Environmental Rhetoric and Social Media

A Major Qualifying Project
Submitted to the Faculty of Worcester Polytechnic Institute
In partial fulfillment of the requirements for the degree in
Bachelor's of Science in Professional Writing

Submitted by
Jia Yazon

Submitted on
April 25, 2024

Project Advisor
Sarah Riddick

WPI

ABSTRACT

The climate crisis raises many crucial and urgent questions on what we have to change and how we can make those changes. However, climate communication is often less accessible for public audiences than for political, industrial, and academic leaders (also referred to as the "Triple Helix") because it is not written in understandable ways and is often not widely circulated. Thus, in this project, I investigated how scientists can make climate science information more accessible to the public through social media. First, I rhetorically analyzed different forms of climate communication, then I conducted a survey to gather data on public perceptions of climate topics. Next, I drafted a portfolio of Instagram carousel posts that discuss a climate science topic: biofuels. I conducted multiple rounds of user-testing to guide the portfolio's development and to gather more information about what audiences prefer in climate posts on social media. Overall, I found that participants cared most about credible information and that rhetors can communicate that credibility through tone, language, and visual design.

Key Words: Social media, environmental rhetoric, visual rhetoric, renewable energy, biofuel, Triple Helix

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1. Introduction

The climate crisis raises many crucial and urgent questions on what we have to change and how we can make those changes. In our efforts toward sustainability, climate science plays a crucial role. However, climate science remains a "black box" to the public, due to the inaccessibility of climate information. For example, scientific research is often written in ways that are intended to communicate with other scientists; this research presents specialized scientific language that is difficult to understand for non-scientists.. Additionally, industries, academics, and the government typically keep scientific information behind paywalls and databases, further distancing the public from scientists' knowledge about topics like climate change. Throughout this project, I explore social media as an optional medium through which scientists can communicate to public audiences about progress related to addressing climate change, which I refer to as "climate progress."

Communication about climate science is largely inaccessible, both because it is often behind a paywall and it is often written in a way that public audiences can't easily understand. Thus, the public has limited knowledge about climate progress, thus allowing science to play an authoritative role over public knowledge. This phenomenon of scientific authority has been a "longstanding interest" for scholars (Ramírez-i-Ollé 387). Rhetorician Lynda Walsh explains one theory: the entanglement of science in academia, government, and industry, or the "Triple Helix," gatekeeps scientific knowledge from the public (18). The disempowered role of the public in climate discourse thus creates risks for the spread of misinformation and climate anxiety among the public (Schmidt; Williams and Jaftha; Smith).

However, social media creates a channel for communication between the Triple Helix and the public. For example, industry and government commonly use these platforms for marketing and campaign strategies (Safiullah et al.; Bashar et al.). On the other hand, the public are able to engage in political and industrial matters by using social media platforms for organizing and assembling collective efforts (Stahl and Literat). Social media platforms thus create many opportunities for climate communication that is more inclusive of public audiences.

In this project, I explore how scientists can effectively communicate about climate change and climate progress through social media. In doing so, my project also addresses certain questions regarding the significance of how key terms and phrases function as symbols within environmental rhetoric, including the terms *carbon*, *fuel*, and *science*. Who do we tend to blame for environmental issues? Which ideas do we value? What do we fear? And most importantly, how can scientists make information more readily available and understandable for non-scientific audiences? These are the questions I hope to investigate with this analysis.

Through this project, I use multiple methods to investigate environmental rhetoric and social media. First, I analyzed current climate communication to understand how rhetors currently talk about this topic. Then, I conducted a survey to see how public audiences tend to think about climate topics. Finally, I experimented with creating Instagram posts and conducting multiple rounds of user-testing. Overall, through this project, I aimed to promote a more holistic and sustainable approach to climate communication by making climate science and information more accessible to the public through social media.

2. Background

As we address the climate crisis, we face the rhetorical challenge of *communication*. For us to find climate solutions, we must rely on experts in academic, political, and industrial fields to communicate between each other to make climate decisions (Sato). Without clear and honest communication, progress with climate action will cease.

Climate rhetorician Lynda Walsh (2019) explains that what we tend to overlook in this rhetorical challenge is how academic, political, and industrial experts communicate to the public about the climate crisis. This process occurs through various mediums—online platforms are one of the more accessible mediums. However, I argue that (1) our current methods of addressing climate communication are unjust and unproductive, and that (2) social media can be an effective tool for conducting effective public communication and for addressing this issue.

2.1 The Triple Helix and Unjust Communication

To understand the injustice of current communication, we must first recognize that we specialize knowledge into different fields, such as academia, politics, and industry. Walsh warns us that by separating and specializing knowledge, we limit the information that the public can receive. This power imbalance essentially oppresses the masses from pertinent climate information.

The three fields of academia, politics, and industry are parts of the "Triple Helix," a sociological knowledge model proposed by Loet Leydesdorff and Henry Etzkowitz in 2000. The Triple Helix models the flow of knowledge between universities, government, and industries. With this flow of information, the Triple Helix allows for economic development.

We can observe how each strand of the Triple Helix acts as a gatekeeper of knowledge. For example, the government and politicians have direct control over what they communicate to their constituents. Likewise, industries and businesses keep information contained within their companies. Lastly, universities and scholars limit accessibility to their research behind paywalls and language that is hard to understand. As a result, the entanglement of the Triple Helix leaves civil society out by controlling the information the public can receive. Not only does this system severely marginalize civil society, but it also grants disproportionate influence to scientific rhetoric over the general public.

In 2009, Elias Carayannis and David F.J. Campbell observed that the Triple Helix leaves out a major source of knowledge: "civil society," or the general public. In an attempt to modify the Triple Helix, Carayannis and Campbell have proposed a new model to include the public as an additional pillar of knowledge: The Quadruple Helix. Walsh, however, claims that the Quadruple

Helix model does not accurately reflect the imbalance of power between the original Triple Helix and the added strand of "civil society." She states, "[I]t doesn't matter how many strands get added [to the Triple Helix]—the [entanglement of state, industrial, and academic actors] will still act as gatekeeper on climate knowledge and communication" (Walsh 18). For this reason, I will refer to the "Helix" models of knowledge as just the Triple Helix, as it is the system that persists in our society.

2.1.1 Greenwashing and Scientific Authority

In her analysis of the Triple Helix, Walsh also implores her readers to reconsider and criticize the authority we have granted science in climate communication. The Triple Helix gatekeeps knowledge in general from the public, but it especially values and gatekeeps *scientific* knowledge. In the same way that scholars, politicians, and industries hold authority over the masses, *science* also has a similar relationship to the public.

We can observe scientific authority in many ways, such as the phenomenon of "greenwashing" and "science-washing" in marketing practices. Greenwashing is the manipulation of scientific rhetoric to make products or ideas more appealing to consumers who may be more conscious of climate issues (Gatti et al.; Bowen and Aragon-Correa). Particularly on social media, which provides efficient and almost immediate exposure to information, there is potential for spreading misinformation, such as "greenwashed" advertisements (Dolega et al.). For example, the clothing company *H&M* markets a large portion of their products as "sustainable," when in reality around 60% of their claims were classified as "misleading" by the Changing Markets Foundation in 2021 ("Synthetics Anonymous"). These misleading claims ultimately helped *H&M* appeal to consumers who would otherwise be wary of similar "fast-fashion" brands.

There is a similar practice in the beauty industry called "science-washing." Science-washing also relies on scientific authority when marketing products to consumers (Brown). The practice uses scientific and medical terms, such as chemical names or the various "health vitamins," in order to create a sense of credibility and "transparency" on product ingredients and their benefits. However, these claims can also be purposefully misleading. One cosmetic chemist, Ron Robinson, describes science-washing as the "belief that science is absolute," highlighting the dependence of marketing misinformation on scientific authority (Brown).

From these examples, we can infer that scientific authority is rooted in public unfamiliarity with scientific concepts—in other words, science only has authority among public audiences *because* the Triple Helix deprives civil society from scientific information. This authority is the result of the unjust system of communication that is the Triple Helix.

2.2 Discouraging Civil Society from Climate Action

Another consequence of our current system of climate communication is escalating climate anxiety. By limiting our knowledge on the climate crisis, the Triple Helix system removes power from the general public to have a substantial impact as individuals. This powerlessness ultimately discourages public engagement.

On a basic level, individual civilians lack significant power in regards to the environment. Individuals who hold higher positions of power in the more obvious circumstances, such as policy-makers, have more direct control over decision-making for the climate. However, there are more subtle effects from the gatekeeping of climate information from the public. In other words, as climate anxiety heightens, there is a growing effect of *discouraging* the public from engaging with climate issues (Aitken et al.).

First of all, the majority of climate communication is through a one-way transfer of information from experts (e.g., academic researchers, policy-makers, and industrial leaders) to the general public (Wullenkord et al.). This communication takes place through television, newspapers, and social media. As these mediums mainly limit communication to a one-way flow, the public must take extra steps to get involved in the discussion by reaching out to policy-makers and/or to collaborate with other civilians to attract the attention of global leaders. However, whether people actually take climate action may depend on how powerless or anxious they feel (Williams and Jaftha).

It might be easy to assume that feelings of anxiety would hinder climate efforts; however, studies on climate anxiety and climate denial imply differently. Marlis C. Wullenkord et al. (2021) conducted a study that showed a positive correlation between climate anxiety and personal intentions to make environmentally-conscious decisions. Similarly, a study by Daniela Maran and Tatiana Begotti (2021) revealed that those with climate anxiety were more likely to believe in the greater impact of smaller, individual actions. Although it may seem that climate anxiety correlates with *positive* action, it still poses risks to the productivity of climate discourse.

Feelings of climate anxiety, or any anxiety, are rarely pleasant or sustainable. However, climate anxiety may increase with more frequent exposure to climate news and information, and too much anxiety may have detrimental effects on mental health. For example, Charles Schmidt (2023) explains that while anxiety is an essential motivator for making change, there are risks for those who cannot manage their anxiety. This inability may result in "emotional paralysis" and "[a spiral] into distress." Matt Williams and Bruce Jaftha (2020) support this claim with data on the relationship between "powerlessness" and climate inaction; their research suggests that as participants felt more "powerless," they were less likely to engage in climate action. Additionally,

Carien Smith (2022) argues that with too much exposure and anxiety, we risk desensitizing the public to the severity of the climate crisis, which may result in public "inaction in responding to the problem" (2). As a result, messages intended to stir action and urgency may actually work *against* the goal of spreading climate knowledge, creating an unproductive system of climate communication.

2.3 Empowerment through Social Media

Scholars, scientists, and engineers have the capacity to participate in public discourse by making information more accessible *and* more encouraging. One way to do so effectively is through social media.

Communicating about the climate through social media can be especially effective for younger audiences. The importance of social media on youth culture is undeniable, especially after the 2020 COVID-19 pandemic forced much of social, educational, and political interaction online. Catherine Cheng Stahl and Ioana Literat (2023) describe social media's role as an "outlet for youth expression, civic engagement, political participation, informal learning, and collective meaning-making" (928). In other words, social media serves as a platform for interdisciplinary and intersectional discourse, essentially challenging the separation of knowledge into specialized fields through diverse communication.

From a rhetorical standpoint, Stahl and Literat also describe how social media serves as a two-sided window. For youth audiences, social media provides insights into current events and global discourse. On the other hand, for rhetoricians, social media provides insights into youth culture, behaviors, and beliefs. I will use this lens to study how different rhetors use social media as a platform to educate, inform, and motivate audiences in the context of climate change.

3. Methods

My goal for this project was to explore how climate scientists can communicate to the general public. I pursued this goal by using the following methods and objectives:

1. Rhetorically analyze public climate communication.
2. Conduct a preliminary survey about climate content on social media.
3. Develop a portfolio of social media content about a climate-related topic, biofuels.
4. Conduct three rounds of user-testing for the portfolio.

In the following sections, I describe each method and their procedures.

3.1 Rhetorically Analyzing Public Climate Communication

To begin my study, I rhetorically analyzed instances of environmental discourse. I focused on the relationship (or lack thereof) between two of the four categories in Carayannis and Campbell's "Quadruple Helix" model: academic knowledge and public knowledge. For my analysis, I chose three forms of public communication: academic research articles, news outlets on social media, and activist social media accounts. Because scholars, news outlets, and activists have their own specific purposes and target audiences, I wanted to investigate how each genre uses rhetorical strategies. My methods of analysis included cluster criticism and visual analysis, each providing insight to the narratives that audiences may perceive.

Cluster criticism, based on work by Kenneth Burke, focuses on *symbols*, such as words, items, and images, and on how the relationships between symbols affect the overall message in a text. Sonja Foss (2017) describes the analytical process as "charting the symbols that cluster… key symbols," or in my case, words that cluster together other keywords within a "rhetorical artifact" (63). Burke's description for this method is taking note of "what subjects cluster about other subjects (what images *b, c, d* the poet [rhetor] introduces whenever he talks with engrossment of subject *a*)" (Foss 63).

For the more subtle and visual aspects of climate rhetoric, however, I used visual rhetoric. Sarah Kornfield (2021) defines visual rhetoric as a tool for understanding ideologies and conclusions communicated through visual features (218-219). In other words, visual rhetoric is an especially helpful tool for understanding the more subtle messages in rhetoric. The process of visual rhetorical analysis involves listing the visual features in an artifact, then exploring multiple interpretations for each feature until a narrative becomes apparent.

For the first category of academic rhetoric, I analyzed two academic research papers. I specifically analyzed the abstracts and introductions of these papers to understand how they describe the greater context of climate change. I chose these papers because they discuss biofuels, a form of renewable energy that I planned to write about as part of this project. The authors of these papers are researchers in renewable energy. In one paper, Giulia Zoppi et al. (2022) report their findings on a biofuel production process called Hydrothermal Liquefaction (HTL). In the other, Heather O. LeClerc et al. (2023) investigate the process of reforming the HTL's toxic aqueous phase byproduct (AP) through Aqueous Phase Reforming (APR).

For the next category of news outlets on social media, I analyzed two accounts on Instagram: Post Climate (@postclimate from the *Washington Post*) and Inside Climate News (@insideclimatenews from *Science Insider*). These accounts focus on news about the environment, so I chose one post from each account. The post from Post Climate (2023) reports "Nations made bold climate pledges. They aren't close to meeting them." Then, the post from Inside Climate News (2023) reports about an Alabama coal plant as the "worst greenhouse gas polluter" in the United States (@insideclimatenews, "An Alabama").

Finally, for the third category of activist social media, I analyzed two activist posts on Instagram. One post, created by Environment (@environment) and Impact (@impact) (2023), discusses the failure of Canadian political leaders in fulfilling their climate promises (@impact, "Canada is"). The other post, by Impact and Climate Power (@climatepower), celebrates the increase in jobs in the clean energy field thanks to the Inflation Reduction Act (@impact, "Good news").

After using the methods of cluster and visual analysis, I drew two main conclusions. First, I concluded on how climate rhetors in academia, news, and activism balanced visual vs. verbal strategies. Then, I concluded on the narratives academic, news, and activist rhetors portray about the climate crisis.

3.2 Conducting the Preliminary Survey

Once completing the above rhetorical analysis, I began to collect data via a preliminary survey about environmental content and social media. I received IRB approval to distribute this survey, which had a combination of multiple-choice and open-ended questions (Appendix A). I formatted the survey on a Google form and advertised it on my personal social media account. Additionally, I sent the form to various groups on campus through WPI servers on Discord and Slack to get a diverse pool of participants. I also invited people not from WPI to participate in the survey by sending it to off-campus group servers.

My goal for this survey was to understand which assumptions people may have about the climate crisis. For example, I asked participants to list words they associate with certain topics, such as "fuel" and "carbon." Next, I asked the participants to describe how they feel when they encounter environmental content online. Then, I analyzed their responses by coding and categorizing which patterns emerged. For example, responses to the term "carbon" included "pollution," "global warming," and "emissions," or "element," "diamond," and "organic." I decided to separate these terms into two categories: environmental concern and physical science. For "carbon," I was able to group everything into four main categories. I attempted to sort the responses for this section into as little categories as possible, which was often four. However, the number of categories varied for other terms, such as fuel, which had five categories.

To account for the influence of external factors on response patterns, I also asked participants to provide some demographic information, such as academic majors and fields of profession, and I considered this information throughout my coding process. Overall, this method helped to identify patterns in public perceptions of and reactions to the climate crisis.

3.3 Creating a Portfolio of Ideal Social Media Content

Based on the findings from my rhetorical analysis and preliminary survey, I drafted a portfolio of social media posts about the environment. I created these posts on Canva, then published them to a public Instagram account I created for this project to allow the audience to interact with these posts through the Instagram interface. While developing the portfolio, I updated the posts on Instagram to be the newer iteration for user-testing purposes. Finally, once I completed the entire portfolio, I displayed the portfolio through its three stages on the Instagram account.

I chose Instagram for the platform's 'carousel' feature, which allowed me to upload multiple images in a single post. This format allows the audience to swipe through the images on their own. Additionally, I used the caption feature, which is the verbal text that Instagram presents below the image or carousel of a post.

Each of my posts presented the same information about biofuel technology and research. I designed each post to have a distinct style or purpose, emulating specific rhetorical strategies I identified within academic, news, and activist environmental communication. A table of the name and purpose of each of my drafted posts is shown in Table 1.

There were three phases of developing the portfolio: drafting the cover images of Posts 1-3, creating the full versions of Posts 1-3, and creating Post 4. Each phase included one round of user-testing, as displayed in section 3.4. I intended for Posts 1, 2, and 3 to follow the typical characteristics of an academic, news, and activist post, respectively, then for Post 4 to combine

features of each category to create a more "ideal" version of environmental social media content. To view the development of the portfolio, refer to the additional file, "Social Media Portfolio."

Table 1. The name and purpose of each post in the portfolio

POST	PURPOSE
Post 1	Academic
Post 2	Informational, News
Post 3	Activist
Post 4	Subverting the Three Categories

3.4 User-Testing the Portfolio and Understanding the Audience

While creating my portfolio, I conducted three rounds of user-testing (Appendix B). By adding this step to my portfolio revisions, I gathered outside perspectives to guide the development phases of the portfolio drafts. Each round of user-testing corresponded to a phase of the portfolio draft, as shown in Table 2.

Table 2. Phases of user-testing and the phases that were tested. Each phase had different content to present to participants, as well as their own user-testing formats.

PHASE	CONTENT TESTED	METHOD OF TESTING
Phase 1	Post 1-3 (Cover Images)	Informal In-Person Interviews
Phase 2	Post 1-3 (Complete Posts)	Google Form
Phase 3	Post 4 (Complete Post)	Google Form

4. Results

Through my research, I collected data on what social media users value the most when it comes to online climate discourse. In the following sections, I describe my findings from: (1) rhetorically analyzing academic, news, and activist communication; (2) conducting a preliminary survey; and (3) drafting and user-testing the portfolio.

4.1 The Rhetoric of Climate Discourse

I rhetorically analyzed the following sources, displayed in Table 3.

Table 3. Sources used for the rhetorical analysis

Category	Source	Source Topic Description
Academia	LeClerc et al. (2023)	Research on Hydrothermal Liquefaction (HTL), a biofuel-making process
	Zoppi et al. (2022)	Research on reforming HTL's aqueous phase. The process is called Aqueous Phase Reforming (APR)
News	@postclimate (2023)	Global leaders failed to fulfill climate pledges
	@insideclimatenews (2023)	"An Alabama coal plant is the US's worst greenhouse polluter"
Activism	@impact, @environment (2023)	"Canada is on track to fail its 2030 climate target… Here's how you can change that"
	@impact, @climatepower (2023)	"Good news! Over 170,000 clean energy jobs have been announced"

4.1.1 Cluster Analysis

In my cluster analysis of academic research papers, I found that academic researchers tend to write with feelings of empowerment and hope. For example, LeClerc et al.'s (2023) main key term was "HTL," or hydrothermal liquefaction, an engineering process that makes biofuels. As Table 4below shows, clustering words for "HTL" were "convert," and "under-developed." Similarly, Zoppi et al.'s (2022) key term was "APR," or aqueous phase upgrading, which is a process that extracts more value from HTL's wastewater. Zoppi et al. cluster their key term, "APR," with words like "able," "convert," and "exploit" (1). These clustering terms create a tone that emphasizes the *ability to manipulate* the physical world through science and technology. In other words, scientists tend to emphasize their agency as they have the means (the science and

technology) to "convert" materials, to "develop" these engineering processes, and to "exploit" the uses of these processes.

Table 4. Example sentences of academic communicators describing chemical processes

Source	Example Sentences
LeClerc et al.	"**HTL** has been studied for the <u>conversion</u> of… <u>waste</u> feeds into an <u>energy-dense</u> biocrude" (2427) "**HTL**… a promising, yet <u>under-developed</u> area to maximize obtainable yields" (2428)
Zoppi et al.	"[**APR**] [is]... <u>able</u> to <u>convert</u>…" (224) "[**APR**] <u>exploit[s]</u> the… [<u>carbon</u>] content and reus[es] it…" (224) "[**APR's**] <u>potential </u>is noteworthy" (224)

It is interesting to note that these researchers use "exploit" in a more objective way, focusing on the direct impacts of the technology they are researching. According to Dictionary.com, "exploit" means "to utilize," "to use selfishly," or "to advance." Typically, audiences would perceive "exploit" with more selfish connotations due to its frequency in phrases such as: "businesses [*exploit]* their workers." Therefore, the way that Zoppi et al. avoid the typically negative connotations in words like "exploit" reveal more details about academic communication in general.

Similarly, these two papers created feelings of hope by highlighting opportunities despite the urgency and pressure of the climate crisis. For example, both papers used words like "promising," and "potential," which emphasize the hope that goes into scientific research. LeClerc et al. goes further with this concept by clustering typically negative terms, like "carbon" and "waste," with the phrase "energy-dense." Essentially, Leclerc et al. redefines the traditionally 'villainous' roles of "carbon" and "waste" in climate rhetoric as sources of opportunity.

It is important to note, however, that these papers do not create positive outlooks through positive language. Rather, these rhetors write with objective and neutral language, using less nuanced forms of certain terms, such as "carbon," "exploit," and "waste." Therefore, this analysis suggests that these academics create moments of empowerment by emphasizing the agency and freedom that science provides, while still using objective and neutral language. As a result, academia tends to subvert the negativity of the climate crisis as areas of opportunity and development.

Table 5. Example sentences of academic communicators describing chemical processes

Source	Example Sentences
LeClerc et al.	"**Waste streams** offer a[n]... low-<u>carbon</u> emission, <u>energy-dense</u>

	source to… fuels" (2427) "By <u>utilizing</u> **waste**… there is a <u>potential</u> to <u>reduce</u> <u>greenhouse</u> <u>gas emissions</u> by over 2.4% in the United States" (2427)
Zoppi et al.	"**Carbon**-laden aqueous streams… should be <u>valorized</u> to <u>reduce</u> environmental concerns" (224) "<u>Conversion</u> of **carbon**-rich industrial wastewater into hydrogen or <u>value-added compounds</u>" (224)

Among the two news posts by @postclimate and @InsideClimateNews, I found that they present a more critical perspective on climate, as displayed by their writing in Table 6. For example, @PostClimate clusters "carbon" with "climb," and "new records," depicting the alarmingly high levels of carbon dioxide currently in the atmosphere. @InsideClimateNews also described carbon dioxide and greenhouse gases using "polluter," and "trap," emphasizing the negative effects of carbon dioxide in the atmosphere.

Table 6. Example sentences of @postclimate and @insideclimatenews

Source	Example Sentences
@postclimate	"Levels of methane [greenhouse gases, **carbon**] in the atmosphere continue to <u>climb</u> to <u>new records</u>" "**Countries** are <u>still far</u> from meeting [their] <u>much-hyped promises</u>"
@insideclimatenews	"Greenhouse gases [such as **carbon** dioxide]... **trap** heat in the atmosphere" "The [**Alabama coal**] **plant** is the <u>single largest</u> greenhouse gas <u>polluter</u> in the United States"

Not only do the news accounts focus heavily on the alarming state of the climate crisis, they also direct blame to certain people and organizations. PostClimate emphasizes "nations" or "countries" (i.e. global leaders) as main climate actors, and criticizes them for their failures. They explain that many leaders' "promises" are "much-hyped," and "far" from being fulfilled. Similarly, InsideClimateNews depicts the coal and energy industry as a source of the climate crisis, describing an Alabama "coal plant" as the "single largest . . . contributor" of "greenhouse gas[es]." These two climate news accounts show a much more pessimistic view of climate issues by highlighting alarming climate news, and *villainizing* political and industrial leaders.

Lastly, the two activist posts by Impact, ClimatePower, and Environment displayed an approach that balances the hope found in the academic research articles, and the critical view from the news posts. For example, as shown in Table 7, the post by Impact and ClimatePower

acknowledges that the "fossil fuel industry" is largely responsible for the climate crisis, but also directs the reader to a possible solution: "clean energy." Specifically, they describe "clean energy's" role in making a "better future." Similarly, the post by Impact and Environment highlights Canada's unfulfilled climate pledges, by noting how "companies" are "responsible" for "emissions," but then reminds their audience that they can "take action now" in the same post. In certain ways, the activist posts were similar to the news posts by painting political and industrial leaders as *villains*. Then, the activist posts used a similar stance as the academic articles by creating positive and empowering messages. However, these messages were for their *audience* to take action.

Table 7. Example sentences of @impact, @environment, and @climatepower news

Source	Example Sentences
@impact and @climatepower	"By shifting to **clean energy**, <u>we</u> can reduce our reliance on **fossil fuels**, one of the <u>primary drivers</u> of <u>climate change</u>" (5) "**Clean energy** jobs… [equals] a <u>better future</u>" (caption)
@impact and @environment	"**Canada** is on track to <u>fail</u> its 2030 climate target" (1) "**Oil and gas companies** are <u>responsible</u> for the <u>biggest share of emissions</u> in **Canada**" (4)

Overall, these three categories differ through their approaches to communicating about the climate crisis. The results of the above cluster criticism suggest that academic research is more hopeful and empowers scientists to take control of climate issues; news outlets are pessimistic and critical of influential leaders' failures to take climate action; and activist accounts balance criticizing the climate crisis by empowering their audiences to partake in climate action. These differences affect how each type of rhetor communicates information about the climate crisis to their audiences, and ultimately the insights they grant their audiences into environmental issues.

4.1.2 Visual Rhetoric

As expected, my visual analysis of academic papers was not very complex. Both papers used a simple color palette of black text on a white background. There is little information portrayed through images or visual symbols, emphasizing how much more academic researchers value verbal communication. These visual design choices also reveal how academic researchers prefer straightforward and 'neutral' communication. Additionally, the two texts were fairly dense, formatted into multiple columns on a page with little spacing between the lines. The font sizes were also small, allowing for further compression of information on a page. Visually, this may appear overwhelming; however, this format relies on the audience and author's shared desire to share information primarily through written communication.

Figure 1. Screenshots of both the first page of (left) LeClerc et al. and (right) Zoppi et al.

Although the news posts I analyzed relied on alphanumeric text and simple formatting, too, they also incorporated a few images and visual features. Visually, both news posts have attention-grabbing titles and vibrant images. The titles are in a large, bold font, and they create a stark contrast with the background images. For example, PostClimate's title is in white font and formatted over a picture that mainly has dark colors. PostClimate only uses the single image and title, then communicates the rest of its message through a long caption, similar to the way the academic papers relied heavily on text over visuals. On the other hand, InsideClimateNews uses Instagram's carousel feature, and allows their readers to swipe through multiple images. The text in this post is scattered throughout each slide of the carousel, but still uses a long caption to summarize the information. The balanced mix of text and multiple images provides the audience with a more visual experience than the academic papers, but still relies on textual communication.
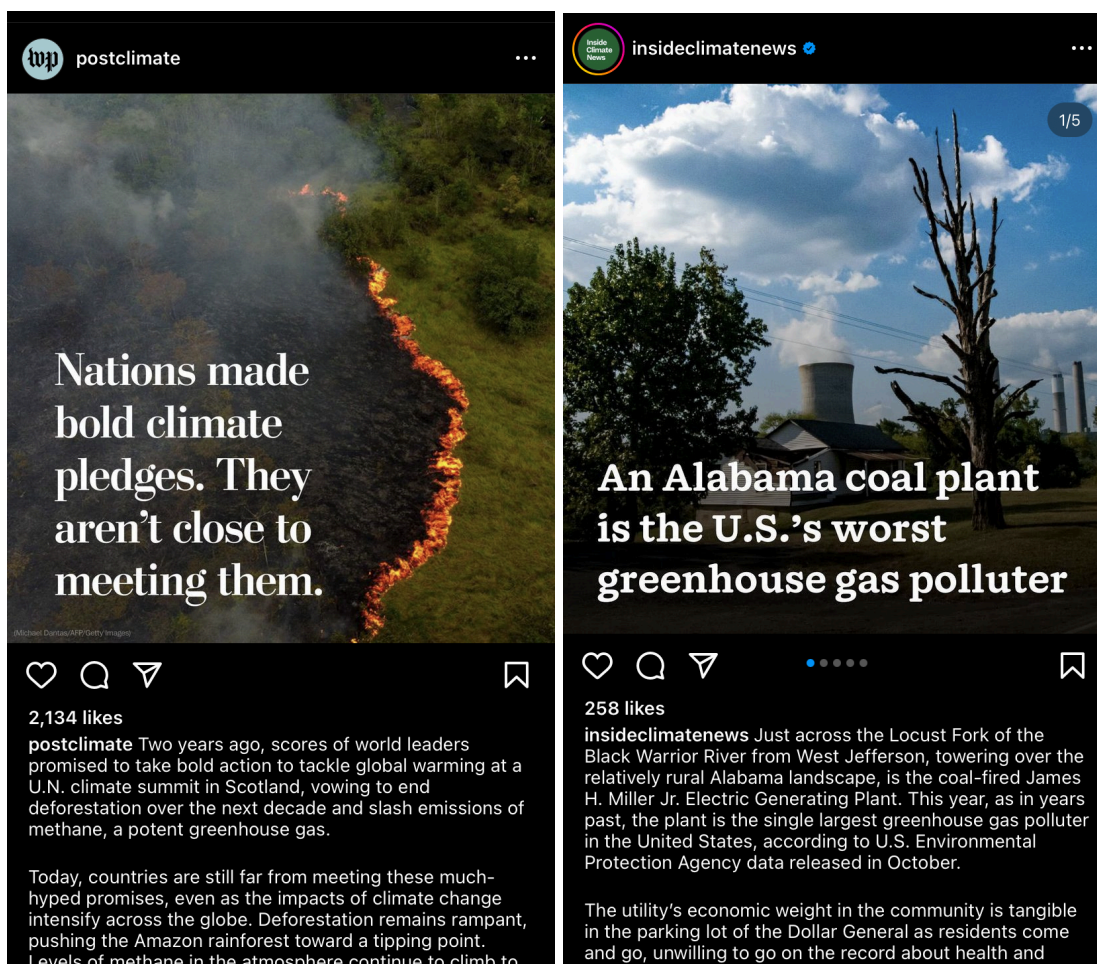
Figure 2. Phone screenshots of @postclimate's report on global climate pledges (left) and @insideclimatenews's post on the Alabama coal plant (right)

Looking more closely at the news posts, they also use visuals to continue their messages of pessimism and blame I found in my cluster analysis. The features that make these posts so eye-catching—the bold text and contrasting images—compose the same feelings of panic, urgency, and hatred toward global leaders and industries. For example, PostClimate's post presents an aerial view of a forest fire, as shown in Figure 2. The audience will likely read the text first "Nations made bold climate pledges. They aren't close to meeting them," then see the image of a fire destroying a luscious, green forest, as shown in Figure 2.

Similarly, the InsideClimateNews post uses contrasting and striking imagery as well, with pictures of a coal plant next to a suburban town. However, at the forefront of the picture is a dying tree. These features as the first impression of both posts immediately point blame toward "nations" and the "coal plant." Thus, industries become the enemy to everyone, including nature (i.e., the forest from PostClimate) and humans (i.e., the neighborhood shown in

InsideClimateNews). These messages urge the audience to feel the panic of environmental disasters, and then to associate those feelings with political and industrial leaders.

Of the three types of rhetors, activist social media relied the most on visuals. Whereas the academic papers and news posts relied on verbal communication, activist social media used more images and icons to communicate with less text. For example, Impact uses more vibrant colors, backgrounds, and images, as well as different font sizes, styles, and formatting, as displayed in Figure 3. Similarly, Environment uses colors that we typically associate with the environment in positive ways, such as green and blue. Not only do these design choices attract attention, but they also support the accounts' critical, yet hopeful messages, as explored in my cluster analysis of activist Instagram posts.
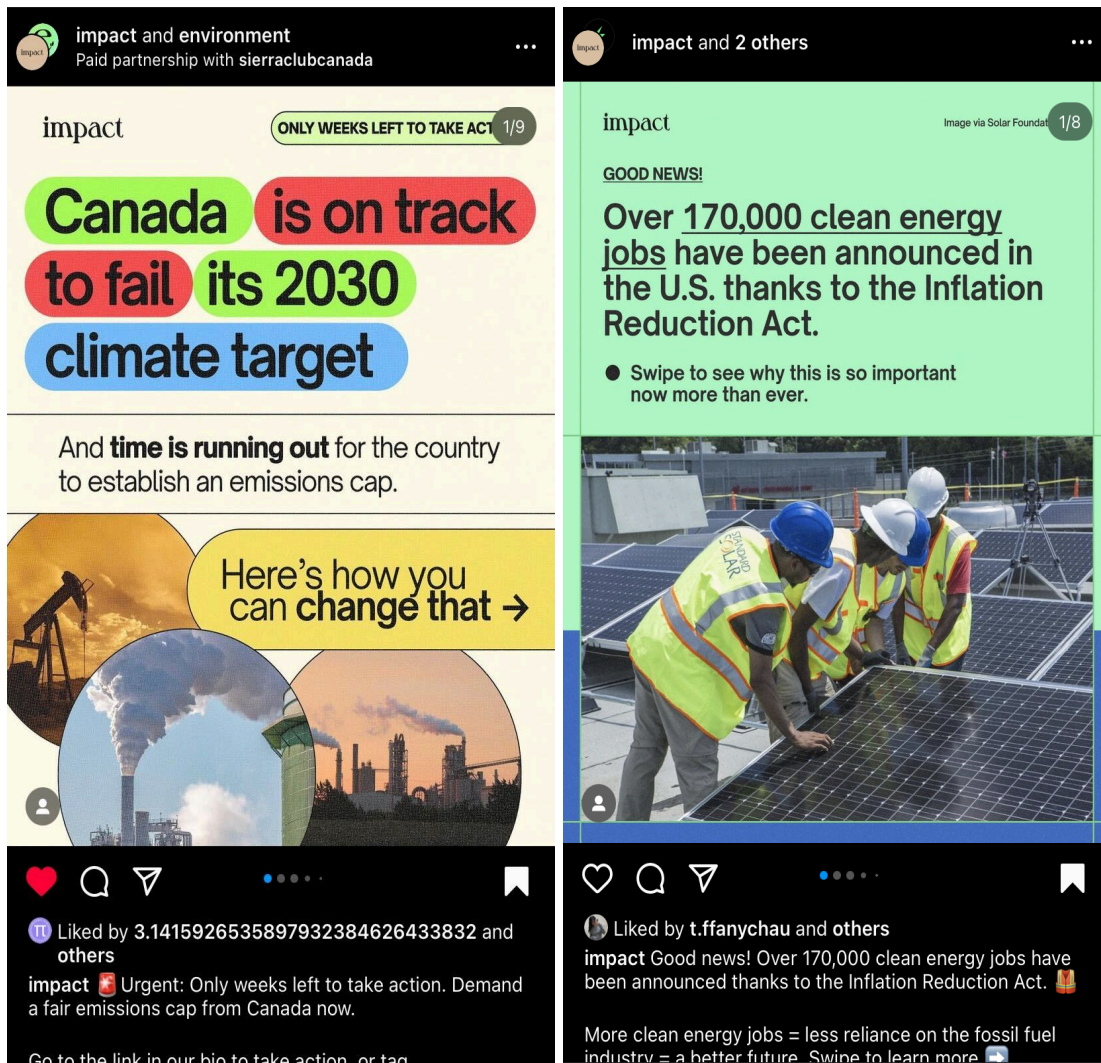
Figure 3. Image of @impact and @environment's post on the Canadian emissions cap (left) and @impact, @climatepower, and @environment's post on clean energy employment (right)

The visual design of these posts encourages and empowers the audience. For example, Impact calls attention to certain aspects, such as the text in Figure 3 that says, "Here's how you can change that." Impact also emphasizes this portion of text with a bright yellow background and bold text. This emphasis on audience inclusion may help the audience feel more empowered and help them engage further with the post. Unlike the news outlets, which only provide information about the climate situation, the activist accounts make sure to acknowledge their audience as people who can also take action.

Overall, I can sort my findings through my rhetorical analysis into two main topics: 1) verbal vs. visual communication; and 2) the narratives that rhetors provide about the climate crisis. First, consider a spectrum of verbal to visual communication. Academic climate rhetors use primarily verbal communication with very little imagery. On the opposite end of this spectrum, activism climate rhetors rely the most on visual communication. In the middle, news climate rhetors use a more balanced blend of visual and verbal communication, relying on striking visuals to grab viewers' attention and on explicit, written text to discuss climate topics.

In regards to narratives, however, the spectrum becomes hopeful on one end and critical on the opposite. I found that news climate rhetors paint more critical views of the climate crisis. Conversely, academic news rhetors are more hopeful about proposed solutions for climate change. Somewhere in the middle, activist climate rhetors balance their criticism for the climate situation as well as their hope and empowerment of others to take action. Each of these rhetors' approaches to climate communication has strengths and weaknesses, which is why I continued to conduct my research through surveys and user-tests.

4.2 A Preliminary Survey of Climate Topics

To understand audience preferences when receiving climate content on social media, I conducted a preliminary survey. In this survey, I asked questions about how participants feel when they encounter environmental content on social media, which social media platforms they use most, and finally, which concepts they associate with different climate topics.

4.2.1 Reactions to Environmental Content

When asked how participants feel upon encountering environmental content on social media, responses varied. This question was formatted as an open-ended answer, yet a few common patterns arose from the responses. I took note of certain themes in the responses, and I listed them in Table 8 with the number of times that participants' responses mentioned these themes. Note that a participant's response may have mentioned multiple themes.

Table 8. Participant response topics on encountering environmental content

RESPONSES	AMOUNT
Bad, Sad, or Concerned	7
Inspired or Hopeful	5
Short-Term Effect	4
Neutral or Uninterested	4
Interested	4
Pressured	3
Prefer it to be factual	3
Educated or Informed	2

The most common response to this question was along the lines of feeling "bad," "sad," or "concerned." However, participants also reported feeling "inspired" or "hopeful" as the second most popular response. These two categories were the most frequent themes, yet they almost directly oppose each other. The contrast in responses reveals how polarizing and complex climate issues can be. However, I expected these kinds of conflicted responses due to the correlation between climate anxiety and climate knowledge (Maran and Begotti). I defined this motivation generated from climate fear as *urgency* to encompass the complexity of the climate situation.

A few individual responses also highlighted this complicated feeling of urgency. One participant stated that they simultaneously feel "guilty" and "inspired" when seeing environmental content. Another participant reported that they usually feel disheartened, but they feel more hopeful when they see reports of progress toward solving the issue. The connection between these separate responses reveals the complex effects of environmental communication: the urgency of the situation might make individuals feel guilty for their inability to help on the individual scale, which can be balanced out by news of progress and hope.

Another point of interest among responses was one participant who claimed that the lack of scientific evidence in "call to action" posts creates feelings of frustration for them. They fear misinformation, emphasizing the importance of *credibility* in climate communication. These results suggest that climate content requires a balance of urgency, positivity, and credibility to facilitate productive conversations about the environment.

4.2.2 Preferred Social Media Platforms

In the preliminary survey, I also asked participants to list what—if any—social media exposure they get regarding the environment. For this section, I first asked participants which social media platforms they use. Most participants listed Instagram and TikTok—two platforms that almost

fully depend on visual presentation as a form of communication. Snapchat, which received the third-highest number of responses, is also heavily *visual*, with picture-taking as the main form of communication between users.
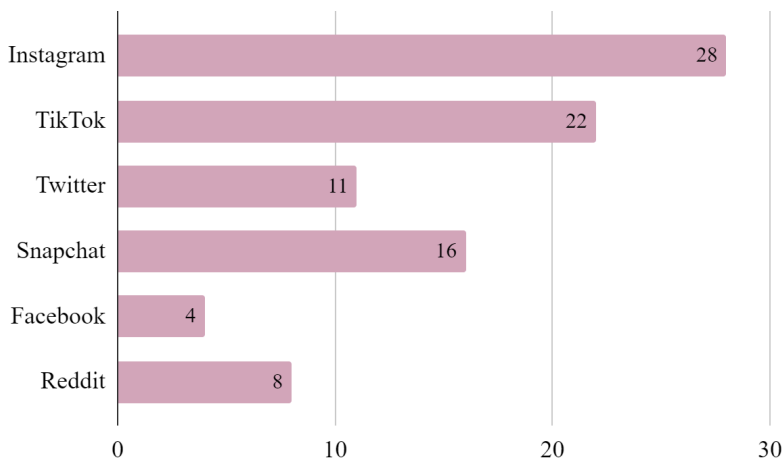
Figure 4. Participant responses listing which social media platforms they use regularly

Out of 29 participants, only 8 reported following environmental activism accounts on social media. However, 15 participants reported that they see environmental content on social media at least daily, whereas 10 reported only seeing it once or more per month, and 4 reported seeing it less than once per month.

4.2.3 Word Associations and Impressions

Evidently, environmental content is a common topic on social media, and many people are exposed to it almost regularly. To make this urgent topic on social media more effective, persuasive *visual* and *verbal* communication is required, as shown by the high usage of visual platforms found through the survey.

In one section of the survey, I prompted participants with keywords related to the climate issue, then asked participants to list two words they associate with each of the prompts. Response rates varied between each prompt; as shown in Table 9, participants either answered with only one word or phrase, or they omitted a response completely. There were 29 participants for the survey, thus a possible total of 58 terms per prompt. Below, I present notable findings and patterns from the responses.

Table 9. Response rates for each term in the word association portion of the survey

TERM OR PHRASE	RESPONSES	RESPONSE RATE

Carbon	57	98.28%
Oil and Gas	58	100.00%
Renewable Energy	57	98.28%
Biofuel and Bio Oil	47	81.03%
Fuel	55	94.83%
Renewable Natural Gas	46	79.31%
MAXIMUM	**58**	**100.00%**

The preliminary survey suggested that the audience has a limited perspective on or understanding of "renewable energy." In reality, there is a wide variety of renewable energy sources. However, over 50% of the survey responses for this prompt were limited to "solar" power and "wind" power. Furthermore, not a single response included other types of renewable energy, such as nuclear power, biofuels, hydropower, and so on. In other words, solar and wind seem to dominate public conceptions of "renewable energy," which suggests that public audiences need more exposure to different possibilities of renewable energy.

Specifically, "biofuels" and "bio-oil" are one form of renewable energy that had a very low familiarity among the survey participants. For example, there were only 47 responses out of a possible total of 58 for this prompt; three participants explicitly stated that they were unfamiliar with the concept. Overall, there was an overwhelming unfamiliarity with alternative renewable energy sources—biofuels in particular—which highlights the need to expand the public's understanding of renewable and alternative energy.

Another interesting result from this portion of the survey was participants' responses to "carbon." Carbon is a common and vital element in the physical world, and it is a fairly neutral, or even favorable, scientific concept. It makes up all organic matter, serving as a building block of life. However, "carbon" has become distorted as an environmental concept, and it is now often associated with public panic and concern about the climate crisis, as participants' responses suggest. For example, the majority of responses to "carbon" were climate concerns, such as "emissions," "global warming," and "dioxide." Strong associations of "carbon" with climate concerns reveal the need to redefine "carbon" as separate from "carbon dioxide."

The following subsections expand on the results and conclusions found from this section of word association in the preliminary survey.

1. CARBON

Responses to the term "carbon" revealed four categories: (1) feelings of environmental concern, (2) neutral and scientific terms of the physical sciences, (3) terms associated with life sciences, and (4) terms associated with abundance. The division of terms among these categories is displayed in Table 10. The majority of responses indicate an almost immediate association of "carbon" with environmental concerns.

Table 10. Responses to the term "Carbon"

Category	Frequency of Responses (%)	Example Responses
Environmental Concern	50.88	Carbon Dioxide, Emissions, Global Warming
Physical Sciences	33	Element, Diamond, Steel
Life Sciences	8.8	Cells, Life
Abundance	7.02	Common, Copy, Everything, In most things

2. OIL AND GAS

Categories that appeared in the responses for "oil and gas" were: (1) negative connotations, (2) fossil fuels, (3) industry, (4) objective uses of oil and gas. The frequency of responses within these categories is displayed in Table 11. There was an apparent disconnect and negativity associated with oil and gas, with negativity and industry making up 47% of the responses combined.

Table 11. Responses to the concept "Oil and Gas"

Category	Frequency of Responses (%)	Example Responses
Neutral Uses of Oil/Gas	41	Transportation, Energy, Heat
Negativity	28	Bad, Fumes, Lazy
Oil and Gas Industry	19	Industry, Petroleum
Fossil Fuels	12	N/A

3. RENEWABLE ENERGY

Categories for responses to "renewable energy" were: (1) solar, (2) wind, (3) green, and (4) miscellaneous. Results for each category are displayed in Table 12. There was an overwhelming connotation of renewable energy with solar and wind power, and no mention of other forms of renewable energy.

Table 12. Responses to the concept of "Renewable Energy"

Category	Frequency of Responses (%)	Example Responses
Solar	38.6	N/A
Wind	19.3	N/A
Green	5.3	N/A
Miscellaneous	36.8	Inefficient, Good, Clean

4. BIOFUEL AND BIO OIL

Categories for responses to "biofuel" and "bio-oil" were: (1) sustainable, (2) energy, (3) science, and (4) miscellaneous. It appeared that most responses indicated the accurate association of biofuel and bio-oil with sustainability and energy, but the lower response rate as indicated in Table 13 shows a lower familiarity among participants.

Table 13. Responses to the concept "Biofuel and Bio-Oil"

Category	Frequency of Responses (%)	Example Responses
Sustainability	49	Biodegradable, Compost, Eco-friendly
Energy	12.8	Cars, Coal, Alt. Fuels
Science	17	Organic, yeast, biology
Miscellaneous	21.2	Expensive, Rubber, Study

5. FUEL

The categories that appeared in responses to "fuel" were: (1) transport, (2) fossil fuels and gas, (3) energy and power, (4) combustion, and (5) miscellaneous. There were no immediate patterns of positive or negative connotations with this concept. Rather, the responses revealed the shared agreement that fuel is important for its functions and uses (i.e., for transportation and energy). Additionally, there seems to be an awareness of the downsides of the kinds of fuels we currently use, as shown by participants' associations of "fuel" with fossil fuels, combustion, or emissions.

Table 14. Responses to the concept of "Fuel"

Category	Frequency of Responses (%)	Example Responses
Transport	32.7	Airplanes, Car, Transportation
Fossil Fuels & Gas	27.3	Fossil
Energy & Power	25.5	Battery, Engine, Energy
Combustion	3.6	Burn, Combustion
Miscellaneous	10.9	Black, Windmill, Emissions, Necessity

6. RENEWABLE NATURAL GAS

Categories of responses to the concept of "renewable natural gas" (or RNG) were: (1) sustainability, (2) environmental concern, (3) energy, and (4) miscellaneous. Frequency of responses for each category is shown in Table 14. When combined, sustainability and energy categories comprise approximately 40% of responses, which is the objective definition of RNG (i.e., it is a renewable source of fuel). However, around 24% of participant responses expressed feelings of concern associated with RNG, including "emissions," and "carbon dioxide."

These responses indicate a possible gap of familiarity with RNG, as there is a mix of contradicting information; more specifically, some participants seemed to know that RNG is a source of clean, renewable energy, whereas others expressed concern. Additionally, the responses of environmental concern were similar to those submitted for "fuel," suggesting the term "natural gas" or simply just "gas" may be powerful enough to detract from the addition of "renewable" in front of it.

Table 15. Responses to the concept of "Renewable Natural Gas"

Category	Frequency of Responses (%)	Example Responses
Sustainability	32.6	Environment, Hope, Reuse, Safe
Environmental Concern	23.9	Emissions, Carbon Dioxide, Fossil
Energy	8.7	Fuel, Heating, Heating
Miscellaneous	26	Nitrogen, Oxygen, Farts

4.3 Drafting and User-Testing the Portfolio

My last phase of research was creating and user-testing a portfolio of social media posts. The portfolio specifically explores the three categories of academia, news, and activism and their respective rhetorical strategies that I identified in my rhetorical analysis. All of these posts present the concept of biofuels and renewable energy to a public audience. As I developed this portfolio, I conducted three rounds of user-testing, which informed my revisions. In this section, I present the findings from user-testing my drafts, as well as an overview of my portfolio's progression throughout this project.

4.3.1 Round 1: Cover Images and First Impressions

My first draft of the social media portfolio included three Instagram carousel "cover pages"—in other words, the first image from a carousel post that an Instagram user would encounter when scrolling through their feed. The three posts were labeled "Post 1," "Post 2," and "Post 3." In this order, I aligned each post with the categories of public communication that I explored in my analysis: "Post 1" corresponds with academia, "Post 2" with news, and "Post 3" with activism. My design choices for each post followed the characteristics I found through my rhetorical analysis of these categories. As I developed my portfolio, I altered which features I used, such as the carousel itself and the captions that typically appear below or beside the images of an Instagram post.

For the visual design of my posts, I used images and colors commonly associated with renewable energy and science, such as green color palettes and pictures of lab research or the environment. For example, I designed Post 1 to include a picture of a lab, specifically algae in test tubes; verbal text in the image acts as a headline or title for the topic. The font I chose for this post was a serif font, as these fonts are commonly used in scholarly content.

Figure 5. First drafted cover image for Post 1

Similarly, Post 2 also included a single image of something or someone real (i.e., photographs, not illustrations or graphics) and a title written in a serif font within the image.

Figure 6. First drafted cover image for Post 2

On the other hand, Post 3 features more illustrations and graphics rather than real, photographic images, as well as a "collage" format rather than a single image with a title. Additionally, I used a sans-serif font used for the text in the cover of Post 3 because this kind of font is often considered more modern and casual than "academic," or serif fonts ("The Difference").
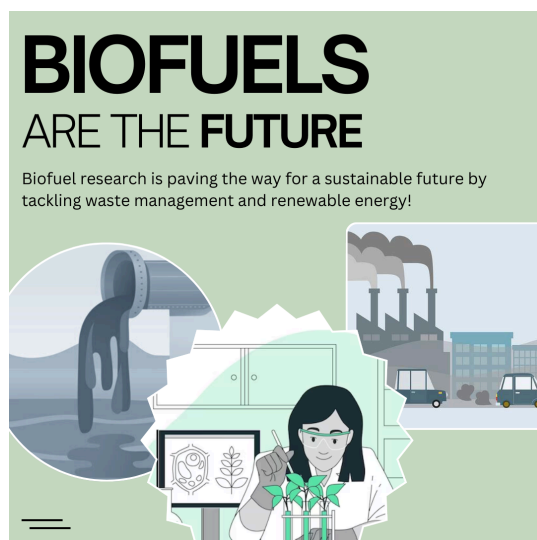
Figure 7. First drafted cover image for Post 1

The first round user-test provided me with audience perspectives about whether those differences made an impact on their impressions of the texts. I conducted the first round of user-testing for the images in Figure 5 through 7. I conducted this round of user-testing through in-person, one-on-one, informal interviews with two participants. During each conversation, I simultaneously presented the three images then I asked for the participant's impressions of and general feedback for each post. The goal of this round of user-testing was to find out if the participants perceived the different design intentions between the three posts.

Overall, Post 1 and Post 3 successfully portrayed their intended categories, whereas Post 2 did not. The participants described Post 1 using words such as, "straightforward," "professional," and "scientific" or "academic." Then, they described Post 3 as, "[something] I'd see . . . in a social media post" and "[not] professionally made." However, the participants noted that Post 2 was text-heavy, visually boring, and felt more like a "research paper." Additionally, one participant said it seemed like "clickbait," as the images felt "doctored" and "premeditated." They reported feeling a disconnect between the topics in the text and the images themselves. Although the "clickbait" description matches the attention-grabbing nature of news media, the negative impressions pointed to possible improvements for the next draft.

Overall, Post 1 and Post 3 impressions aligned with their initial purposes of being academic and activist posts, respectively. On the other hand, the participants were more hesitant to like or read Post 2 due to the "generic" and disconnected design. Additionally, the participants noted that I could improve Posts 1 and 3's visual appeal, which I took into account when making the next iteration of the portfolio draft.

4.3.2 Round 2: Full Instagram Posts and Audience Preference

The goal of the second round of user-testing was to get audience feedback on the fully drafted Instagram posts. I created an Instagram account for the purpose of this project, and I published the drafts on this account so the participants could experience scrolling through these posts as they would for any other Instagram post. Then, I used a Google Form that included the link to the Instagram account and the questions I asked each participant to answer about the posts. A total of 14 individuals participated in this round of user-testing.

For this phase of portfolio development, I edited the designs of each post according to feedback from round one, then I expanded these cover images into full Instagram posts. Post 1 was a single, standalone image with a brief caption in the image itself, and a long caption presented the majority of the post's information. Because Post 1 did not include a carousel of images, it kept the same visual design as its first draft.

On the other hand, Post 2 was a carousel of images and text with a slightly less lengthy caption.
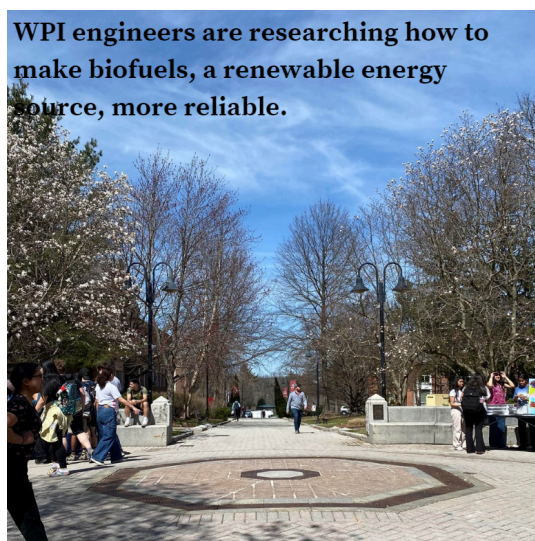
Figure 8. Second drafted cover image of Post 2 Instagram carousel

Lastly, Post 3 was a carousel of images, icons, and text with a very short caption. The cover images for the social media posts in this round of user-testing are displayed in Figure 8 and Figure 9. For the full posts as well as their captions, refer to the attached file, "Social Media Portfolio."
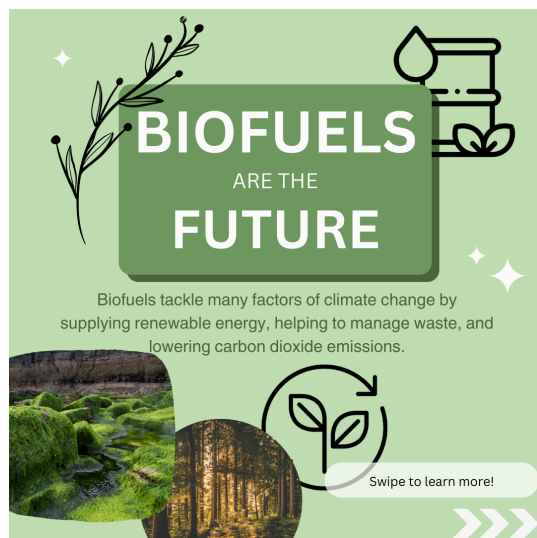
Figure 9. Second drafted cover image of Post 3 Instagram carousel

The second round of user-testing also revealed a similar split in preference for Post 1 and Post 3 among participants. I then asked each participant to select which one of the following four factors played into their decision: the post's "trustworthiness," "visual aesthetic," "relatability," and "novelty." Overall, most people reported being more influenced by trustworthiness (6/14 participants), with "visual aesthetic" having the second most selections (5/14), then "relatability," "novelty," and "other" having one selection each. Evidently, trustworthiness and visual appeal play significant roles in the audiences' responses to Instagram posts.

In general, responses to the three posts remained the same as in the first round of user-testing. Participants favored Post 1 due to its more "technical," "professional," and trustworthy appearance. One participant noted they felt this way due to the citations at the end of the post and in-text citations. On the other hand, Post 2 received more polarizing responses. Some participants disliked the simplicity in its images, format, and delivery, whereas others enjoyed the use of Instagram's "swipe" feature more than the caption-heavy design in Post 1. Lastly, Post 3 received more positive reviews; participants claimed it was "visually pleasing" and "easier to read" because of the carousel's "swiping" mechanism and "fun" design. Participants also appreciated the use of citations in this post. However, some participants noted that the design felt more "immature" due to the use of icons and "fun" designs, thus seeming less professional or credible.

Overall, the second round of user-testing further demonstrated the importance of credibility and visual appeal. This round of user-testing illustrates that audience members *truly* care about the credibility of new information they encounter on social media. Additionally, many factors affect the perceived credibility of a post, including visual design, professionalism, citations, and

language. Therefore, I took these factors greatly into account when creating my final post for my portfolio.

4.3.3 Round 3: The "Ideal" Post and Refining Climate Communication

The final post of my portfolio was my idea of an "ideal" social media post. For this last draft, I I identified features that seemed to be the most important or notable from the first two rounds of user-testing, and I applied these features in one post; in other words, I combined features that were persuasive from the three different types of posts (i.e., academic, news, activist) rather than treating these features as strategies that belong to each category. I also published this post onto my experimental Instagram account.
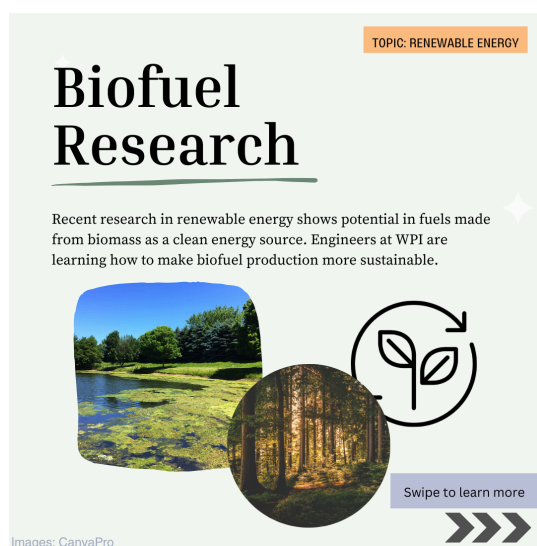
Figure 10. The cover of the first draft of Post 4

For this third round, I first asked the participants to pick which of the following purposes the draft seems to have: "to educate me about something new," "to report news about events to me," or "to persuade me to believe or support something." 13 out of 14 participants described the purpose as educational, whereas only one participant chose "reporting news." The majority of the participants reported feeling this way due to the post's citations, scientific explanations, and straightforward communication. One participant in particular noted that the post's design was "calming, not urgent like breaking news." In other words, this post was more successful in the sense of appealing to audiences while also avoiding the typical "climate anxiety" of climate content online.

Additionally, all of the participants agreed that the post seemed trustworthy, although one individual claimed the "fun" theme seems "less professional" or credible. However, I expected

this type of response because the previous user-tests also showed participants' hesitancy to trust the style of Post 3, which is the basis for the design of the final post.

As for improvements to make on this post, most participants reported the font size was too small. They also said that there was too much text on some images in the carousel. To fix this, participants suggested keeping more simple information in the carousel itself, and putting more text-heavy information in the caption. I agreed with this idea, as it would further integrate the formatting styles of an academic and news post rather than the way it was initially designed to closely emulate an activist post. As a result, I edited the draft to produce a final, "ideal" post.
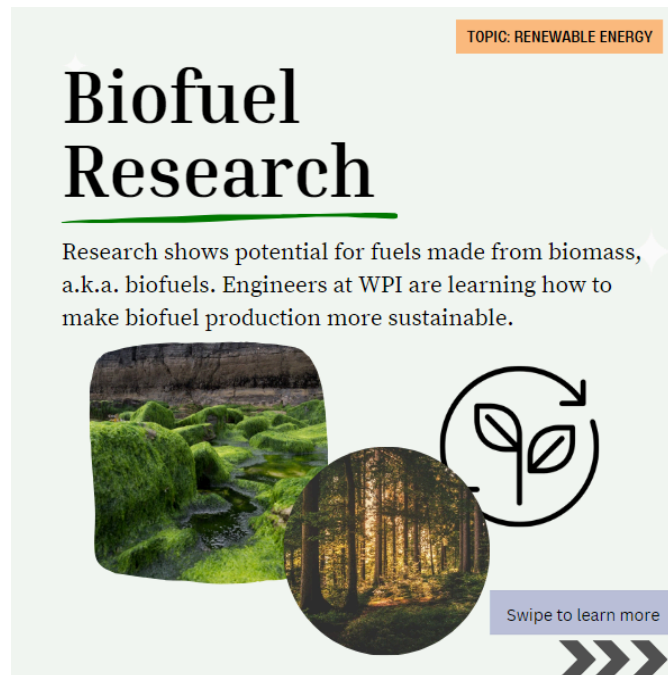
Figure 11. Final version of Post 4

5. Conclusion

In my research, I came to three key findings. First, from a rhetorical standpoint, academic, news, and activist communicators tend to create different viewpoints about climate issues, and they use different strategies regarding verbal vs. visual communication. Academic rhetors tend to create a more hopeful perspective; news rhetors tend to write from a more critical perspective; and activist rhetors tend to land somewhere in between. Additionally, academic rhetors tend to rely more heavily on verbal communication; activist rhetors tend to rely more on visual communication; and news rhetors tend to use a more balanced mix between both.

Second, data from the preliminary survey suggested patterns of anxiety and unfamiliarity regarding climate topics. For example, participants reported feeling a complicated mixture of "guilt," "pressure," and "motivation" when encountering climate content online. Participants also expressed unfamiliarity with climate science topics such as biofuels. These two findings point to the need for more coverage about climate science that is accessible to the public. Therefore, I created an experimental portfolio of social media posts about biofuel research.

Third, user-testing the portfolio revealed that credibility and authenticity mattered most to the participants. Although attention-grabbing tactics and overtly positive language succeeded in grabbing attention the fastest, participants were less likely to trust the information in posts with those kinds of features, which directly opposed my purpose of communicating new climate information.

Overall, this project illustrates how social media can help scientists create more accessible scientific communication, which can promote a more productive, ethical, and sustainable rhetorical approach to climate progress. My results present interesting patterns in audience preferences for climate content on social media. These findings suggest that scientists can contribute to public discussions about climate change through social media, but they must be careful with their tone and presentation. In particular, scientists must find effective ways to appeal to online audiences that are wary of misinformation on social media while still being understandable to general audiences. Based on my results, scientists can achieve this by displaying credibility with academic designs and topics, and using easy-to-understand language. However, the size of this research was fairly limited with small participant pools (30 participants at most) that comprised of college students. Future research in this area can include larger and more general pools to address a broader audience. Additionally, expanding the rhetorical analysis would help make the study more representative of the academic, news, and activist genres. These suggestions could help strengthen the correlations suggested in my research.

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Appendices

Appendix A: Environmental Rhetoric Survey

SECTION 1: Demographic Information

1. What is your age?
   a. 17 or younger
   b. 18-21
   c. 22-25
   d. 26-30
   e. 31-40
   f. 41-60
   g. 61+

2. What is your ethnic background?
   ☐ Native American or Alaska Native
   ☐ Asian
   ☐ Black or African American
   ☐ Hispanic or Latinx
   ☐ Native Hawaiian or other Pacific Islander
   ☐ White

3. What is your field of study or profession? _____

SECTION 2: Word Association

List 2 words or phrases you associate with each of the following terms or concepts

1. Carbon _____
2. Oil and gas _____
3. Fuel _____
4. Renewable Energy _____
5. Bio-fuel and Bio-oil _____
6. Renewable Natural Gas _____
7. Humanities and Liberal Arts _____
8. STEM _____

SECTION 3: Social Media Usage and Exposure

Answer the following questions

1. What social media platforms do you regularly use?

      ☐ Instagram

      ☐ TikTok

      ☐ Twitter

      ☐ Snapchat

      ☐ Facebook

      ☐ Reddit

      ☐ Other _____

2. Do you follow any environmental activism accounts?
   a. Yes
   b. No
      If so, which ones? _____

3. How often do you encounter environmental content on social media?
   a. Multiple times per day
   b. Once per day
   c. Once or more per week
   d. Once or more per month
   e. Less than once per month
   f. Rarely or never

4. How do you feel when you encounter environmental content? _____

5. Do you often encounter news or content about STEM research regarding the climate crisis?
   a. Yes
   b. No

6. How do you feel when you encounter STEM content regarding the climate crisis? _____

Appendix B: User-Testing Questions

Appendix B.1 (Round 1)

SECTION 1: Preliminary Questions

Your experience and preferences with social media

1. How do you feel about social media posts that seem to be persuading you of something?
   _____

2. How do you feel about social media posts that seem to be educating you?
   _____

3. How do you feel about social media posts that seem to be educating you?

   _____

4. What feature of social media posts do you care about the most?
   a. Relatability
   b. Trustworthiness
   c. Visual aesthetic
   d. Novelty
5. Why do you care about this feature the most?
6. What feature of social media posts do you care about the least?
   a. Relatability
   b. Trustworthiness
   c. Visual aesthetic
   d. Novelty
7. Why do you care about this feature the least?

SECTION 2: Viewing the Posts *(displayed cover images of Posts 1-3 simultaneously)*

1. Looking at the three posts, which one draws your attention the most in a positive manner?
   a. Post 1
   b. Post 2
   c. Post 3
2. What about the post drew your attention based purely on its visual design? (e.g. font choices and style, color palette, shapes, images, etc.)

   _____

3. What about the post drew your attention based purely on its content? (e.g. word choice/language, image, subjects, etc.)

   _____

4. What impression does post 1 make to you based on both its visuals and content and why? Does anything engage you or turn you away?

   _____

5. What impression does post 2 make to you based on its visuals and content and why? Does anything engage you or turn you away?

    _____

6. What impression does post 3 make to you based on its visuals and content and why? Does anything engage you or turn you away?

    _____

7. Which post is the most relatable to you?
    a. Post 1
    b. Post 2
    c. Post 3
8. Which post is the most trustworthy to you?
    a. Post 1
    b. Post 2
    c. Post 3
9. Which post is the most visually pleasing to you?
    a. Post 1
    b. Post 2
    c. Post 3
10. Which post is the most novel to you?
    a. Post 1
    b. Post 2
    c. Post 3
11. Which post is your favorite of the three?
    a. Post 1
    b. Post 2
    c. Post 3
    d. None/neutral
12. Why is that post your favorite? Or why do you not have a favorite?

    _____

13. Lastly, what suggestions or feedback do you have for each post?

    _____

Appendix B.2 (Round 2)

SECTION 1: Preliminary Questions

Your experience and preferences with social media

1. How concerned are you about the environment? (Scale from 1-5; 1 = "I don't think about it often," and 5 = "I think about it and try to make climate-conscious choices) _____

2. How do you view social media posts that seem to be persuading you? (e.g. activism, 'call-to-action', advertisements etc.)
    a. I scroll past them
    b. I read them but do not think of them afterward
    c. I read them and think of them after reading
    d. I read them and engage with them
    e. Other _____

3. How do you feel about social media posts that seem to be educating you?
    a. I scroll past them
    b. I read them but do not think of them afterward
    c. I read them and think of them after reading
    d. I read them and engage with them
    e. Other _____

4. How do you feel about social media posts that seem to be reporting news to you?
    a. I scroll past them
    b. I read them but do not think of them afterward
    c. I read them and think of them after reading
    d. I read them and engage with them
    e. Other _____

5. What feature of social media posts do you care about the most?
    a. Relatability (It appeals to your style of communication, humor, or interests)
    b. Trustworthiness (It seems credible or comes from a typically credible source)
    c. Visual aesthetic (Font style, color choices, images, etc.)
    d. Novelty (Different formats, information, or visuals than usual posts)

6. (Optional) Why do you care about this feature the most?

7. What feature of social media posts do you care about the least?
    a. Relatability (It appeals to your style of communication, humor, or interests)
    b. Trustworthiness (It seems credible or comes from a typically credible source)
    c. Visual aesthetic (Font style, color choices, images, etc.)
    d. Novelty (Different formats, information, or visuals than usual posts)

8. (Optional) Why do you care about this feature the least?

SECTION 2: Initial Impressions

This section will ask you to review the cover images of 3 different Instagram posts. You will get the chance to review the rest of each post in the next section.
[DISPLAY COVER IMAGES FOR POSTS 1-3]

1. Which cover image do you prefer the most?
    a. Post 1
    b. Post 2
    c. Post 3
2. Why did you choose that post cover image?
    a. Relatability (It appeals to your style of communication, humor, or interests)
    b. Trustworthiness (It seems credible or comes from a typically credible source)
    c. Visual aesthetic (Font style, color choices, images, etc.)
    d. Novelty (Different formats, information, or visuals than usual posts)
3. (Optional) How did the post's cover visually give you that impression?

    _____
4. (Optional) How did the post cover image's content give you that impression?

    _____
5. Based on the covers, which post is the most relatable to you? (It appeals to your style of communication, humor, or interests)
    a. Post 1
    b. Post 2
    c. Post 3
6. Based on the covers, which post is the most trustworthy to you? (It seems credible or comes from a usually credible source)
    a. Post 1
    b. Post 2
    c. Post 3
7. Based on the covers, which post is the most visually pleasing to you? (Font style, color choices, images, etc.)
    a. Post 1
    b. Post 2
    c. Post 3
8. Based on the covers, which post is the most novel to you? (Different formats, information, or visuals than usual posts)
    a. Post 1
    b. Post 2
    c. Post 3

SECTION 3: Full Instagram Post Impressions
In this section, you will view and respond about the full posts.

If you have your phone and the Instagram app, please navigate to the instagram page @env.content.study and view the posts there (each one is labeled as 1, 2, or 3 in the caption). Otherwise, continue on the device you are on and either navigate to the page on instagram.

Here is a link to the profile if you would prefer: https://www.instagram.com/env.content.study/

1. Rate how you feel about Post 1 (Scale 1-5) _____

      1 = "I really don't like this post"

      5 = "I really like this post)

2. (Optional) What about Post 1 makes you feel that way? (e.g. Purpose, audience, interactability, content, etc.)

      _____

3. Rate how you feel about Post 2 (Scale 1-5) _____

      1 = "I really don't like this post"

      5 = "I really like this post)

4. (Optional) What about Post 2 makes you feel that way? (e.g. Purpose, audience, interactability, content, etc.)

      _____

5. Rate how you feel about Post 3 (Scale 1-5) _____

      1 = "I really don't like this post"

      5 = "I really like this post)

6. (Optional) What about Post 3 makes you feel that way? (e.g. Purpose, audience, interactability, content, etc.)

      _____

7. Thank you so much for your time and your responses! Just one last question that is completely optional: If you have any suggestions or recommendations for the posts or even how this survey was conducted, please list them here! All feedback is welcome and appreciated. (OPTIONAL)

      _____

Appendix B.3 (Round 3)

SECTION 1: Demographic Information
1. What is your major/career field?
2. How concerned are you about the environment? (Scale 1-5) _____
   1 = "I don't really thinking about it"
   5 = "I constantly think about it and take action"

SECTION 2: Post 1 Impressions *[Include link to an academic social media post]*
1. On a scale of 1-5, how likely would you read through the entire post? _____
   1 = "Not likely at all"
   5 = "I definitely would"
2. How likely would you engage with the post (like, comment, share, or follow the account)? _____
   1 = "Not likely at all"
   5 = "I definitely would"
3. How likely would you retain the information in the post? _____
   1 = "Not likely at all"
   5 = "I definitely would"
4. (Optional) Why do you feel this way about? Is it something about the post, your own social media tendencies, or something else?

   _____

SECTION 3 and 4 [Repeat Section 1 but replace academic post with news and activist post, respectively]

SECTION 5: Drafted Post Impression
1. What purpose does this post seem to have?
   a. To educate me about something new
   b. To report news about events to me
   c. To persuade me to believe or support something
   d. Other _____
2. (Optional) What gives you that impression? (Its content, visuals, design, text, style, etc.)
3. Does the post seem trustworthy?
   a. Yes
   b. No
   c. Other _____
4. (Optional) Why or why not?
5. Is the post visually pleasing?

   a. Yes

   b. No

   c. Other _____

6. (Optional) Why or why not?

7. Does the post seem applicable or useful?

   a. Yes

   b. No

   c. Other _____

8. (Optional) Why or why not?

9. If you were to encounter similar content on your social media feed, how likely are you to read through it, understand it, and retain the information? _____

     1 = "Not likely at all"

     5 = "I definitely would"

10. (Optional) Why do you feel that way?

   _____