSATIONS AROUND CLIMATE CHANGE ON TWITTER

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<sup>1</sup>Mayfield-Smith, Kennedy. Submitted to Journal of Applied Communication, February 18, 2021.

## **Abstract**

**Audience-facilitated information flow has become the new norm created by the publics' divergence from traditional media sources. New, instantaneous news media delivery creates a discursive forum for users to share ideas and opinions, regardless of their agreement with the new outlets' perspectives. Mobile device advancements and partnerships have changed how audiences view news media and the sources we rely upon to obtain information. With these advancements, social media users have become primary information providers and information gatekeepers. Twitter specifically has become a news media platform for some based on its effectiveness in facilitating information flow and triggering reorganization as it provides a platform for collaboration and coordination. Despite widespread acceptance by the scientific community of the threat climate change poses, it is still a topic of contention on social media.**

Climate conversations are typically approached with an “us versus them” mindset with “us” being used as representation of the communities’ to which audiences belong. The communities one belongs to typically follows social media users social, political and environmental ideologies. Walton’s theory of argument or inference schemes served as the theoretical framework for this study. Argument schemes represent common arguments and special context arguments, in this case scientific argumentation. Walton’s argument from ignorance was used as a framework for the study. The argument states that if there has been a thorough search through the knowledge base then concrete proof of a fact would exist. Results indicated social events, political events, and scientific discoveries were the main triggers for climate conversations on Twitter. While the primary tweets were typically positive, public comments were most often negative with arguments seen in regard to climate change mitigation and the political influence of environmental policies currently represented in media. The most

aggressive user arguments were when climate was linked to politics or a political account outside of the community a user deemed credible. The findings indicated social media may be a useful tool when exploring climate change conversations through a sociopolitical lens and additional research is needed to closely examine how political ideologies, global location, and different environmental topics impact issue awareness and beliefs.

Keywords: climate change, Twitter, public engagement, argumentation theory, climate communication, information sources

## Introduction

The ability to send and receive real-time information at the push of a button has made social media one of the most trusted public sources of news (National Science Board, 2016). Social media provides a platform for eyewitnesses to report on recent events in real time and in some cases traditional media sources glean information from these online eyewitness reporters (Westerman et al., 2014). Riffe et al., (2008, p. 4) stated,

The growing use of the internet reflects many factors, but at least four characteristics of the internet stand out when compared to traditional media: 1. The Internet features almost instantaneous delivery of information, which makes it faster than traditional print media. 2. The Internet is interactive, which allows more immediate feedback than any other medium. 3. The Internet allows for the distribution of multimedia content, which many media do not. 4. The Internet allows for the distribution of large amounts of low-cost, in-depth information. These four relative advantages of the Internet help explain its spread and its potential importance in the micro-level dependency between individuals and media.

As such, the public has diverged from the consumption of traditional (fact-based) news and science media to what they can obtain quickly on social media platforms (National Science Board, 2016). The instant delivery of information can work both for and against science communication efforts.

Twitter, specifically, has evolved from being a personal information sharing platform to a platform for sharing what is happening around the world and in various communities (Berland, 2016). Twitter's evolution has created a new gatekeeping system where power switches from content producers to content consumers (Haas & Wearden, 2003; Westerman et al., 2014). The power switch has provided opportunities for feedback, which in turn promotes active interaction among users. The negative impacts of climate change on the environment and global economies has attracted the attention of people globally, making climate change a societal and political issue (Kirilenko et al., 2015). Recognition of climate change as a societal and political issue has made it one of the most discussed topics on social media (Pearce et al., 2014). Despite widespread acceptance around the world that climate change poses a threat to the environment and global economies, it remains as one of the major controversial issues among most Americans due to differences in opinion regarding its causes and mitigation measures (Jang & Hart, 2015).

Social media platforms, such as Twitter, are often used by Americans as a host for public debates about climate change between people who believe climate change is real and those who believe it is a hoax (Kirilenko et al., 2015; Pearce et al., 2014). The interactive facet of social media accelerates the spread of both factual and non-factual information. Furthermore, the fast-thinking contextual cues, and other short-cuts associated with social media messages, may influence the public who already have limited trust in science communication and direct experience with certain scientific topics such as climate change (Abrams et al., 2015). Moreover,

in other cases headlines are often more interesting than the article content leading to audience consumption of half-truths despite the large amounts of in-depth information available. Twitter is known to be effective in facilitating information flow and responsible for triggering revolutions as it provides a platform for collaboration and coordination among activist groups (Segeberg & Bennett, 2011). As a result, Twitter has become one of the platforms where people argue about a myriad of issues including climate change.

The presence of strong associations between political party affiliation and climate change beliefs contributes to arguments surrounding climate change as people use it as a tool to defend their identities (Fielding et al., 2012; McCright & Dunlap, 2011; Painter & Ashe, 2012). Moreover, the presence of online communities has also created social factions covering a range of subjects (Bruns & Bahnisch, 2009). Online communities form when enough people carry on computer-mediated nonprivate discussions long enough, with sufficient human feeling, to develop what are considered *social relationships* with other online participants (Bruns & Bahnisch, 2009). These communities develop over the course of several months or years and their social dynamics shift throughout the lifetime of the community (Bruns & Bahnisch, 2009). Online communities can be distinguished by usage and participation trajectories with trajectories defined by extrinsic and intrinsic aspects (Bruns & Bahnisch, 2009). Studies have been conducted linking local weather events with climate discussions on social media (Zanocco et al., 2019; Pearce et al., 2015) and most research has aimed at exploring climate change conversation on Twitter based on trending hashtags (Hamed et al., 2015; Haunschild, et al., 2019; Holmberg & Hellsten, 2015). Zanocco et al. (2019) found evidence that those who have experienced or been impacted by climate events rely less on political ideology or economic standing and more on concrete experiences when interpreting climate change mitigation policies. If this finding holds

for other extreme weather events and these events become more frequent and severe as climate science suggests, we could see substantial shifts in public opinion about climate change, particularly among conservatives (Zanocco et al., 2019).

The research done by Hamed (2015), Haunschild (2019) and Holmberg & Hellsten (2015) focused primarily on engaging with twitter audiences and the communities they belong too. While valuable the studies did not emphatically describe what causes audiences to engage with a tweet or hashtag and how different communities receive different messages.

In addition, several studies have explored the framing of climate change messages on Twitter (Jang & Hart, 2015) yet little research has examined the triggers of Twitter climate change conversations and the associated responses from other users. During a social media study done by Pearce et al. (2015) they determined there may be not be a single effective way to communicate climate change in a way that captures and educates all audiences. Researchers highlighted the need for studies of public perception where the frame of the message rather than the messenger should be studied; however, it can be presumed that the messenger's tone and ideologies have just as much of an effect on the public's perception of a message as the message itself.

### **Theoretical Framework**

Walton's (1996) theory of argument or inference schemes served as the theoretical framework for this study. Argumentation is viewed as a type of communication aimed at resolving a difference of opinion by critically testing the acceptability of the standpoints of an issue (van Eemeren & Grootendorst, 1992). Walton (1996) uses a set of schemes to define different types of arguments.

Walton et al. (2008) stated, “Argumentation schemes are forms of argument (structures of inference) that represent structures of common types of arguments used in everyday discourse, as well as in special contexts like those of legal argumentation and scientific argumentation” (p. 1).

As such, argumentation schemes elaborate everyday reasoning, or common reasoning, in politics or science (Lumer, 2016). It is for this reason argumentation theory is easily applied to social media and climate conversations where political reasoning has primarily dominated the conversation. Specifically, Macagno and Walton (2016) reported that arguments from ignorance can aptly be used to describe the premise of arguments seen on social media. Furthermore, the temporal nature of information that is available on Twitter prompts users to respond in the heat of the moment, hence, increasing the likelihood for arguments (Lange et al., 2018). Therefore, the desire for people to make their opinion or stand known forces them to respond quickly while the topic is still trending.

Arguments stem from people’s reaction to an idea or issue through discussions (Lange et al., 2018). It is believed individuals always have a goal or objective for introducing a specific issue or idea (Walton, 1995). Therefore, once an idea or issue is presented, an audience analyzes the idea or issue by evaluating the words and expressions used when conveying the idea or issue to identify its goal (Schneider et al., 2012). Once the audience identifies the goal, the audience then engages in an objective presentation of a justification or challenge toward an idea or issue and not an expression of an individual’s opinion based on their position regarding an idea or issue (Lange et al., 2018). However, Lange et al. (2018) further indicated that social media arguments are interpreted as a person’s reflection of reality and, as such, are deemed to be an expression of an individual’s position or identity. Individual’s engagement in arguments over issues or ideas may affect them and how they feel (Van Eemeren et al., 2014). An individual's

beliefs and standpoint about a specific issue or idea influences their interest and desire to engage in an argument (Visser et al., 2020).

This common argumentative scheme is so frequently and naturally used that people are unaware that it has infiltrated their persuasive speech. Therefore, an individual can argue about a specific issue based on their knowledge of the subject matter or based on ignorance. The argument from ignorance assumes that there has been a search through the knowledge base that has been deep enough so that if something were there it would have been found (Walton & Macagno, 2016). This mindset represents challenger logic, a theme commonly seen in climate arguments (McAdam & Scott, 2005). Whereas if climate change is actually a problem then it should have already affected us, therefore, it does not exist.

An argument stemming from ignorance is closely related to an argument from the best explanation wherein the non-existence of an entity can be regarded as the best possible explanation of the lack of evidence or knowledge (Walton & Macagno, 2016). The type of language used, either formal or informal, to express one's opinions and the type of analysis that one conducts whether objective or subjective are what differentiate an argument from a discussion. Differences exist among and between users of social media on why and how they argue as well as how arguments are advanced in various social media platforms (Schneider et al., 2012). However, not much is known regarding the motivation behind public engagement in argumentative conversations about climate change on Twitter. Perhaps people engage in argumentative conversation because they have similar views represented by a post or because they want to defend and share their opposing viewpoints and sway the majority.

## **Purpose and Research Objectives**

The purpose of this study was to explore how Twitter is being used to shape public conversations about climate change. The following research objectives guided the study:

1. Identify what triggers conversations about climate change on Twitter
2. Describe public comments and reactions toward climate change on Twitter; and
3. Examine the relationship between the triggers of conversations about climate change and public comments toward climate change on Twitter.

## **Methods**

A social media analysis was conducted to achieve the research objectives. Social media analysis refers to the practice of gathering data from social media platforms and analyzing the data to help researchers address specific problems in relation to the research objectives (Lee, 2018). Specifically, a qualitative inductive content analysis of tweets on climate change using Meltwater was conducted. The inductive content analysis involved identifying and creating categories from the data based on the research objectives and theoretical framework (Elo & Kyngäs, 2008). During the analysis codes and sub-codes were created that represented different categories. These codes and sub-codes were used as themes and sub-themes when reporting the results.

Meltwater is a media monitoring and business intelligence software that tracks conversations that people are discussing on various social media platforms all over the world. Using Meltwater, a social media search for the keywords “climate change” was done. Then a custom dashboard utilizing the keywords “climate change” was created. The dashboard consisted of the following five widgets designed specifically for media monitoring: trending themes, hot topic, top location,

top social media source, and topic momentum. The trending themes widget showed the current number of discussions about the keywords. The hot topic widget was a heat map that created a visual of where primary climate conversations were happening. The top locations widget was used as an accessory to the hot topics widget where the software narrows down the location of conversation by country although tweets only from tweeters in the United States were chosen. Top social media sources included Twitter, Facebook, and personal blogs.

Twitter was chosen because it focuses on connecting people that know each other physically and is also used as a source of news on different issues (Allen et al., 2010; Berland, 2016). In addition, Twitter unlike other social media platforms, provides opportunities for users to engage in conversations (Comm, 2009). In addition, the presence of information seekers and information sources as the major categories of Twitter users, as well as the temporal nature of the information available on Twitter, prompts immediate response from users (Java et al., 2007; Lange et al., 2018) made Twitter the best social media platform for the study. The presence of information seekers and sources as well as the temporal nature of the information provides a conversation medium based on the amount of real time conversations, variety of influencers and increased opportunity for conversations amongst users.

Tweets containing or associated with the keyword's climate change from February 1, 2019 through December 31, 2019 were collected and analyzed. A total of 10 tweets with 10 comments each were collected for each month which translated to a total of 1,200 tweets. Tweets were selected based on potential reach and actual number of comments being greater than 10. However, only the first 10 tweets were selected for each month from the top users for this study. The selection of the first 10 tweets was based on the assumption that they will include tweets from users who care more about the topics and would respond instantly. Tweets from each handle

were copied and pasted into word documents. The word documents were then uploaded to MaxQDA, a data analysis software.

The data was analyzed in MaxQDA by two coders. Prior to analysis, an intercoder reliability test was run using tweets from the month of January 2019. Cohen's Kappa for each of the 10 tweets of 1 were observed. This Kappa was above that which was reported in other research where Kappas of .86, .68 and .70 were used to proceed with individual coding (Liu et al., 2015; Merzdorf et al., 2019; Rutsaert et al. 2013). The coders were able to achieve such a high intercoder reliability because prior to the analysis the coders read through all the documents more than once to have a clear picture of the data (Elo & Kyngäs, 2008). After reading the tweets, a code book was developed with input from both coders based on the research objectives and theoretical framework. Among others, the code categories included: Triggers of tweets, origin of tweets, the tone of the tweet and reactions. These categories were modified from a similar study that examined social and traditional media coverage of food crisis (Shan et al., 2014). As such, both coders had a concrete understanding of the codes and their descriptions. Once intercoder reliability was established, the primary coders analyzed the rest of the tweets independently and then merged the results during interpretive analysis.

Themes and sub-themes emerged from the codes which informed the findings of the study. However, to address the third research objective code relationships were established between the themes and explored further. As is the case in qualitative research, it is imperative to reveal any potential bias. In this case both coders have a background in agricultural and environmental issues and believed climate change was real. While both tried to remain unbiased, this perspective may have influenced their data collection process and the resulting analysis. To

mitigate this effect, peer debriefing was conducted with several individuals separate from the coding who agreed with and approved of the analysis (Lincoln & Guba, 1985).

## **Results**

### **Triggers of conversations about climate change on Twitter**

During the analysis process seven themes emerged in regard to triggers of conversations about climate change. The seven themes included: climate event, social event, political event, scientific discoveries, random and natural disasters. The top three triggers were related to political events (41 tweets), social events (24 tweets), and scientific discoveries (17 tweets). Political events included presidential debates, congressional meetings, and climate summits. Social events included protests, rallies, community-specific tweets, and local news. Scientific discoveries covered any scientific discovery caused by, or in relation to, climate change. Table 1.1 provides a summary of the themes and examples of the tweets from each Trigger.

**Table 1.1**

### **Triggers of climate change conversations on Twitter**

Trigger

Trigger	Example of Conversation
Social Event	<p>“Jane Fonda and Sam Waterston arrested in climate change protest <a href="https://cbsn.ws/31uoRzU">https://cbsn.ws/31uoRzU</a> (@CBSNews)”</p> <p>Chief executives are taking vocal stands on issues like gun control, climate change and immigration, but global affairs bring a different complexity and calculation, especially for companies doing business in China (@TheWallStreetJournal)</p> <p>LIVE: Climate activist Greta Thunberg leads climate change rally in Denver. @ABCLIVE: Climate activist Greta Thunberg leads climate change rally in Denver.pscp.tv (@ABCNews)</p> <p>Climate activist <a href="#">@GretaThunberg</a> was just named Time's Person of the Year. She's the youngest individual to ever receive the honor. Watch Greta's full TED Talk on why we need to start acting on climate change now: (@TEDTalks)</p>
Political Event	<p>State Department analyst Rod Schoonover resigned in protest after the White House blocked some of his testimony on the threat climate change poses to national security (@TheWallStreetJournal)</p> <p>Pres. Trump said his administration will fight for a better environment in a speech Monday that did not mention the threat of climate change. (@ABCNews,)</p> <p>Former Pres. Barack Obama says the Paris Agreement on climate change may fall short of expectations but is still the way forward to achieve progress and encourage businesses to invest in clean energy.(@ABCNews)</p> <p>Gov. Jay Inslee unveils his initiative to combat climate change, proposing 100% clean energy standards across three sectors. <a href="https://abcn.ws/2ZSOPxh">https://abcn.ws/2ZSOPxh</a> (@ABC)</p>
Scientific Discoveries	<p>Climate change is one of the toughest challenges facing the world. But don't despair... Scientists and entrepreneurs are working on some innovative solutions. Here are four that I'm excited about: <a href="https://b-gat.es/2zJTXaY">https://b-gat.es/2zJTXaY</a> (@BillGates)</p> <p>We're not going to stop climate change with just seedlings and fancy agriculture. We also need to reduce emissions. (@WIRED)</p> <p>Super-soaked spring soils, unplanted fields, record-rising rivers, runaway barges—this is what climate change looks like for the middle of the US. And it's harming the nation's ability to produce food. (@WIREDScience)</p> <p>Scientists believe that the Amazon's absorption of greenhouse gases plays a crucial role in slowing climate change, but the Brazilian President Jair Bolsonaro has encouraged loggers to deforest more of the rainforest. (@TheNewYorker)</p>
Natural Disasters	

Trigger	Example of Conversation
	<p>“The Amazon Rainforest, one of the wettest places on Earth, is on fire. Siberia, one of the coldest places on Earth, is on fire. That aint normal. Climate change is for real and our planet is burning up. Humans are the cause of this deadly fever. <a href="#">#PrayforAmazonia</a>” (@Eugene Gu, MD)</p> <p>'Shocking': Scientists — including Venetians — sound alarm as Venice floods As climate change causes sea levels in Venice — and across the planet — to inch higher, scientists say catastrophic floods could become more severe and more frequent (@NBC News)</p> <p>Wildfires and Floods Push Russia to Revise Its Stance on Climate Change. A double blow of floods and wildfires in Russia this summer is injecting fresh urgency into rethinking the country’s usually skeptical stance toward the dangers posed by climate change (@TheWallStreetJournal)</p> <p>SUMMER HEAT WAVE: Record-breaking heat had Parisians taking a dip in front of the Eiffel Tower on Friday. Experts say climate change is to blame for the temperature spike <a href="https://cbsn.ws/2KMCOW0">https://cbsn.ws/2KMCOW0</a> · (@CBSNews2)</p>
Random	<p>“Donald Trump believes climate change is a hoax. Donald Trump is an idiot.” (@BernieSanders)</p> <p>“Fighting for the <a href="#">#GreenNewDeal</a> isn't just about fighting climate change. It's a commitment to building a better future for the working people of our country by creating millions of good union jobs. We can't fight climate change with a low-wage economy.” (@ElizabethWarren)</p> <p>PLANT TREES IN THE FALL! “Trees not only help mitigate Climate Change by absorbing carbon dioxide, THEY ALSO have huge benefits in combating desertification &amp; land degradation, particularly in arid countries, &amp; providing food, shelter, fuel, fodder, and medicine." TREES=RAIN! (@bettemidler)</p> <p>Today’s global challenges, be they climate change, poverty and inequality, or migration, are growing and they affect rich and poor countries alike. (@UnitedNations)</p>

### Public comments and reactions toward climate change on Twitter

During the analysis three primary themes and three subthemes emerged in user reactions to tweets agreeing or disagreeing with climate change. The three primary reaction themes were Negative, Positive, and Argument. Subthemes under the primary Argument theme included

Heated, Moderate, and Unheated. The majority of the initial posts about climate change were positive. Variations emerged when other users commented. One theme that emerged when analyzing the public comments and reactions toward climate change focused on *type of reactions* which looked at whether the reactions was opposing (negative) or in agreement (positive) towards the ideas expressed in the original tweet.

In the types of reactions sub-theme, public comments were primarily negative represented by the 541 comments. The negative comments represented a commenter's disagreement with climate change as being real. However, there were also positive comments and reactions to climate change that were represented by 459 comments from followers who agreed climate change was real and needed attention. Examples of users positive and negative reactions to climate change messages can be seen in Table 1.2.

Table 1.2

*Users reactions to climate change messages*

Reactions

“Some people need climate change to slap them across the face before they can finally acknowledge its existence.” (@BernieSanders)  
“The human race is destroying not only the planet, but itself at a rapid pace and doesn’t seem to have the good sense to stop.” (@ChelseaHandler)  
“Elect intelligent politicians who welcome scientific fact and make climate change a top priority.” (@WIREDScience)

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In addition, a subtheme that looked at the level or argument based on the comments also emerged. These reactions were categorized based on the type of language used whether formal or informal. Comments coded as negative frequently occurred with moderate and heated arguments while comments coded as positive most frequently co-occurred with unheated arguments and solution-seeking behaviors. Many of the negatively coded segments tended to be unfocused with both parties coming to separate resolutions or questioning why they were arguing in the first place (see Table 1.3).

**Table 1.3**

**Argument levels of comments to tweets**

Argument Level

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	<p>“These snotty little brats had no idea what they were talking about. They were parroting crap fed to turn by their leftist parents. Feinstein wasn’t strong enough in shutting them down. I’m proud of her.”  (@sunrisemvmt)</p>
Moderate	<p>My favorite parts are where you lie and have strawman arguments”(@BernieSanders)</p> <p>How much emissions were expended to built that thing and to fly her two crews back and forth to pilot it? She may be young, but she’s got a head start on learning climate change elitism’s hypocrisy” (@TODAY)</p> <p>What a colossal waste of time” (@CBSNews)</p> <p>They would only “earn more” because of federal spending to begin with. That spending comes from somewhere. And with hundreds of billions of dollars of petroleum and lng leaving the country, who the hell is going to pay for all that? Th energy cost increases would be catastrophic” (@ElizabethWarren)</p>
Unheated	<p>here is room for more than one solution. Actually we may need all of them.” (@BillGates)</p> <p>Climate change is also a factor but some problems could have been alleviated through proper planning and good governance” (@BernieSanders)</p> <p>For progressives, data and reality are conspiracies” (@BernieSanders)</p> <p>That isn't work. That is just opinion. Science means using scientific method not pop culture and group think” (@TEDTalks)</p>

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**Relationship between triggers of conversations about climate change and public comments toward climate change on Twitter**

Relationships between triggers of the tweet and the reactions from the audience were then examined. Specifically, the relationship between reactions from followers to tweets based on their comments, language and tone used in their responses as well as whether they were in support of the original message or not was explored. A visualization of the results can be seen in

Figure 1. tweets coming from political leaders attracted heated debates while tweets from news handles attracted moderate arguments. In addition, some of the news handles and personal handles attracted unheated arguments. Therefore, to have a thorough understanding of what was going on, the level of argument for each tweet was analyzed in relation to the origin of the tweets, the opinions put forth in the tweets, the tone of the tweets and triggers of the conversation. Four themes emerged: tweeter's opinion versus level of argument, tone of tweet versus level of argument, the origin of the tweet versus level of argument, and triggers of conversation and type of handle versus level of argument.

Figure 1.1

Relationship between Levels of Argument and Sources of tweets

### **Tweeter's Opinion and level of Argument**

The first subtheme, tweeter's opinion and level of argument, described whether the source tweeter agreed or disagreed with climate change based on their tone and the information being conveyed. Agreeing tweets were typically met with negative comments, and unheated arguments with users primarily attempting to provide contrary evidence to the threat of climate change. Disagreeing tweets incited more moderate and heated arguments especially when a blaming or aggressive tone was used. It was noted that if a primary tweet agreed or disagreed with climate change but came from a personal account of a political figure, it was more likely to be met with an opposing viewpoint with moderate and heated arguments. Details are provided in Table 1.4.

#### **Table 1.4**

**Comparison between primary Tweeter's Opinions about Climate Change and Reactions from Followers**

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Change Isn't Really A Big Deal. We only have about 12 years before the changes become irreversible, but who's counting?  
(@BuzzFeed)

Pres. Trump said his administration will fight for a better environment in a speech Monday that did not mention the threat of climate change.  
(@ABCNews)

“I know y'all are looking for clicks, but maybe don't add fuel to the GOP's fire. Kthx” (@BuzzFeed)

### **Tone of the Tweet versus Level of Argument**

The original tweeters tone was categorized within this subtheme as: aggressive, blaming, passive, informational or sympathetic. To categorize the original tweeters tone, coders paid attention to the words and syntax used in the tweet. Table 1.5 shows the tone of Tweet and the corresponding reactions from the audience.

#### **Table 1.5**

#### **Comparison between Tone of Primary Tweet and Reactions from Followers**

Tone of  
Tweet

Tone of Tweet	Primary Tweet	Reaction
	act I still haven't heard anything from him. But here's what happened this week in GOP climate denial instead" (@SenSchumer)	have ZERO plans to address climate change. It's time for @SenateMajLdr to stop hiding and tell the truth about climate change once and for all." (@SenSchumer)
Blaming	World leaders are failing our future generations on climate change" <a href="https://wapo.st/335ully">https://wapo.st/335ully</a> via @PostOpinions (@TheWashington Post)	But #Republicans like warm, moist weather...just look at their takeover of Florida...." (@TheWashingtonPost)
	President Trump has failed us on climate change. Preventing scientists from monitoring and reporting on carbon emissions and other climate warning signs is inexcusable. We can't — and won't — wait for Washington to discover reason."Trump Administration Hardens Its Attack on Climate Science.In a significant escalation, policymakers are seeking to undermine or discard research showing the most dire risks of inaction on climate change. <a href="http://nytimes.com">nytimes.com</a> (@MikeBloomberg)	guess it's a new approach to 'tackling' climate change. Just stop measuring it. That'll do it."(@MikeBloomberg)
	Trump Interior chief says climate change response falls on Congress: "Isn't this your job?" <a href="http://hill.cm/35CDKoK">http://hill.cm/35CDKoK</a> (@thehill )	Trump's greatest challenge remains converting the subsidized old-age home known as Congress into a full-time legislative body. The two-day work week and extended Spring, Summer, election, and Winter recesses aren't helping either. Kindergarten is in session more hours per year!" (@thehill)
	Prince Harry using a private helicopter to go to Birmingham then lecturing us about climate change is beyond parody. Walk the walk, Your Royal Highness - or spare us the hectoring, hypocritical talk." (@PiersMorgan)	Climate change is good. Freezing in Burnley." (@PiersMorgan)
Passive	people really out here denying climate change when it's 22 celsius in NYC in march" (@CodySimpson)	people really out here shocked when extreme weather patterns happen. people out here say "i wish global warming was real bc im cold" people really be using plastic bags to hold one item they bought at the store" (@CodySimpson)
	AOC gets it. She sees that fear is dividing us. We can address income inequality. We can address climate change, if we get together	Perfect. A fake science guy and a fake economist." (@BillNye)

Tone of Tweet	Primary Tweet	Reaction
	and get to work. <a href="#">#SXSW @AOC</a> ” (@BillNye)	
	NO FLY ZONE: Climate change activists faced problems with their plan to disrupt Heathrow Airport as their drones failed to take off. <a href="https://abcn.ws/2Ao0AAo">https://abcn.ws/2Ao0AAo</a> (ABC News)	And another fail by liberal fascists! Good! Liberal fascists are violent criminals!” (@ABC News)
	I somehow missed this terrific post by <a href="#">@sjwrenlewis</a> . "No one in 100 years time who suffers the catastrophic and (for them) irreversible impact of climate change is going to console themselves that at least they did not increase the national debt." <a href="https://mainlymacro.blogspot.com/2019/02/how-to-pay-for-green-new-deal.html">https://mainlymacro.blogspot.com/2019/02/how-to-pay-for-green-new-deal.html</a> (@paulkrugman)	With current policies those descendants will inherit climate change AND debt” (@paulkrugman)
Informational	State Department analyst Rod Schoonover resigned in protest after the White House blocked some of his testimony on the threat climate change poses to national security (@The Wall Street Journal)	<a href="#">#FactsMatter</a> ...but not to this administration. We need real leadership in Washington DC. We cannot continue to deny the <a href="#">#ClimateCrisis</a> . We need a President with the intelligence and courage to act. <a href="#">#ClimateAction</a> <a href="#">ClimateChange</a> ”( @The Wall Street Journal)
	The people who will suffer most from climate change are the ones least responsible for it. Here’s how we can help them: <a href="https://b-gat.es/30JC8EM">https://b-gat.es/30JC8EM</a> (@Bill Gates)	The people who are most affected by these changes today are the farming households in South Asia and Africa, they earn their living by raising crops and livestock on small parcels of land. These families have the fewest resources to cope with the many impacts of a warming climate”( @Bill Gates)
	As the U.S. confronts more extreme weather caused by climate change, itinerant workers — overwhelmingly made up of undocumented immigrants — are traveling to clean up disaster areas, facing haphazard payment and threat of deportation in the process (@The New York Times)	Wow, managed to weave the evils of climate change and immigration into one sentence.” (@The New York Times)
	Meet Liza Goldberg, the 17-year-old high school senior who works at NASA mapping the effects of climate change (@NowThis)	I just straight up basked in her intelligence. People like Liza and Greta give me hope that the “being stupid is cool” era will soon be over.” (@NowThis)

Tone of Tweet	Primary Tweet	Reaction
Sympathetic	Climate change is one of the toughest challenges facing the world. But don't despair... Scientists and entrepreneurs are working on some innovative solutions. Here are four that I'm excited about: <a href="https://billgates.com/2zJTXaY">https://billgates.com/2zJTXaY</a> (@Bill Gates)	It's a CULT, not a Science !!!" (@Bill Gates)
	Super-soaked spring soils, unplanted fields, record-rising rivers, runaway barges—this is what climate change looks like for the middle of the US. And it's harming the nation's ability to produce food. (@WIREDScience)	I'm in northern Illinois. The fields are under water and there's rain in the forecast for the entire next week and beyond. They're not going to get planted." (@WIREDScience)
	Today's global challenges, be they climate change, poverty and inequality, or migration, are growing and they affect rich and poor countries alike. (@UnitedNations)	Everybody should be on-board when addressing and acting upon Climate crisis" (@UnitedNations)
	One challenge will define the future for today's young generation more dramatically than any other: Climate change. The millions of young people worldwide who've organized and joined today's #ClimateStrike demand action to protect our planet, and they deserve it. (@BarackObama)	The continental United States is 1.8 degrees Fahrenheit warmer than it was a century ago. Seas at the coasts are nine inches higher. The damage is mounting from these fundamental changes, and Americans are living it. And obviously the acting so called „President“ doesn't get it." (@BarackObama)

### Origin of Tweets versus Level of Argument

Differences in reactions depending on whether the tweets were reported, or tweeter's thoughts were observed. Most of the tweeter's thoughts emanated from personal handles while reported tweets were from news handles. Despite large news accounts presenting nonbiased scientific, political, and social information reactions to the tweet were biased based on type of news content and news source. Personal handles with a large reach and a large number of comments fell into the politician or celebrity category and were typically verified by Twitter as indicated by a blue check mark on their profile. Reactions to personal tweets from political

accounts typically centered around personal attacks towards the politicians or influencers themselves and their ideals versus an actual climate discussion.

Audience reactions towards tweets from personal accounts tended to draw more unfocused arguments that were equally unheated, moderate and heated in nature. While unheated arguments appeared whether the primary tweeter agreed or disagreed with climate change, moderate and heated arguments showed up when the origin of tweets were the authors thoughts, more specifically if the author was in the opposing political party of the audience. These reactions typically consisted of deflections, recycled arguments or personal attacks. In contrast audience reactions to tweets from news accounts were less heated and often more headline. Overall, tweets coming from personal accounts garnered more attention and a wider range of negative reactions compared to tweets from news outlets typically because of their political ideologies in relation to climate change.

**Table 1.6**

**Comparison between Origin of Tweet and Reactions from Followers**

Origin of Tweet

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Origin of Tweet

(@ChelseaHandler)

Reactions

“The human race is destroying not only the planet, but itself at a rapid pace and doesn’t seem to have the good sense to stop.”

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Origin of Tweet

Santa Barbara, the cradle of the Earth Day movement, is reckoning with some of the most rapid climate change in the United States. The warming is driving extreme fires, deadly mudslides, drought and more.

Fires, floods and free parking: California  
(@TheWashingtonPost)

Reactions

You guys are doing fantastic work.”

Trigger	Personal Handle	News Handle
Social Event	<p>“Woman you are the gift that keeps on giving. I love your rhetoric. Please continue. Don’t let up for a single second. We need you &amp; the rest of the <a href="#">#WhackPack</a> talking so voters will see the Dem party for what it is. A bunch of socialists that would make Marx proud”  (@Alexandria Ocasio-Cortez)</p>	<p>“The young people will change the world!!!” (@ABC)</p>
	<p>“I’m a huge fan of <a href="#">#Tesla</a>. Not so much of the <a href="#">#GreenNewDeal</a>. So, I guess it all depends on how you want to make this brave new world.”  (@SethMacFarlane)</p>	<p>“Washed up Hanoi Jane and other Hollywood rejects need to do some reading on climate change along with the rest of the world”  (@CBSNews)</p>
	<p>“Alexandria Ocasio-Cortez is a total screwball out of nowhere and now a Congressional “hero” to the radical Democrats. Insanity dwells among us.” (@BillNye)</p>	<p>“100 companies are responsible for 78% of global carbon emissions”( @nytimes)</p>
Political Event	<p>“<a href="#">#climatechange</a> <a href="#">#ClimateCrisis</a> <a href="#">#GlobalWarming</a> Kamala Harris has splurged on luxury cars, airline tickets, and first-class accommodations, raising questions about the California front-runner's spending habits. One stay. One hotel. \$1,886. <a href="#">#WalkAway</a> <a href="#">#MAGA</a>”  (@KamalaHarris)</p>	<p>“I applaud his effort, but when people cannot pay their bills they don't care about climate change, and 75% of people are living paycheck to paycheck. One of the best ways of building support to combat climate change is to correct the mentality that prevents us from addressing it.” (@ABC)</p>
	<p>“I guess it's a new approach to 'tackling' climate change. Just stop measuring it. That'll do it.”  (@MikeBloomberg)</p>	<p>“I would really love to know the specific demographics, number polled, and general location of participants. All the issues are important and urgent.”  (@NewYorker)</p>
	<p>“This isn't a head in the sand plan, this is a "make as much money as we can for as long as we can while we're in power" plan. This entire administration, and the Republican support is all about money and power, nothing else.” (@RepAdamSchiff)</p>	<p>“There's plenty of real scientists who agree climate change is a natural process, not a man made one. Solar minimums and maximums. Had more to do with the sun and Earth's orbit, than carbon. The Earth is greener (trees, ect...) Than 50 years ago. "Science" has become dogma in 2019” (@washingtonpost )</p>

Trigger	Personal Handle	News Handle
Scientific Discovery	“The science is crystal clear. Unfortunately they don’t understand science and facts. Wonder what they’ll say in twenty years when they can no longer deny it? Oops sorry about the climate change stuff.” (@ChelseaHandler)	“Elect intelligent politicians who welcome scientific fact and make climate change a top priority.” (@WIREDScience,)
	“Climate change is a democratic scam (same as global warming was) to get more of our money in to their pockets. Don't fall for it. If it were so "urgent" politicians and Hollyweirdo's wouldn't be flying all over the world in private jets. Damn hypocrites!!” (@HillaryClinton)	“Well how bout you get everyone to work on something. Try a multifaceted approach. Also get Elon on a light rail or something instead of trucks.” (@WIRED)
	“There’s nothing unusual or worrisome happening with the earth’s climate. It’s an invented problem” (@BillGates)	“I remember in the late 60’s and 70’s California used to be soggy like this almost every year..Then it completely dried up this century..Now we’re back to the old days and it’s due to global warming? I’m a little confused” (@USATODAY)
Random	“It’s about government control over every single aspect of our lives. In order to do so they will impose massive taxation at our expense. Our politicians will continue to live lavish lifestyles while we are beholden to them.” (@ElizabethWarren)	“ohh that's fantastic, except the UN has been saying that for 30 years while food supplies have greatly increased Lesson being "UN warns" is always wrong...always” (@TheNewYorkTimes)
	“It is a hoax. Pole shift is real, first they called it Global warming, not very true, now climate change? Yes, with chemtrails and Haarp they have changed the climate. CO2 does NOT cause Global warming this was a blatant lie, proven by science!” (@BernieSanders)	“Everybody should be on-board when adressing and acting upon Climate crisis” (@UnitedNations,)
	“Just when I thought you were getting your self together you go and do this?! Climate change has only one solution and it’s “get out of the way and let God manage His creation”.” (@MarcoRubio)	“United nations has zero credibility” (@TheNewYorkTimes)

## Discussion

The results indicated people's response to climate change conversations on Twitter were more for argument than agreement. In most cases users commented for persuasion purposes with the intent of swaying the conversation to their side. Unlike Pearce et al. (2014), who found tweeters were likely to interact with other tweeters who shared similar views about climate change, these results indicated that, in most cases, there was a lot of back-and-forth response between tweeters with differing climate change views. It was also observed that tweets where the original tweeter used language that portrayed blame and aggressiveness towards a specific group received primarily aggressive comments and were associated with the use of bad language and personal attacks.

Unlike Anderson et al. (2017), incivility was found to be high overall in the comments to a tweet that used accusatory language and were from political figures. In this study, arguments (whether unheated, moderate or heated) were seen as the primary response to tweets from personal handles possibly indicating that users belonging to specific communities sought out or exposed themselves to influencers who held opposing viewpoints as a way to argue their viewpoint in an attempt to get the original tweeter to either agree or disagree with climate change based on their own motives. As seen with some of the pulled example tweets, due to Twitter's lax posting and content rules tweets from users that include harsh language or blaming tones can be used to incite aggressive conversation through the quote tweet or retweet feature. However, neither evidence nor reasoned debate often swayed such emotional orientations (Bennett, 2012). A study done by Anderson (2017) highlighted the need for communication research to focus on the tonal cues needed to positively engage with social media users. In this study it was hypothesized that certain tones positively engaged users who may have had little knowledge on a

subject while sarcastic or negative tones may turn people away and dismiss further engagement. Many of the source tweets in this study agreed with the threat of climate change. However, if they used aggressive or blaming tones, they invited arguments rather than educated conversation; even more so when the tweets were coming from political accounts.

Aggressiveness and blame in response to the original tweet also brought up an interesting observation regarding followership on Twitter. In this study, Twitter users did not always follow people who only agreed with them or had similar views. This finding is in line with a study by Java et al. (2007) where they categorized Twitter users as information seekers and information sources. Therefore, the availability of information may be influencing an individual's choice regarding who to follow rather than the presence of similar views because the chances of seeing a tweet from someone you do not follow or have similar interests with is very slim.

Furthermore, the results indicated political events are major triggers of climate change conversations on Twitter with most of the heated conversations coming from accounts of politicians. This indicated that politicians who have political accounts with a large following can incite debates about climate change to elicit comments from their followers who are in opposition deliberately in hopes of facilitating an argument. While news handles elicit responses from a range of user's as well, personal political handles almost always have responses from followers who oppose the original tweeter's political ideologies and talking points. Perhaps the blaming or aggressive tone frequently used by politicians works as an argument bait or challenge for users who disagree with climate change. Even though people trust media stories they get on social media from friends or likeminded peers who they perceive to be opinion leaders (Turcotte et al., 2015), this may not always be true when it comes to a controversial issues such as climate

change. Therefore, it is important to explore how communication can be used to combat ingrained political and social views to incite appropriate action in response to climate change.

### **Conclusions and Implications**

It is important to consider that credibility is a perception, and thus is not a quality inherent within a channel or source itself (Fogg & Tseng, 1999). A user's perception of a tweeter's credibility can have either a negative or positive impact on their views of climate change. While a previous study of climate change discussions over Twitter provided evidence that people tend to talk to others who are like-minded with a minority of users talking to people who share diverse views (Williams et al., 2015) our results show otherwise. The argumentative nature involved with climate change conversations primarily as a result of political influence seems to attract Twitter users to follow people with diverse views.

The conservative end of the personalized politics spectrum is heavy with references to personal freedom and highly emotional reactions in attempts to adjust the social equity balance in schools, health care, or income, which are seen as threats to that freedom (Bennett, 2012). With this in mind, we must realize that when communicating about climate change and climate science it is important to take into account how tweets coming from personal or political accounts can be seen as a threat to a user's freedom based on the tweeter's previous political history and motives. While censorship of political accounts is highly unrealistic, agricultural communicators should think about how to separate physical science from political ideals.

Climate communication from opposing viewpoints is likely to be considered as false. Therefore, to mitigate the lack of trust regarding climate change, climate change panels with nonbiased speakers, moderators and fact checkers should become the new norm instead of using climate change just as a talking point for the benefit of specific political parties.

To better reach the public through open-ended climate change conversations, information should be presented in an informational nonbiased light. Scholars suggest that language and iconic visuals that are alarmist in nature or rely on fear appeals may raise concerns but also disengage audiences (Nerlich et al., 2010; O'Neill & Nicholson-Cole, 2009). Attitudes in relation to source content was also a relevant pattern. While users may distrust science media, arguments are less likely to occur when tweets come from reported sources that provide links or pictures that back up the information. The results of this study indicated that political views shape people's reception and acceptance of scientific findings and recommendations about climate change. Therefore, it is important for communicators to pay attention to the language that they used when communicating to the public about climate change as well as the political affiliation of various climate change advocates.

Public reception of climate change messages on social media is a crucial part of how we must approach climate communication. While positive and intentional messaging is meant to engage and inform social media users, online spaces also provide an open floor for framing climate change skeptically and activating those with a skeptical perspective of climate change (Anderson, 2017). Therefore, further research determining how political ideologies, global location and living area influence or affect conversations centered around and in relation to climate change. While this study only monitored Twitter conversations in North America it would be interesting to see how climate conversations vary in other countries especially in relation to the difference in political priorities of various countries. Climate conversations based on living area may also be different. A survey comparing climate knowledge and attitude based on urban, suburban or rural living area may be worth analyzing. These further studies could help

researchers better understand how to create and increase effective global climate change messages to be distributed on social media.

## CHAPTER 4

### DETERMINING HOW CHOSEN ONLINE CONNECTIONS AND INFORMATION SEEKING BEHAVIORS ON SOCIAL MEDIA INFLUENCE CLIMATE BELIEFS AND KNOWLEDGE

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<sup>2</sup>Mayfield-Smith, Kennedy. Submitted to Sage OPEN, March 22, 2021.

## **Abstract**

Scientists must explore new pathways for communicating climate information with the rise of technology and changes in public information seeking behaviors. While social media has been established as a public news source, the individuals whom users connect with on social media, and the type of information they trust, has not been explored thoroughly. Using media dependency and the gratifications that come with using social media as a conceptual framework, this study sought to determine how online connections and information seeking behaviors influenced public climate beliefs and knowledge. To fulfill the study objectives, an online survey was used to capture how U.S. adults claim to use social media, in addition to determining climate change beliefs and knowledge. The survey included Likert-type scales, a scored climate knowledge test, and demographic items. Responses were analyzed descriptively and inferentially to determine possible relationships between variables. The results revealed the highest connectivity group were family and friends along with noncelebrities whom users trust.

Noncelebrities are not typically scientists, but influential users who have no relation or connection to respondents who still garner a high level of trust from respondents based on appealing characteristics and reputation. The respondents indicated an average amount of climate knowledge. Level of social media use and social media connections were identified as significant predictors. The results imply the rise of new type of opinion leader in online spaces whom audiences trust to accurately convey climate knowledge have the most influence. Changing the face of agricultural and environmental communication to align with social media use was identified as a next step in reaching audiences to convince them to engage in climate discussions with the purpose of furthering climate education and informed policy.

**Keywords:** climate change knowledge, information seeking behaviors, internet interactions, science communication, public engagement, climate communication, information sources

## **Introduction**

Socio-scientific environmental issues like global warming, pollution and climate change have become increasingly important (Zhang & Zhong, 2020). The negative impacts of climate change, along with its recognition as a societal issue, have made it one of the most discussed and highly contested topics on social media (Kirilenko et al., 2015; Pearce et al., 2014). Members of the millennial age group (born between 1980 and 2000; DeVaney, 2015), who are the primary users of social media, will bear the impact of today's inaction toward climate change issues and must learn how to manage and/or cope with climate change challenges (Walter et al., 2018).

Social networking sites are web-based platforms on which members can create personal profiles, articulate friendship connections, and socially interact with those outside of their physical circle (Phua et al., 2017). The emergence of social networking sites has ushered in an era of diverse media use while providing new ways for the public to build relationships and obtain knowledge. Sites such as Facebook, YouTube, Instagram, and Twitter are changing the way we communicate through their innovative features and services (Hossain, 2019). A previous study found that motivations for social networking site use included information exchange, conformity, freedom of expression, social maintenance, and recreation, with the act of making new connections as the strongest predictor (Phua et al., 2017).

Information exchange between a curated network of connections is one of the reasons social media sites are so appealing. Users can now utilize different communication resources that intersect as they operate within the same ecological system, which, in turn, creates the ability to link diverse sources together allowing the user to create a more complete information profile on

a specific topic (Walter et al., 2018). While connected information systems provide for a more holistic platform for information seeking behaviors, the current media landscape exposes individuals to a diversity of messages from a variety of sources, anywhere, at any time complicating the measurement of media exposure (de Vreese & Neijens, 2016). This is particularly important when considering the types of scientific information networks social media users have created. The wealth of information sources and variations in each user's personal network makes it hard to determine whether mainstream media is the only information resource that shapes people's opinions about science (Walter et al., 2018).

Scientists are currently questioning whether it is possible for environmental values to be transmitted through interpersonal communication, a main reason for social media site use (Ahern, 2012). A previous study done by Nelms et al. (2017), found adolescents who defined themselves as environmentalist had a higher level of environmental and scientific media exposure when compared to their peers who did not define themselves as environmentalists. They also maintained that exposure, coupled with media use, equipped those who define themselves as environmentalists with enough relevant knowledge to rouse them into engaging with pro-environmental communications. In addition, Huang (2015) reported that obtaining global warming information through news reports directly encouraged audiences to take on promotional and proactive behaviors that benefit the environment.

These findings highlight the ability of the media to encourage users to boost their environmental attitudes and levels of knowledge while increasing engagement levels in behaviors that are beneficial to the environment related to climate change. Environmental attitudes, which can be positive or private, are ideologies that are directed toward conservation and the protection of natural resources and the ecosystem (Dietz et al., 2005). Positive

environmental attitudes may be the precursors for audiences to participate in both public and private pro-environmental behaviors (Pisano & Lubell, 2017). Private environmental behaviors include buying specific products, saving energy or water at home, while public environmental behaviors include signing petitions and participating in public climate rallying events (Pisano & Lubell, 2017).

Agricultural and environmental communication scientists have expressed concern that a false balance—an argumentative approach to climate change showcasing a difference in opinions in the media coverage of climate change—has contributed to distorted public perceptions of climate truths (Koehler, 2016). Social media as a climate news information source presents new challenges. Social media channels provide a platform for scientific discussions, but also provide the foundation for the denial of scientific findings based on lax contribution rules and minimal fact checking (Lewandowsky et al., 2019). For some audiences, climate change may be perceived as a minimal issue because of the lack of trust from due to the perceived uncertainty of scientists coupled with low knowledge levels (Spartz et al., 2017). While the current scientific consensus, or agreed upon fact, is the reality of human-induced climate change, public climate change deniers and dissenters typically attack the work of others in the court of public opinion and in the mass media making it easier to cast doubt on the previously established consensus (Oreskes, 2018). Reaching a scientific consensus may shape public attitudes, behaviors and levels of knowledge related to climate change.

Perception of a scientific consensus has been found to work as a gateway belief by affecting attitudes toward climate change and public policy support (Cook et al., 2016). A *change* in perceived scientific consensus acts as a “gateway” in the sense that it predicts

smaller subsequent changes in personal beliefs and attitudes about climate change (van der Linden et al., 2015).

Scientists have attempted to combat public uncertainty by joining online platforms and posting scientific research. Sharing information with scientific consensus upheld across scientists has been shown to push public attitude toward the scientific mainstream (Lewandowsky et al., 2019). While this push is needed, the speed at which information can be shared, coupled with limitations on information gatekeeping, allows for opposed scientific opinions to be shared. The few dissenting climate change views are used to undermine the actual perception of a scientific consensus while dismissing the need for expert agreement (Koehler, 2016). Since Americans rely heavily on social media channels for information on climate change, climate change deniers use uncertainty to manufacture doubt about the level of scientific consensus through attacks on scientific data and questions of credibility. Scientists' reluctance to present their results to broad audiences has left scientific knowledge open to misrepresentation, this misrepresentation and doubt are the most effective means of reducing climate literacy levels in addition to reducing the acceptance of climate change as an issue (Cook et al., 2016; McCright et al., 2016; Oreskes, 2018; Spartz et al., 2017)

Previous studies have argued that media use may generate stronger effects of mobilization toward environmental engagement in poor environmental situations while highlighting the need for cross cultural studies that examine how environmental concerns and knowledge may be linked with self-reported environmental engagement behaviors (Zhang & Zhong, 2020). While the impact of media use on climate attitudes has been studied, there has yet to be research that analyzes if a link exists between climate attitudes driven by media use and level of factual climate knowledge. An ecological approach, where focus is placed on the

interdependent relationship of the individual in relation to the systems in which they act, must be adopted to investigate the communication resources that individuals connect with to construct climate knowledge and achieve behavioral change (Hammond, 2020; Walter et al., 2018).

### **Conceptual Framework**

This study was guided by media dependency theory and the uses and gratification approach.

#### **Media Dependency**

The rise of social media and the continued development of the internet has created a communication evolution that is consistently changing at high speeds (George, 2016). A large portion of current societal media dependency can be attributed to media convergence, the process of the development of media and communication through several overlapping eras – in which newer forms of technology disrupted and modified older forms (Campbell, Martin and Fabos, 2012). All media have now converged on the Internet, causing even more profound disruption of status quo patterns in the communication of mass information (Anim, 2013). Advancements in technology, namely device mobility, now support mediated social connectivity making each user a mobile terminus for communicative interactions (Campbell, 2012).

American industrialization has brought with it a dependence on social media for information that allows Americans to develop an understanding of the world and knowing how to act within its limits (George, 2016). Media dependency posits that media influence is determined by the connected relationships between the media, its audience, and society (Liu, 2015). Media dependency theory works on a needs system. That is, the more a person depends on media to have their needs met, the more important the role media plays in their life, which in turn sets the standard for the amount of influence the media will have over their choices (Baran & Davis, 2012).

Social media platforms appeal to audiences based on their allowance of self-curated and algorithmically determined news feeds and networks. The allowance of local and international information sources creates a unique media environment where individuals are able to express their own thoughts while simultaneously propagating messages unhampered (Melki & Kozman, 2019). Users' specific selection of news media sources may be determined by their established relationships and social values. Based on its foundational concept of trust, media dependency explores how individuals choose to selectively expose themselves to specific media outlets while also examining the formation of social values (Groshek, 2011; Melki & Kozman, 2019).

Since consistent and regular exposure to social media as a sole information source has the ability to influence cognitive and behavioral changes in audiences (Mafe & Blas, 2006) any level of doubt causes users to lean heavily on media structures for how they should react or interact with the messages. In addition, reduced clarity increases the feeling of threat in a psychological, economic or physical way which then results in increased reliance on media to provide information (Ball-Rokeach, 1985). With increased reliance on social media sources users have turned to self-deemed 'influencers' as credible information sources based on the level of trust associated with them. These esteemed users are appointed as influencers through recruitment, nomination and even appointment (Lamm et al., 2014) based on the position they hold within their target audiences. Influencers are now seen as users with a high level of trust, credibility and authority (Hansen, 2011) and the high levels of trust placed in them may have a significant role in the spread of misinformation. While media dependency highlights how the public has accepted a shift in trusted information sources, the reasons why audiences continue to use these platforms and the gratification they get from them has yet to be explored.

## *Uses and Gratifications*

The uses and gratification approach holds a unique and important role in communication studies (Quan-Haase, 2012). The foundation of the theory aims to understand the reasons and purpose for which people use media in their daily lives and has become increasingly relevant with the rise in media platforms that allow for autonomous user choice and interaction (Dolan et al., 2016; Liu, 2015). Using this foundational approach, the underlying assumption of uses and gratifications states that users are actively involved in some level of media usage (Dolan et al., 2016). While involvement in media usage has heightened, with it comes the deregulation of communication. This deregulation combined with increases in digital technology have dramatically changed the consumption patterns of audiences (Liu, 2015).

Individuals may acquire a variety of gratifications from using social media sites (Gan & Tan, 2017).

According to Petric (2011), there are four different communication purposes that describe interpersonal media use: (a) Informational-cooperative use: People get and give information, learn, disseminate information; (b) Relational use: Developing social relations, executing social norms, sustaining relations, gaining social support, and making and maintaining friends; (c) Expressive use: People express themselves, personal experiences, wishes, beliefs, self-presentation, identity, and presenting internal communication; and (d) Strategic use: People have conscious or unconscious personal aims that they can reach by communication.

While informative cooperative use is the primary focus of agricultural and environmental science communicators due to its focal point of the dissemination of information, it may not be working in their favor. The level of user interaction with informative content has actually been found to negatively impact engagement; with engagement being represented as likes, comments and

shares similar to the relation communication described by Petric (Lee et al., 2013). However, Lee et al.'s (2013) findings directly contradict what Whiting and Williams (2013) found where they maintained that 80% of their survey respondents used social media specifically to seek out information and learn new things. Both of these studies emphasized social media as an information or news source with uses and gratification theory providing the theoretical framework to better examine exactly what information seeking gratifications users obtained from different platforms and the people they connected with on those platforms.

### **Purpose and Objectives**

The purpose of this study was to determine how agricultural and environmental science communicators can capitalize on social media dependency to promote climate change awareness, increase factual climate change knowledge and encourage behavioral change. The following research objectives guided the study:

1. Describe public attitudes towards climate change, level of climate change knowledge, online information seeking behaviors, and connections on social media platforms.
2. Determine if public online information seeking behaviors and interactions on social media platforms predict attitudes towards climate change.
3. Determine if public online information seeking behaviors, and interactions on social media platforms predict level of climate change knowledge.

### **Methods**

The study presented here was part of a larger research project designed to better understand public perceptions and understanding of water resource conservation and climate change. Four sections of the survey were relevant for this specific study: respondent's climate

beliefs; attitude towards climate change; factual climate knowledge; and social media information use, sharing, and seeking behaviors.

### **Instrumentation**

A researcher-adapted instrument using previously developed scales was used. The instrument included self-evaluation, semantic differential, social, demographic, and Likert-type questions. Respondents' personal climate beliefs were measured by a multiple-choice question asking them to describe the statement that most closely aligned with their personal climate beliefs from the Six Americas scale (Maibach et al., 2011). Of the three options the first stated climate change is happening now and is caused mainly by human activities, option two stated that climate change is happening now and is caused mainly by natural occurrence, and the final option stated that climate change is not happening now.

Questions from previous studies by Vedlits et al. (2008) and Vogt et al. (2008) were used to measure respondents' attitudes toward climate change. Respondents were asked to indicate their level of agreement with eight statements using a five-point Likert-type scale (1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5 = Strongly Agree). Statements included if they were very concerned about climate change, if climate change will significantly impact their state, if climate change will significantly impact the United States, if climate change will significantly impact other countries, if they believe climate change will have a positive impact, if they believe climate change will have a negative impact, if the number of extreme weather events will increase because of climate change, and if the level of extremity of extreme weather events will increase as a result of climate change. The responses to the eight items were averaged to create an overall score for respondents' attitudes towards climate change. Reliability was calculated post hoc (.79).

Eleven true or false questions were used to determine respondents' actual climate knowledge that were deemed reliable in the Six Americas study (Maibach et al., 2011). Each response was re-coded as a one if a respondent answered the question correctly or zero if they had the incorrect answer. A straight grading scale was constructed using only those items for which there was a correct answer (Leiserowitz et al., 2010).

Respondents were then asked if they used social media to connect with family, friends, colleagues they have met face to face, colleagues they have not met face to face, non-celebrity individuals they do not know but whose opinion they value, and celebrities with a check all that apply question. Respondents then indicated whether they were more likely to connect with individuals on social media who agree with their opinions, remain neutral, or disagree with their opinions. The answers from these questions were then computed to create a new construct where the totals from each answer were added then the average was taken. This new construct was then used to determine social media connections.

To determine respondents' attitudes towards social media use they were asked to indicate their level of agreement with 13 statements on a five-point Likert-type scale (1 = Strongly Disagree; 2 = Disagree; 3= Neither Agree nor Disagree; 4 = Agree; 5 = Strongly Agree). The statements included if social media makes it easy to interact with people, if they find it easy to get social media to share information, if it easy to become skilled at social media, if it is easy to interact with others through social media, if using social media enables them to reconnect with people, if social media is useful in their personal life, if they use social media to stay informed of current events, if they use social media to learn more about issues they are concerned with, if they rely on social media to get the majority of their news, if social media is useful in their professional life, if what they learn on social media impacts the decisions they make in their

personal life, if they trust information they obtain from social media sources, and if they use social media to communicate with others. Responses to the 13 items were averaged to create an overall score for respondents' attitude towards social media use. Reliability was calculated *post hoc* (.93).

Climate science and survey design experts reviewed the survey for face and content validity. To increase validity, survey respondents were accessed through a third-party survey group, Qualtrics. Maturation and history may be threats to validity specifically with possible physiological and psychological changes in participants due to the recent global challenge presented by the COVID-19 outbreak. To ensure data quality and remove sources of invalidity, attention filters were used throughout the survey and weighting techniques applied *ex post facto* using the 2010 census data. Nonresponse procedures included the removal of respondents who did not respond to questions as required and a speed check to increase validity.

#### Data Collection

The study employed a quantitative research design to differentiate factual climate knowledge and ideology, while comparing current information seeking behaviors amongst the representative population. The research was approved by the University of Georgia Institutional Review Board (IRB #00001893) and pilot tested on 50 individuals who were representative of the population of interest based on race, ethnicity, gender and age. Data was collected in August and September 2020 from United States residents aged 18 or older who were representative of the population based on their gender, age, and race or ethnicity. Potential participants were identified through survey websites, then recruited via Qualtrics through non-probability opt in sampling (Baker et al., 2013). Nonprobability sampling is not random based on participant willingness to opt in or sign up to be in the testing pool (Lamm & Lamm, 2019). Bias may arise

from non-probability opt in sampling due to the fact that not all individuals have access to the chosen sampling methods and not all types on individuals will participate in the survey (Lamm & Lamm, 2019).

### **Population and Sample**

A total of 1,048 individuals completed the survey. Gender was fairly equally distributed between respondents with 47.9% identifying as male and 52.1% identifying as female (Table 2.1). The average respondent identified as White (85.5%), 35 years or older (78.3%) and had at least some college education (84.9%). Table one represents the demographic profile of the respondents.

#### **Table 2.1**

#### **Survey Respondent Demographics (N = 1048)**

4-year college degree	268	25.6
Graduate or Professional degree	328	31.3
<b>Family Income</b>		
Less than \$24,999	156	14.9
\$25,000 - \$49,999	195	18.6
\$50,000 - \$74,999	148	14.1
\$75,000 - \$149,999	295	28.1
\$150,000 - \$249,999	181	17.3
\$250,000 or more	73	7.8

## **Data Analysis**

Data was analyzed descriptively to determine respondent's climate beliefs and factual climate knowledge. Inferential statistics were used to determine the possible relationships between social media use and social media connectivity in relation to climate knowledge and climate beliefs using SPSS 26. Descriptive data from the answers to whom they primarily use social media to connect with and their attitudes toward social media use were then aggregated to create social media use and social media connectivity constructs to provide a holistic view of the data. These constructs were then used with an aggregated climate knowledge test score and aggregated climate beliefs construct to address objectives two and three respectively.

## **Results**

### **Describing public attitudes toward climate change, climate knowledge and information seeking behaviors on social media**

Survey respondents were asked to describe their attitudes and beliefs toward climate change (Table 2.2). More than half of the respondents agreed climate change is happening now and caused by human activities (69.8%). Other respondents indicated climate change is happening now but is caused primarily by natural forces (23.5%). A small portion of respondents indicated climate change is not happening now (6.7%).

**Table 2.2**

**Climate Beliefs (N = 1048)**

“Global warming will cause some places to get wetter, while others will get drier.” Full rate of response can be seen in Table 2.4.

**Table 2.4**

**Climate knowledge questions (N = 1048)**

**Table 2.5**

**Social Media Connections (N = 1048)**

Agree	411	39.2
Strongly agree	391	37.3

Respondents were then asked to indicate how they felt about the different aspects of social media use (Table 2.8). The majority of respondents agreed or strongly agreed on the ease that social media provides when connecting with other users (82.9%). Respondents relied on social media to obtain information (67.9%) and learn about issues they were concerned about (64.8%). While users were relying on social media to stay informed, 31% did not rely solely on social media to get the majority of their news. The item with the highest neutral answer was whether or not respondents actually trusted the information they obtained from social media websites (33.1%). The social media use responses were aggregated to create an information seeking construct score ( $M = 3.73$ ;  $SD = .78$ ).

Table 2.8

*Social Media Use (N = 968)*

Social media is useful in my professional life	14	12.4	25.8	27.7	20
What I learn on social media impacts the decisions I make in my professional life	15.2	15.7	25.9	24.5	18.7
I trust the information I obtain from social media sources	11.8	16.5	33.1	23.3	15.3

**Determining if online interactions and information seeking behaviors on social media predicted attitudes toward climate change.**

A multiple linear regression model was used to determine if respondent’s information seeking behaviors and social media interactions predicted their attitude toward climate change. The model was found to be statistically significant ( $F = 2.97, p = .00$ ) and predicted 2.4% of the variance (Table 2.9). The only significant predictors of attitude toward climate change were information seeking behaviors and interactions with friends on social media. If a respondent indicated they connected with friends on social media, there was a .13 increase toward having a more positive attitude toward climate change. In addition, the less a respondent used information seeking behaviors on social media, the more negative their attitude toward climate change.

**Table 2.9**  
**Attitudes toward climate change predicted by information seeking behaviors and social media interactions (N = 968)**

## **Determining if online interactions and information seeking behaviors on social media predicted factual climate knowledge**

A multiple linear regression was used to determine if information seeking behaviors and interactions on social media predicted factual climate knowledge. The model was found to be statistically significant ( $F = 4.28$ ,  $p = .00$ ) and predicted 2.6% of the variance (Table 2.10). Social media use and engagement with noncelebrities on social media were significant predictors. If someone indicated they connected with noncelebrities whom users trust on social media there was a .58 increase in factual climate knowledge. In addition, the more respondents used social media the greater their factual climate knowledge score.

### **Table 2.10**

**Factual climate knowledge predicted by information seeking behaviors and social media interactions (N = 968)**

information about climate change. In addition, the information gathered from social media sources influences how users interpret information and how that information influences their environmental behaviors. Baran (2003) indicated the more a person depended on having their needs gratified by the media the more the media will influence them. This is supported by the respondents' attitude toward climate when compared with their factual climate knowledge.

Americans are relying more and more on social media to inform them of important and often complex topics, such as climate change. Petrics (2011) found there were multiple reasons for interpersonal media use. Based on the results of this study, users were primarily interested in informational cooperative and relation use to reach a desired outcome. Audiences used specific communication channels and sources to better understand climate change in addition to receiving social cues on how concerned they should be about the subject.

Recent evidence from Rees and Bamberg (2014) supported the idea that perceived social norms can be used as a determiner of an individual's motivation to engage in climate protection behaviors. While a study done by Spartz et al. (2017) discussed that users can also get information directly from opinion leaders, the findings revealed that while users do connect with influencers and/or noncelebrities, their relational connections are more likely with family and friends. While this is true, users still share content from noncelebrities to their primary connection networks which in turn continue the outside influence. The finding implies how influential trusted sources, family and friends in this case, are in influencing climate behavior and factual climate knowledge.

The results also indicated knowledge obtained from social media can be skewed and/or incorrect. Forty-nine percent of users reported they primarily connected with social media users who agreed with their opinion. While previously the communication field has focused on the

concept of selective exposure in relation to election coverage, the bases of this concept is the idea that people seek out information they agreed with in order to avoid dissonance (Melki & Kozman, 2019). Attitude and the importance of subject material have both been found to strengthen the selective exposure to media that supports ideologies (Knobloch-Westerwick et al., 2015).

Respondents primarily believed climate change was occurring but there was a split between respondents who believed it was caused by human activity and those who believed it was naturally occurring. Public skepticism about anthropogenic climate change is still a marker of misinformation regarding the source of climate change (Bain et al., 2012). While belief in climate change is a starting point, the move to factual climate knowledge must still be accomplished. Out of 1,048 respondents only 67 answered all of the climate knowledge questions correctly highlighting the need for increased climate education. Since climate change has become a highly contested political topic some believe there is little reason to overcome skepticism or disagreement on climate knowledge (Sarewitz, 2011).

It is important to recognize the study did have limitations. For questions expressed as select all that apply some users did not answer or only responded to the statement 'other'. In addition, data was gathered immediately after most of the United States was under shelter in place restrictions due to the COVID-19 pandemic and during the presidential election season. Changes in environmental attitudes and climate concern may have been a direct result of political and mainstream media influence.

Despite these limitations, the findings showcase the importance of continuing efforts to reach audiences on social media. The study highlighted the relational connections that are built and maintained on social media in addition to how users find information on social media

platforms and channels. Information seeking behaviors directly predicted climate concerns and factual climate knowledge. It is essential for science communicators to further explore the connections, outside of friends and family, that may determine users' environmental ideologies and capitalize on these connections to further influence knowledge regarding climate change. A significant number of users reported they do in fact connect with noncelebrities they do not know but whose opinions they trust. From a practical perspective, noncelebrities may be worth looking into as opinion leaders who can be used to sway public opinions related to climate change. In a time when audiences are reaching out to nontraditional sources for scientific information it is important that science communicators further consider the use of social media and the power of opinion leaders within social media spaces to uphold the scientific consensus in order to maintain public trust, increase climate knowledge and encourage pro-environmental behaviors.

### **Recommendations**

The results provided insight into future research and can be used to inform current and future science communication efforts. Based on the findings, the public wants to find information on the platforms in which they already engage. The respondents exhibited an average to low amount of climate knowledge; therefore, it can be assumed the information they have obtained may be limited to what is being shared in the social media sectors they frequent in combination with who they follow. While friends and family are currently the primary social media connections that users follow, it is worth noting that connecting with noncelebrities that users trust may be worth looking into as a point of influence. Since respondents reported they primarily choose to connect with or follow other users who value their opinions, science communicators must find a way to break through these tight connections or find a way to utilize them in order to create a continued cycle of shared information.

Further research should be done to take a closer look at what makes a noncelebrity a trustworthy information source to users. Perhaps a qualitative study using focus groups could elicit information through discussions with low, average and high social media users to indicate how much influence noncelebrities have over their choice of information source. In addition, if noncelebrity sources of information could be identified, a quantitative study using social media analytics and mention tracking could inform how their information is being accessed and distributed by those who trust them as sources of climate change information.

Through these efforts, science communication researchers may be able to appeal to common traits within audience segments and use these specific sources as communication conduits to increase climate knowledge and support pro environmental behaviors. Based on the ever-changing facets of technology, and the age pockets that exist on different social media sites, it may be worthwhile to do a further breakdown of social media audiences by age to determine if connection preferences change based on age group. After completing this breakdown, science communicators could better tailor messages to specific audiences based on their preferred social media connections and channels.

## CHAPTER 5

### DISCUSSION AND RECOMMENDATIONS

The purpose of this mixed methods study was to explore climate change dialogue on social media and how science communicators can capitalize on social media dependency to promote climate change awareness, increase factual climate change knowledge and encourage behavioral change. This chapter includes a discussion of the major findings in relation to current media dependency and social media usage and gratifications literature and how those findings may impact future science communication and research by wholly addressing the research objectives:

- RO1. Identify what triggers conversations about climate change on Twitter.
- RO2. Describe public comments and reactions toward climate change on Twitter.
- RO3. Examine the relationship between the triggers of conversations about climate change and public comments toward climate change on Twitter.
- RO4. Describe public attitudes toward climate change, level of climate change knowledge, online information seeking behaviors, and interactions on social media platforms.
- RO5. Determine if public online information seeking behaviors and interactions on social media platforms predict attitudes towards climate change.
- RO6. Determine if public online information seeking behaviors, and interactions on social media platforms predict level of climate change knowledge.

## **Interpretation of Findings**

While large online social media communities provide a platform for information distribution and reception, the lack of gatekeeping leads to streams of misinformation shared as fact with little scientific recourse (Treré, 2012). Based on the findings from these studies many users share information online with others and are ready to defend their stance even if their findings are not grounded in a factual source.

Results from both the qualitative and quantitative studies indicated users on social media are often arguing above their climate change knowledge level, which leads to more confusion and often warring opinions on the topic. The current social media norms that come with platforms like Twitter also make it easier for groups of individuals to lean heavily on one side of an argument, even forming communities solely around that opinion, in an effort to primarily target those who disagree with their communities' opinion. In addition, who users choose to create online communities with is very different when compared to who they are trying to persuade. Currently, groups consist of like-minded individuals (particularly friends and family) but more and more users are relying on outside sources they deem trustworthy to guide their opinions and support their ideologies.

## **Point to Prove**

The findings indicated responses to climate change were primarily for argument rather than agreement. Pearce et al. (2014) found Twitter users were more likely to engage and interact with other users who share their viewpoints and opinions about climate change. The findings from this study contradicted what was previously found. Users sought out conversations where they attempted to prove their viewpoint with the intent of disproving the opposing viewpoint;

particularly in reference to the severity or even “realness” of climate change. Instead of putting them off, users who found comments with an opinion differing from their own encouraged them to argue through the use of quoted scientists, scientific articles, graphs and even audio clips that proved why their reasoning was correct.

The argumentative schema was especially prevalent in regard to tweets that came from accounts relating to or representing political figures at any level. Climate change has become a highly politicized topic instead of a scientific one with references to limitations or threats to freedom and higher taxes instead of scientific facts (Bennett, 2012). Due to the complexity of climate change itself, combined with the identities represented by climate change believers and non-believers, users look to others in their respective communities for cues or social norms that determine how they should feel about the subject (Rees & Bamberg, 2014). The findings from this study also indicated 49% of user’s self-reported they primarily connect with social media users who agree with their opinion. Becoming locked into a community can limit the introduction of new information while simultaneously sharing information perceived to be a fact in their own personal feeds.

Since the study focused only on climate conversations in North America where climate policy is lacking and has not been wholly accepted as a bipartisan issue, it would be worthwhile to compare and analyze climate conversations from a range of countries with more progressive climate allocations and policies. Monitoring conversations on a larger scope could allow researchers to determine if there is a difference in conversations and reactions to information sharing from users outside of another users perceived social bubble particularly when faced with information that is wholly accepted.

## **Increases in Climate Knowledge**

In both portions of the study, the lack of factual climate knowledge was apparent. In the first study, climate misinformation, or lack of knowledge as a whole, was seen in the way users represented their climate opinions, particularly when battling with those who agreed. The primary arguments amongst climate deniers included claims that the climate has always been changing and that this is no different, liberal politicians are using climate change as an excuse to raise taxes or simply the fact that it does not exist. These argumentative positions were mirrored within in the second study where a population representative of the public had their actual climate knowledge tested along with their opinions and beliefs about climate change. Out of 1,048 respondents only 67 respondents or 6.3% of the respondents were able to answer all of the climate knowledge questions correctly.

The results not only indicate the general public does not have a holistic understanding of climate change as an issue, but they are lacking the factual knowledge to make informed decisions about the subject. While the test results may be discouraging, 69.8% of users actually believed climate change was happening now, caused by human activities. This large percentage seems to be almost polar opposite of what was represented by conversations on social media where users were primarily disagreeing with not only the existence of climate change but the cause. Since much of climate denial is shown to be a result of misconception or misunderstanding, researchers are tasked with presenting evidence in a clearer more convincing way that clearly outlines the problem.

## **Social Media Connectivity and Influence**

It is important to consider when interpreting the results from both the self-reported and observational study who users think they are choosing to interact with versus what their behavior is revealing. The majority of respondents indicated they primarily form social media connections with those in their primary circles, including friends, family and colleagues they have met. A rising social demographic is emerging though, the noncelebrity. Unlike the previous categories, users do not personally know these individuals, yet they value their opinions more than celebrities and even colleagues they have not yet met. The majority of respondents agreed or strongly agreed with the facets of social media that make it easy to interact with and even obtain information from others. While users are stating they rely on and use social media to stay informed of current events and issues, they are concerned there is a high variance in how much users trust the information they obtain from social media sites. After analyzing how users' online interactions and information seeking behaviors may predict factual climate knowledge it was determined that for every increase in connections with noncelebrities who users trust, there is an increase in factual climate knowledge. In addition, the more a respondent used social media the greater their factual climate knowledge level.

If users neither agreed nor disagreed about how much they trusted information obtained from social media sources how might interactions with noncelebrities impact climate knowledge? Previous literature focuses on the prevalence of echo chambers on social media (Elsasser & Dunlap, 2012) but is only partially supported. In the first study users went out of their way to voice their climate opinion, or what they perceived to be facts, underneath tweets of accounts of users they disliked and often times did not even follow. This directly contrasts with

the self-reported portion of the study where respondents stated their primary connections were with other users who shared their opinions.

## **Recommendations**

The recent trend of increasing denial suggests relying on ‘converting’ climate change deniers may not be a successful or timely strategy. Broadening the debate to encompass outcomes that are related to deniers’ willingness to act, and which are already accepted by many deniers, may be more likely to foster the widespread consensus and support that governments need to enact effective mitigation policies (Bain et al., 2012). The results from both studies provided insight into how social media can be used as a communicative tool to increase climate knowledge while also fostering a new relationships or partnerships with sources that users deem credible.

The respondents of the Twitter study demonstrated little amounts of credible knowledge while the respondents of the general population study demonstrated average climate knowledge. These differences may be representative of the observational knowledge of the Twitter study in addition to the self-reported habits and age group of the general population study. Friends and family currently make up the primary connection points based on the interactions seen in the Twitter study and the rising trust of noncelebrities as points of credibility and influence may be worth analyzing as a source of environmental change and influence. Based on the findings, close social connections are the highest level of influence with little room for users that respondents did not know.

Determining how the level of influence impacts different age groups through a more age-specific survey or focus group would also further the line of inquiry. Breaking down social media use analytics using audience segmentation may show difference in influencer impact and

trust in nontraditional media sources. To better disseminate climate information science communicators must find a way to break through tight knit connective channels to spread information more effectively on social media.

With social media users being deemed influencers based on follow count and reach, the sources of information that users turn to each day play an important role. Further research could be done exploring what makes noncelebrities a trustworthy information source to users, particularly among different age groups. Through these additional efforts, science communicators may be able to appeal to common traits within audience segments and use these specific sources as communication conduits to increase climate knowledge and support pro-environmental behaviors.

## **Conclusions**

Both climate deniers and believers evaluate climate change, yet the frameworks they use to do so are inherently different. Instead of relying heavily on scientific truths and evidence, a large portion of climate opinions, and even what is perceived to be knowledge represent a public expression of a user's values and political or ideological allegiance (Bain et al., 2012). Based on this, it can be concluded the increased reliance on social media as a news source has altered the way the public seeks out and consumes information about climate change. A user's perception of a credible news source can have either a negative or positive impact on their views of climate change.

While a previous study of climate change discussions over Twitter provided evidence that people tended to talk to others who were like-minded with a minority of users talking to people who share diverse views (Williams et al., 2015) our results showed otherwise. In addition, the information gathered from social media sources is influencing how users interpret information

and how that information influences their environmental behaviors. The findings imply that influential trusted sources, family and friends in this case, are influencing climate behavior and factual climate knowledge. Public reception of climate change messages on social media is a crucial part of how climate communication must be approached. While positive and intentional messaging is meant to engage and inform social media users, online spaces also provide an open floor for framing climate change skeptically and activating those with a skeptical perspective (Anderson, 2017).

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