THESIS

MAKE ‘EM LAUGH: HUMOR’S ROLE IN SEEKING SCIENCE-BASED MESSAGES

Submitted by

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ABSTRACT

MAKE ‘EM LAUGH: HUMOR’S ROLE IN SEEKING SCIENCE-BASED MESSAGES

Science information as a whole has become known as a controversial topic because it often invokes political beliefs and social values when it is presented in the media. This has resulted in audiences being cautious about engaging with scientific messages. Humor is increasingly being used as a strategy to communicate science-related information, yet research on its effectiveness is still growing. The goal of this project was to contribute empirical evidence to the limited pool of literature and outreach tactics that exist regarding the application of humor science-based content on social media. Through a two-condition, between subjects, online experiment this project measured if positive emotion, conceptualized *as feeling joy, which can be described as experiencing elation or mirth,* was invoked when exposed to a humorous science-based message; whether exposure to humorous science-based messages have a direct effect on information engagement; and if experiencing a positive emotion impacted greater levels of information engagement. Participants were undergraduate or graduate students enrolled at the Colorado State University, Fort Collins campus who were registered in a course within the Journalism and Media Communication department during Spring 2024. A total of 117 participants gave responses while the survey was live in the SONA system, between February 2-23, 2024. Results indicate participants who were exposed to a humorous science message were more likely to experience a positive emotion and had a higher likelihood of seeking out or sharing similar messages in the future. Additionally, the experience of a positive emotion was a significant factor in a participant's likelihood of seeking out or sharing similar messages. Results suggest that individuals exposed to a humorous message are more inclined to experience positive emotions and those who did are

more inclined to participate in information engagement in the future. This study indicates that humor plays a significant role in driving information engagement.

ACKNOWLEDGEMENTS

I am a first-generation non-traditional student, a military veteran, and a parent. When I decided to begin my higher education journey in 2018, I did so out of anger and frustration. At which point I had been separated from the military for ten years and much of my civilian life consisted of being a full-time parent, a few years of volunteer work, and customer service-based work experiences. When I began seeking more substantial employment opportunities, I quickly realized employers viewed the experience I gained in the military as worthless. Instead of viewing my mission preparation and leadership as organizational expertise, competence in critical thinking, and collaborative skills or my two yearlong deployments as demonstrating adaptability and time management skills - I was instead viewed as a liability. Bitter and determined to be valued, I activated my veteran education benefits and enrolled full-time at my local community college. Now, six years later – I am a first-generation non-traditional student, a military veteran, a parent, and a Master of Science in Journalism and Media Communication, with a focus in Science Communication.

This feat would not have been possible without the encouragement of my biggest fan, my partner in life, my better half, my husband John. My maternal drive to show my children, Tristan and Emma, they are capable of remarkable achievements despite the hardship they endured in their early years with the loss of their little brother, Jackson Miles, to cancer. Nor would this have been possible without my relentless determination to prove wrong those who doubt my abilities.

Thank you, Dr. Ashley Anderson, for agreeing to advise me on this journey and for sticking with me despite my ability to overthink and inability to elaborate. Thank you, Drs. Emily Johnson and Nick Marx, for providing me with guidance and encouragement as I

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I dedicate this project to...myself, I worked hard ya'll. She was not easy but definitely worth it!

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CHAPTER 1. INTRODUCTION

Once upon a time long ago, in a land far, far away there was a community full of people who found value in science. The members of the community embraced the uncertainty in the process and celebrated its ability to expand on old ideas. They cherished the moments when they would hear about new discoveries or developments on previous research. One day, this community was visited by the mischievous creature Miss Trueths, or as she was known by her friends, Deception!

Deception, like a black storm cloud, descended onto the community replacing the excitement people felt for science with cynicism. The people were never the same as they were no longer able to find the joy they once felt when hearing about new discoveries. This unfortunately resulted in their untimely death as they would no longer heed any science-based messaging, leaving Deception very pleased with herself.

The end.

Perhaps exaggerated slightly, but the current state of being able to exchange accurate and effective science-based messages with the general public is not fictional and rather remains an ever-increasing concern for scientists in all disciplines (Anderson & Becker, 2018; Yeo et al., 2020; Cacciatore et al., 2020; Su et al., 2022). For this project the term science- message is conceptualized as a message translating a science idea, shared on social media by a science organization, agency, or influencer (Yeo et al., 2021; Becker & Anderson, 2019; Cacciatore et al., 2020; Chinn et al., 2023). Science information as a whole has increasingly become known as a controversial topic because the information tends to circle around political beliefs and social values (Xenos & Becker, 2009; Anderson & Becker, 2018; Cacciatore et al., 2020; Yeo et al. 2021). More often, scientific issues shared in the media are being politicized and polarized, as

seen in news shows such as *The Daily Show* and *Last Week Tonight with John Oliver* (Polk et al., 2009; Xenos & Becker, 2009). Invoking political beliefs and social values when exchanging science-based information is a risky endeavor as it can backfire if not applied carefully. This results in audiences being cautious about engaging with scientific messages leaving scientists as well as science communication practitioners perplexed on how to best exchange information with them (Yeo et al., 2020b; Becker & Anderson, 2019; Yeo et al., 2020a).

Given this strain on the relationship between the scientific community and the general public, the current project examines how humor might be used as a tool for increasing a person's science information engagement, conceptualized as *when a media user has the intent to seek out or share media* on social media. This work is significant because scientists and science communication practitioners are in need of new tactics for communicating with the public so they might begin to break through these barriers. The use of humor is on the short list of strategies scholars and researchers view as having potential.

This work fits into the larger context of science communication in that there is limited empirical evidence when it comes to humor's role in the exchange of science-related topics on social media. Existing studies examine humorous science based messages in stand-up comedy and the role laughter has on the audiences affective response (Cacciatore et al., 2020), exposure to and the impact of sarcastic two-sided climate change messages on one's belief on the issue (Anderson & Becker, 2018), and engagement intentions (Yeo et al., 2020). Humor is worth studying because even with the existing studies, they lack extensive theoretical explanations for the effects evoked by humorous messages.

I plan to address this knowledge gap by first providing an introduction of what emotions are and what happens when an individual experiences a negative or positive emotion. I begin

with this context because a brief surface understanding of how our brains instinctively react to an emotional response is key to understanding the effects of humor on our thought process. I highlight the potential to drive interest in science-based information through positive emotions as they create an environment for one to expand on their thought and actions as argued through the Broaden-and-Build theory (Fredrickson, 1998). Fredrickson argues in this theory that positive emotions serve to broaden an individual's momentary thought-action repertoire by allowing them to cognitively process more of their immediate environment (2001). Additionally, looking through the framework of Selective Exposure Self- and Affect-Management (SESAM) model (Knobloch-Westerwick, 2015), I discuss how emotions impact digital media engagement. Knobloch-Westerwick argues in this theory that media users select messages to regulate their affective states and behaviors (2015). Finally, I cover how humor has been used to date in the exchange of science-based messages and how experiencing a humorous message triggers one's emotions. All of this so I may test my hypothesis that media users who experience positive emotion when exposed to a humorous science message are more likely to broaden their science-related social media exposure. By contributing empirical evidence to this field of study I will be building upon the limited pool of outreach tactics that currently exists for scientists and science communication practitioners.

CHAPTER 2. LITERATURE REVIEW

2.1 Affective States and Behaviors

The word affect serves as the umbrella term for when an individual feels a mental and physical change in their emotions (Frederickson, 2001; Fiske & Taylor, 2013). Emotions are a psychological and physical response of an individual's mind and body preparing instinctively to act in a specific manner (Frederickson, 1998; Frederickson, 2001). The psychological evaluation is automatic, and the physical action is the body's impulse response to that evaluation (Frederickson, 2001; Fiske & Taylor, 2013). For example, when watching a scary movie, the psychological evaluation of danger results in the physical action of an increased heartbeat—which is affect (Fiske & Taylor, 2013). The psychological portion is considered the 'thought' response and the physical is the 'action' response, which are an individual's mind and body are preparing for and responding to, the emotion experienced (Frederickson, 1998; Frederickson, 2001). The thought (psychological) of fear and the action (physical) to escape the scary experience--or identifying one is in a safe space--allows freedom to explore one's environment.

When referring to emotion as positive or negative, this project uses these simplified categories as there are many variations of affect an individual can experience (Fiske & Taylor, 2013; Frederickson, 1998, 2001, 2005). These variations include more complex emotions such as calm, gratification, agitation, or irritation (Fiske & Taylor, 2013). Emotion is more than a sentiment, it is a strong physical manifestation accompanied by physiological arousal (Fiske & Taylor, 2013). Additionally, each emotion triggers its own thought-action repertoire that is not only instinctive, but also socially constructed (Parkinson, 1998; Fiske & Taylor, 2013). The combination of instinct and social expectation equips emotion with powerful influence over one's actions. Positive emotion provides individuals with the opportunity to go beyond the

brain's conditioned response allowing them to explore unscripted actions (Frederickson, 1998). In line with the Broaden-and-Build theory (Frederickson, 1998, 2001, 2005), if a positive emotion is induced through exposure of a humorous media message, that individual is then capable of having increased attentional capacity to seek out similar messages – or expand on their subconscious scripts.

Although emotions are instinctive, meaning they are unconscious or automatic, they are also heavily influenced by our social and cultural environments (Parkinson, 1998; Fiske & Taylor, 2013). An individual's cultural beliefs, social norms, and interpersonal relationship expectations influence their thought-action repertoire when experiencing an emotion (Parkinson, 1998; Fiske & Taylor, 2013). Although two people may label an emotion they feel in the same way, the physical expression of that emotion can vary (Fiske & Taylor, 2013). There are some cultures that maintain strict and specific ideas about how emotion should be expressed, and -- as a result -- those within the culture will display differently than opposite cultures but similarly to each other (Parkinson, 1998; Fiske & Taylor, 2013).

Two people who grow up in separate countries under opposite government structures might hold varying opinions about democracy. When interacting with information on the topic of democracy different emotions will be triggered for each person. An individual's values, social connections, and lived experiences impact what their thought-action repertoire will be (Fiske & Taylor, 2013). Additionally, emotion can influence an individual's attitude toward various topics, as well as how they process information (Yeo & McKasy, 2021). For example, for the person who supports democracy, the topic could induce positive emotion because they value the practice of the people having a voice, whereas the person who opposes democracy might experience negative emotion because they view it as disorganized (Fiske & Taylor, 2013). The individuals'

instincts must appraise the situation being encountered and once it is determined the situation or topic is personally relevant, an emotional response is possible (Lazarus, 1991).

Positive emotion is essential to an individual's ability to broaden-and-build their thought-action repertoire. When a person experiences a negative emotion, that individual is forced to focus their mind on the situation, sort of like tunnel vision (Fiske & Taylor, 2013; Conway et al., 2013). Examples of negative emotion and their actions include anger (thought) with an urge to attack (action), or fear (thought) with an urge to escape (action) (Fredrickson, 1998, 2001, 2005; Fiske & Taylor, 2013). Positive emotions such as joy have the inverse effect and instead of giving the individual tunnel vision, they allow for unscripted thought-action to take place (Conway et al., 2013; Fiske & Taylor, 2013; Fredrickson, 1998, 2001, 2005). For instance, positive emotion prompts the brain to discard the automatic thought-action scripts that are activated by negative emotion and in the absence of an instinctive action the brain searches for a new, or broadens, its scripts (Fredrickson, 1998, 2001, 2005; Fiske & Taylor, 2013; Conway et al., 2013). Positive emotions include but are not limited to joy (thought), which can be described as experiencing elation or mirth (action) (Fredrickson, 1998). Since positive emotion tends to occur when one is in a safe environment, this makes the individual able to increase their openness and receptivity (Conway et al., 2013; Fiske & Taylor,
2013). These unscripted situations then give the individual a chance to broaden-and-build on their action response because they can reduce focus, or let down their guard, so they may process more of their environment (Conway et al., 2013).

Studies of the brain using fMRI (functional Magnetic Resonance Imaging) scans and EEG (electroencephalography) recordings found that negative and positive emotion are processed in different parts of the brain, yet they are also part of intertwined networks that work

together in one system (Konijin et al., 2010; Fiske & Taylor, 2013). Negative emotions such as fear are processed in the lower pathways and happen rather quickly (heuristics), where positive emotions are processed in the higher pathways and tend to take longer (schema) (Konijin et al., 2010; Fiske & Taylor, 2013). The brain reacts to negative emotions as an obstacle one must overcome or avoid, and since our instincts indicate immediate action is required, they are processed much faster (Fiske & Taylor, 2013; Conway et al., 2013). Yet, when experiencing positive emotion, the brain registers nothing of importance and--with no immediate action required--our attention is free to engage more consciously with our environment (Fredrickson, 1998; Konijin et al., 2010; Fiske & Taylor, 2013; Conway et al., 2013).

The broaden effect of Broaden-and-Build theory (Frederickson, 1998) argues when an individual experiences a positive emotion it allows for the opportunity to broaden and expand on ones thought-action scripts. Positive emotions have shown to widen attentional scope, influence thoughts about actions in which an individual would like to engage, and impact flexible and innovative ways of thinking (Frederickson & Branigan, 2005; Ashby et al., 1999). In one experiment participants were influenced to experience positive, negative, or neutral emotion by watching short film clips (Frederickson & Branigan, 2005). The results of the study indicated participants who reported feeling positive emotion were more likely to show a wider attentional scope than others (Frederickson & Branigan, 2005). Additionally, Frederickson & Branigan (2005) reported that participants who were influenced to experience positive emotion also reported large lists of varied behaviors they wished to engage in as a result of the clips they watched. In a separate study the effects of positive emotion on flexible and innovative thinking were tested using Mednick's Remote Associations Test, which requires participants to generate a word that relates to three other words (Ashby et al., 1999). The results indicated those who were

influenced to feel positive emotion generated more correct answers than those influenced to feel neutral, thus demonstrating a broadened scope of cognitive flexibility (Ashby et al., 1999).

Using the theoretical framework of Broaden-and-Build theory in which Frederickson (1998) argues positive emotions provide individuals with the opportunity to broaden their scope of thought-action response and build on their subconscious scripts, I postulate media users who experience positive emotion when exposed to a science message, will be more likely to broaden their media exposure. Broadening is conceptualized as widening one's attentional scope, thoughts about actions in which one would like to engage, and/or expressing flexible ways of thinking. When we take into consideration the fluidity of emotion, such as how they are socially and culturally influenced, the way they are cognitively processed, and how they serve as a mental red flag or indicator that something is important by manifesting a sense of realness, it is easy to see why an individual's emotion would also impact their media selection.

2.2 Cognitive States and Behaviors

With the number of social media platforms ever increasing and their user bases constantly growing, media users are inundated with content from every angle. Social networking sites such as Instagram, LinkedIn, X (formerly known as Twitter), and TikTok are social media platforms where content creators post media messages for other platform users to encounter and engage with. Media messages can be in the form of images, video, or written text. Dependent on the platform's specific algorithm, engaging with these messages can include likes, shares, comments, clicking on the message, or a few-second pause when scrolling through a feed. The affordances and mobility of digital media make it a convenient source for emotional regulation. Previous media effects research has shown media users have become adapted to using their social media to assist in regulating their emotion (Bowman et al., 2010; Knobloch-Westerwick,

2015). The on-demand nature of digital media allows users to co-create content which in turn elicits emotional connections with others and/or the content (Bowman et al., 2010). With the ability to access interactive digital media at a space and time of their choosing, digital media has become an ideal source for emotional regulation (Bowman et al., 2010). Users are able to connect with loved ones or like-minded individuals, in addition to engaging with preferred content. These affordances are what makes digital media effective in triggering emotional responses and why users will seek-out, or avoid, certain media as a way of regulating their preferred emotion (Bowman et al., 2010; Knobloch-Westerwick, 2015).

The Selective Exposure Self- and Affect-Management (SESAM) model (Knobloch-Westerwick, 2015) argues that media users select messages to regulate their self-concept along with affective and cognitive states and behaviors. Self-concept includes an individual's own self-representation expectations or, put another way, how they present themselves in interpersonal and public situations (Markus & Wurf, 1987). For example, as mentioned earlier based on cultural influences, someone might have the self-representation expectation of showing no emotion in particular social environments. Self-concepts include but are not limited to self-schemas, personal standards, and possible selves (Markus & Wurf, 1987). Similar to emotion, the self-concepts an individual holds are socially and culturally influenced in addition to ever changing and evolving. Media users consciously and unconsciously seek out messages that aid them in activating and maintaining a self-concept, yet chance encounters with media messages can also activate them (Markus & Wurf, 1987; Knobloch-Westerwick, 2015).

In addition to self-management, SESAM highlights that media users select certain messages for affect-management. Affect-management is when individuals intentionally select media messages that allow them to regulate their affective states or behaviors (Knobloch-

Westerwick, 2015). As people expose themselves to these particular media, they experience arousal such as elation, fear, or suspense (Raskin, 2008). This arousal instinctively triggers negative or positive emotion (Fredrickson, 1998). Emotions, as experienced by the media user, are real even if experienced in response to a media message (Konijin et al., 2010). When emotions serve as an attention-grabbing function, they are helpful in directing one's focus to certain parts of a media message, and if the message mirrors societal settings and/or makes specific self-concepts more significant, the message will shape the exposure choices a media user makes (Markus & Wurf, 1987; Knobloch-Westerwick, 2015; Konijin et al., 2010). For example, the animal cruelty campaign started by the American Society for the Prevention of Animal Cruelty (ASPCA) in the early 2000's with singer Sarah McLachlan included images of animals in devastating environments overlayed with the heart-wrenching song by McLachlan, "In the Arms of an Angel" (Ragefc, 2006). These messages were intended to elicit compassion, and through those emotions, influence people to donate to the ASPCA (Tuner & Heo, 2010). The campaign has since become a piece of popular culture for some of the most devastating messages that are now avoided by many media users, including McLachlan herself (Brekke, 2014). Contemporary digital media, with its mobility via devices, is ideally suited for emotional regulation as it enables effortless and instant self-management.

Using the framework of SESAM model (Knobloch-Westerwick, 2015), which argues media users select messages to regulate their self-concept along with affective and cognitive states and behaviors, I postulate that when media contain humorous messages that align with an individual's self- and/or affect-management, a positive affect is triggered for the media user, thus making them more likely to select similar media messages in the future. Humor is the tool that can springboard this emotionally driven action.

2.3 Humorous States and Behaviors

Growing attention and curiosity have been given to humor and its ability to connect audiences to science-based information (Polk et al., 2009; Anderson & Becker, 2018; Cacciatore et al., 2020; Yeo et al., 2021; Yeo & McKasy, 2021). In the absence of a consentaneous definition for humor, for this project I refer to the definition set forth by Raskin (2008), "*any sudden episode of joy or elation associated with a new discovery that is self-rated as funny*" (p. 547). Incorporating humor when delivering science-based information is a risky and sometimes difficult endeavor (Muddiman et al., 2017; Ziegele & Jost, 2020). Audience response to humorous messages on television, in stand-up comedy, and via hashtags on social media have been studied by social scientists – yet these messages primarily include political framing (Polk et al., 2009; Cacciatore et al., 2020; Simis-Wilkinson et al., 2018; Yeo et al., 2021). Studies have shown when a message is politically charged it is more likely to trigger a negative emotion because the topic of politics is part of an individual's belief system (Muddiman et al., 2017; Ziegele & Jost, 2020). When humor is applied to a media message it must be done so with great care otherwise the message can lead to a Backfire Effect (Muddiman et al., 2017; Ziegele & Jost, 2020). This is when an individual feels their belief system is being attacked, resulting in a rejection of the information being presented (Muddiman et al., 2017; Ziegele & Jost, 2020)

Humor is seen in online settings in the form of dark humor and used in conjunction with the action of trolling (Navarro-Carrillo et al., 2021; Ortiz, 2020; Sun & Shen, 2021). Trolling is understood by scholars to be an aggressive behavior intended to provoke an emotional response resulting in a disruption of the discussion (Navarro-Carrillo et al., 2021; Ortiz, 2020; Sun & Shen, 2021). Trolling has been shown to trigger negative emotions resulting in negative responses, disengagement, and anger (Navarro-Carrillo et al., 2021; Ortiz, 2020; Sun & Shen,

2021). Those who initiate trolling are referred to as 'Trolls', and these trolls have been found to get joy out of laughing at others (known as katagelasticism) or by having others laugh at them (known as gelotophilia) (Navarro-Carrillo et al., 2021).

Troll-like behaviors are seen most often in online settings that provide the option of two-way communication, such as comments on social media posts or in a news outlet comment section (Navarro-Carrillo et al., 2021; Ortiz, 2020; Sun & Shen, 2021). Trolls rely on members of the community to provide additional commentary - including corrections, pleas, or agreement – which results in successfully derailing the conversation and validating the troll's behavior (Sun & Shen, 2021). Research using Social Identity Theory has shown members who hold a strong identity within a community are more likely to respond to trolling comments with the hope and intent of deescalating the situation (Sun & Shen, 2021). Unfortunately, this engagement is what derails the conversation and how dedicated members of a community removing themselves from the group and/or participating in the aggressive behavior (Navarro-Carrillo et al., 2021; Sun & Shen, 2021). Despite negative impacts such as these, humor has increasingly become a common strategy for drawing engagement in the media.

A great deal of the science messages the general public interact with are presented on television shows such as *The Daily Show* and *Last Week Tonight with John Oliver* (Polk et al., 2009). These programs present current news topics using satire, irony, and sarcasm which are types of humor considered to be aggressive or offensive (Anderson & Becker, 2018). In a 2018 two-condition experiment measuring the risk perception and belief certainty of climate change for participants, the research team found satirical humor increased concern over the topic for those not already interested in the issue (Anderson & Becker, 2018). The experiment utilized YouTube videos from *The Weather Channe*l (*TWC*) and *The Onion* that showcased sarcastic

tones. The video from *The Onion* presented a one-sided sarcastic representation on the topic climate change, while the *TWC* video presented a sarcastic behavior and a conversation discussing the positive and negative aspects of increasing global temperatures (Anderson & Becker, 2018). The team found the one-sided sarcastic video activated an increased interest from those who indicated low interest and issue importance in the pretest (Anderson & Becker, 2018). Although this experiment found a connection, it incorporated sarcastic messages and due to the possible negative effect such messages can invoke, the experiment does not fit well with what this project is attempting to analyze.

As seen with trolling behaviors, if the message being shared is paired with an aggressive humor, it is more likely to offend and be off-putting (Anderson & Becker, 2018; Cacciatore et al., 2020). When a media user experiences a strong emotion to an offensive media message, that negative emotion will result in a narrower focus and the ability to process the science-based information rationally is lost (Fiske & Taylor, 2013; Conway et al., 2013; Tiedens & Linton, 2001). Yet when less aggressive types of humor such as wordplay or anthropomorphism are applied to a message, they have been found to elicit mirth in audiences (Yeo et al., 2021; Su et al., 2022). Wordplay is a type of humor which is defined as a humorous use of puns incorporated into words or phrases that have more than one meaning (Berfer, 1976; Martin, 2007). Puns have a humorous effect due to their ability to violate language conventions while technically having an alternative interpretation as well (McGraw & Warren, 2010). An example of wordplay includes the phrase, “Don’t trust atoms. They make up everything.”

Anthropomorphic humor is recognized as the attribution of human characteristics, such as eyes or a mouth, to objects or animals (Buijzen & Valkenburg, 2004). It is a commonly used strategy when attempting to make science communication more engaging. In a study looking at

media users' intent to engage with a humorous scientific message on social media, the research team found anthropomorphic humor combined with wordplay produced higher engagement intentions from participants compared to when the humor types are applied individually (Yeo et al., 2020). With this in mind, the science joke used in my stimulus will include a combination of these humor types.

Studies have shown humor in messaging to be persuasive and act as a motivator for altering behaviors (Moyer-Gusé et al., 2018; Xenos & Becker, 2009), increase political participation (Skurka et al., 2018), and have a positive influence on audience attention levels (Madden & Weinberger, 1982). Humor has also been shown to have influence on a media user's intended social media engagement, such as their interactive behaviors that include likes, comments, or follows (Yeo et al., 2020). Engagement also includes sharing a message with others such as a repost, share, or direct message (Yeo et al., 2020). On social networking sites, people use social media metrics such as the 'Like', 'Comment', and 'Share' features to engage in social interactions with the content (Khan, 2017). If audiences find the content of the post entertaining or that it aligns with their personal beliefs or attitudes, they are more likely to engage with the post, increasing the total social media metrics for that particular post (Khan, 2017). In advertising, messages containing positive emotion or high arousal emotions such as joy, have been correlated with increased social media metrics, yet those negative emotion such as disgust, have also been correlated with higher social media metrics (McDuff & Berger, 2020).

Although humor is thought to be a useful strategy when communicating science-based information on social media, it has not been adequately tested to prove its effectiveness. The findings of this project will contribute to the limited empirical evidence on humorous science-based messages and the impact it has on media users in a social media setting. I postulate a

science message containing benign humor is more likely to trigger a positive emotion resulting in the media user to be more likely to select or seek out a similar message in the future.

2.4 Limitations

The current project will not include social media metrics in the stimulus even though these types of audience approval social cues have been shown to heighten the enjoyment of media messages for the user (Cacciatore et al., 2020). This is a limitation to consider especially with knowing similar to emotion, what one considers humorous is heavily influenced by cultural and social environments. Additionally, for an individual to experience elation, they must already be in a playful state of mind otherwise they will be unable to successfully process a humorous message (Raskin, 2008). This can be accounted for by measuring an individual's cheerful state before encountering the stimuli, which will serve as an indicator of how likely they are to appreciate a humorous message (Ruch et al., 1997). Negative and positive emotions result in distinct thought-action repertoires. When an individual experiences a negative emotion, the brain instinctively needs their full attention so they may focus on overcoming the obstacle or threat. When one experiences a positive emotion, such as joy, the brain determines there is no need for one's full focus, therein providing them with the opportunity to pursue unscripted thought-action behavior. Broadening one's thought-action includes the selection of media one engages with or seeks out. In an effort to maintain or initiate a positive emotion, media users are more likely to seek out media messages that have produced similar results for them in the past. Humor, which has been increasingly applied to science-based messages on social media, is known for triggering positive emotions, which leads to my overall hypothesis.

I propose the following hypotheses:

Hypothesis 1 (H1): Media users who are exposed to a humorous science message will be more likely to experience a positive emotion.

Hypothesis 2 (H2): Media users who are exposed to a humorous science message will be more likely to participate in information engagement in the future.

Hypothesis 3 (H3): Media users who experience relatively more positive emotion when exposed to a humorous science message will be more likely to participate in information engagement in the future.

CHAPTER 3. METHOD

3.1 Research Objectives

The core contributions of this thesis are identifying whether a humorous science-related message has an effect on positive emotion; determining if the stimulus impacts information engagement; and examining the relationship between positive emotion and information engagement. In order to achieve these objectives, I conducted an experiment to measure if positive emotion is invoked when exposed to a humorous science-related message, whether exposure to a humorous science-related message has a direct effect on information engagement, and measure if experiencing a positive emotion impacts greater levels of information engagement in the future.

3.2 Theory Framework

In order to achieve my research objectives and contribute to the limited pool of existing literature regarding the application of humor in a science-based social media message, I conducted an experiment.

This method was used in Yeo et al.'s (2020) study that measured participant mirth, or experiencing humor, after exposure to a humorous science-related Twitter message. Participants were exposed to one (1) of four (4) different stimuli which included *no humor*, *wordplay*, *anthropomorphism*, and *combined* (wordplay and anthropomorphism) (Yeo et al., 2020). Mirth was then measured with a 7-point semantic differential scale and the results indicated those participants who were exposed to the *combined* stimuli experienced more mirth (Yeo et al., 2020). Based on these results, the current project utilized combined humor in the humor condition. Thats is, the stimulus used contained a combination of anthropomorphism (attribution

of human characteristics) combined with wordplay (humorous use of puns incorporated into words or phrases).

3.3 Experimental Design

To examine the impacts of a humorous science-based message on the likelihood of a participant's information engagement, a two-condition, between subjects, online experiment was conducted. The experiment utilized a survey to measure different, underlying constructs.

A factorial design was employed, participants were randomly exposed to one of two screenshots of an Instagram post containing a science-related message. In all conditions the social media post was made from the same account, 'ScienceCommunicationResearch'. The joke used in the humor post (Figure 1) was created using a large language model-based chatbot, ChatGPT using the prompt, "astronomy puns". The humor art used was created using the generative machine learning model, Adobe Firefly using the prompt, "messy pile of laundry, anthropomorphism and a universe background". The no humor art was created with the same Adobe software using the prompt, "universe background" (Figure 1). Both conditions did not include social media metrics (such as likes or shares) or comments as a way of controlling for social cues of humor.

3.4 Variables

This project used two nominal independent variables, a mediator, and one dependent variable.

3.4.1 Independent Variables

Humorous Message. One independent variable is the stimulus which varies by either having humor (a combination of anthropomorphism and wordplay) or no humor. The stimuli contained two conditions: 1) Humor and 2) No humor (Figure 1). In the no humor condition, the text of the post was altered to be a science fact that was consistent with the joke in the humor

condition, and the image was changed to complement the science fact. In both conditions the number of words was kept as consistent as possible. The absence of humor was also indicated in the image by removing the anthropomorphism. Participants were randomly exposed to one of the possible two screenshots. Of the total 117 responses, 56 participants were assigned the Humor condition and 55 were assigned the No humor condition.

To measure perceived humor, that is if participants found humor in their randomly assigned condition, a Five, 7-point semantic differential scale was adopted from Yeo et al.'s 2020 study to measure the variable. The scale items included: *not humorous:humorous*, *not funny:funny*, *not playful:playful*, *not amusing:amusing*, *not entertaining:entertaining* (see Q3 – Q7 in Appendix A). Although the survey included these items for perceived humor, this construct was not used in the analyses for this project.

Figure 1. Survey conditions 'Humor' and 'No humor'.

3.4.2 Dependent Variable

Information Engagement. This project utilized a post-test only design to measure the dependent variable 'information engagement' which took place after participants were exposed to their conditional stimuli. This variable is conceptualized as *when a media user has the intent to seek out or share media* (Bowman et al., 2010; Knobloch-Westerwick, 2015; Anker et al., 2011).

To measure if the stimulus in the current project had an impact on an individual's information engagement likelihood, an adapted scale from Rain's (2008) study which sought to understand what role self-efficacy plays in an individual's intention to seek information on the Web was used. Rain used a single item in their questionnaire to measure participants' intention to use the Web in the future to acquire health information (2008). The current project used the same scale, with additional researcher-created questions which sought to measure participant intentions of sharing information, and increase validity of the construct 'information engagement'.

The question adapted from Rains's 2008 study is, "*Estimate the likelihood of using the Web to search for science information in the future*." The additional researcher-created questions included, *"After seeing this post, how likely are you to "Follow" this account so you could see updates and new posts from them on your social media feed?*," "*After seeing this post, how likely are you to send this post to a peer?*," "*After seeing this post, how likely are you to send the post to a loved one?*," and "*If you came across this post on the social media platform you most often use, how likely are you to share the post?".* These questions were measured on a 7-point Likert type scale anchored at *1- Extremely Unlikely* and *7- Extremely Likely* (Q10 – Q14 in Appendix A).

Additionally, questions from Yeo et al. (2021) study which measured participate motivation to follow more science on social media after being exposed to a humorous message were included to account for participants future information engagement likelihood. The three questions adapted from Yeo et al. (2021) included, "*Based on this post would you be motivated to pay more attention to science in social media?*", "*Based on this post would you be motivated to follow more scientists on social media?*", and "*Based on this post would you be motivated to pay closer attention to updates from scientists on social media?*". These questions were also measured on a 7-point Likert type scale anchored at *1- Extremely Unlikely* and *7- Extremely Likely* (Q16 – Q18 in Appendix A).

The construct 'information engagement' was measured with these eight questions. The scale had a high level of internal consistency, as determined by a Cronbach's α of 0.858. As a result, the eight questions were combined into one variable using an average of the items, 'Information Engagement' (M = 2.9, SD = 1.39).

3.4.3 Mediator

Positive Emotion. In this project 'positive emotion' is a mediating variable and conceptualized *as feeling joy, which can be described as experiencing elation or mirth* (Fredrickson, 1998; Yeo et al., 2020). Positive emotion was measured pre- and post-condition using questions adapted from the Positive and Negative Affect Schedule (PANAS) developed by Watson et al. (1988) and Gross et al. (1998).

Pre-condition participants were asked two eight-point questions adapted from Watson et al. (1988), "*How do you feel right now?*" The scale included eight items to identify positive affect (*interested, excited, enthusiastic, playful, alert, inspired, attentive,* and *active*) and negative affect (*distressed, upset, hostile, irritable, fearful, ashamed, guilty,* and *nervous*)

(Watson et al., 1988) (Q1 and Q2 in Appendix A). Although the survey included pre-condition items on 'positive' and 'negative affect', these constructs were not used in the analyses for this project.

Post-condition participants were asked two six-point questions adapted from Gross et al. (1998), "*Rate the maximum amount you felt at any point while looking at the post*." The scale includes six items to identify positive affect (*elated, enthusiastic, euphoric, happiness, lively,* and *playful*) and negative affect (*annoyed, anxious, distressed, nervous, irritable,* and *fearful*) (Gross et al., 1998). All four questions are measured on a 7-point Likert type scale anchored at *1- Not at All* and *7- Very Much* (see Q8 and Q9 in Appendix A). Although the survey also included post-condition items on 'negative affect', this construct was not used in the analyses for this project. The post-condition construct 'positive emotion' was measured with one, six-point question. The scales had a high level of internal consistency, as determined by a Cronbach's α of 0.919. As a result, the six-point question was combined into one variable using an average of the items, 'Positive Emotion' (M = 3.1, SD = 1.39).

3.5 Data Collection

3.5.1 Sample

Using a power analysis program (G*Power), effect sizes from a similar study (Yeo, 2020) was used to determine the power analysis and appropriate number of participants per condition. Effect sizes were compiled from a similar study that specifically used self-report questionnaires. Effect sizes were retrieved from Yeo et al. (2020) study, which measured participant mirth after exposure to a humorous science-related message. When alpha = 0.15 and power = 0.242, the projected sample size needed with this effect size is approximately N = 112, indicating each experimental group needs at least 56 participants (Faul et al, 2007).

3.5.2. Participants

Participants were recruited from the Colorado State University Fort Collins campus using the SONA database. SONA is a research participation and management tool that allows undergraduate and graduate students to voluntarily participate in university research studies. Upon completion, participants were compensated with extra credit that the SONA system calculates as a 1% increase to their overall grade in their course. Mass emails through SONA were sent out to those enrolled in the system by their primary instructors.

The use of the SONA system provided a convenience sample of students over the age of 18 and who were able to provide informed consent to participate. Additionally, previous studies have shown social media to be a predominant aspect of college students' lives (Weaver & Swank, 2021). The interactive features of social media allow students to build on their social networks based on shared interests and backgrounds (Kim & Kim, 2017). As a result, college students ages 18-24 have been reported as accessing their social media platforms daily (Auxier & Anderson, 2021), with the majority reporting they access them 10 or more times daily (Kim & Kim, 2017; Weaver & Swank, 2021). These studies indicate the topic I am studying, humorous science-based message on social media, is highly relevant to this population. While this sample does not allow me to generalize findings to college students, it is acceptable for the experimental approach and exploring the relationships between my variables of interest.

A total of 117 participants gave responses with 90% (n = 96) reported as being between the ages of 18 to 34 and 9% (n = 10) being 35 or older (Table 1). Participant political views indicated 42.5% (n = 45) identify as Liberal on a spectrum of slightly (12%, n = 14), middle (21.4%, n = 25), or extremely (5.1%, n = 6); 24.8% (n = 29) identify as Moderate; 27.4% (n = 32) identify as Conservative on a spectrum of slightly (10.3%, n = 12), middle (17.1%, n = 20),

or extremely (0%, $n = 0$) (Table 1). North America accounted for 90.6% ($n = 96$) of participants location of birth (Table 1).

Table 1. Participant characteristics of the sample by experimental condition (n = 117).

	No humor	*Humor*	*Total*
Age			
18 - 24	43	45	88
25 - 34	5	3	8
35 - 44	3	3	6
45 - 54	0	2	2
55 - 64	0	1	1
65 or older	0	1	1
Political Views			
Extremely liberal	2	4	6
Liberal	18	7	25
Slightly liberal	5	9	14
Moderate	12	17	29
Slightly conservative	4	8	12
Conservative	10	10	20
Extremely conservative	0	0	0
Place of Birth			
North America	47	49	96
Central America	0	1	1
South America	0	1	1
Europe	1	2	3
Africa	1	0	1
Other	2	1	3
Prefer not to say	0	1	1

3.5.3 Data Collection Procedures

International Review Board (IRB) Approval. This project relied on human subjects and for this reason it required IRB approval prior to recruiting or collecting data. Human Subjects Protection Training was required prior to IRB approval and was completed (record #

4066373). The researcher sought exempt status with IRB because the project was conducted in an education setting, did not include children, and no personal identifiers were collected. IRB approval was received on December 28, 2023 (ID# 5288), data collection began on February 2, 2024.

Survey. The survey was created using Qualtrics XM, an experience management software that allows the creation and analysis of surveys. The survey was live from February 2, 2024, through February 23, 2024.

Recruitment Email. Using the SONA system's ability to send a mass email to those enrolled, an email was sent inviting students to create an account and participate in the survey (see example email in Appendix B). The email briefly described the purpose of the project, informed the reader how they would be compensated for their time, and indicated any identified risks to them for participating.

Participant Compensation. At the end of the Spring 2024 semester the SONA coordinator will provide a list of students to each Journalism and Media Communication course instructor that had students participate in any extra credit opportunities in the SONA system to ensure those who participated in this project receive their extra credit.

3.6 Pretest

To increase internal validity of the project an informal pretest was completed to determine if the stimulus conditions were eliciting the proper emotion. Participants were exposed to two humorous images, 'Distribution Humor' and 'Astronomy Humor' (Figure 2). They were then asked to rate the humorous level of each image on a Five, 5-point semantic differential scale that included, '*not humorous:humorous'*, '*not funny:funny'*, '*not playful:playful'*, '*not amusing:amusing*', '*not entertaining:entertaining'*. The majority of pre-test participants (n = 33)

preferred the ‘Astronomy Humor’ image due to its simplicity. It was found to be more comprehensible for those with a basic level of education and scientific knowledge.

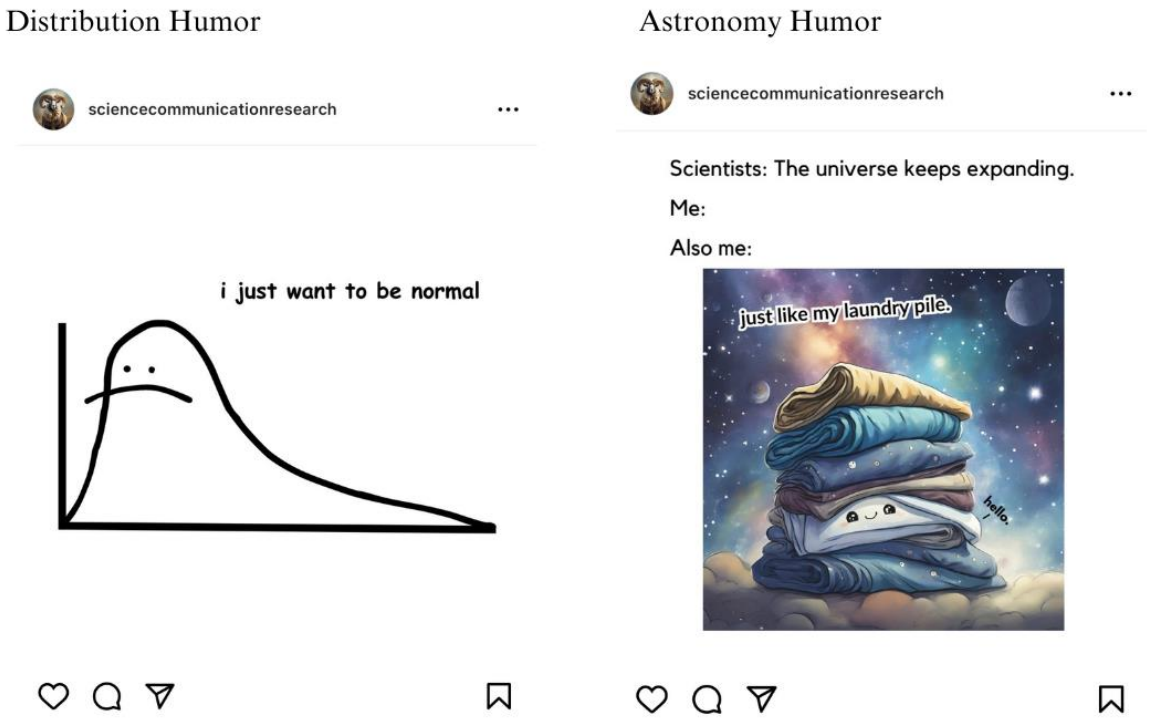

Figure 2. Pretest images. Distribution Humor’ (left) and Astronomy Humor’ (right) conditions.

CHAPTER 4. RESULTS AND ANALYSIS

When the target sample was met, responses were digitally downloaded from Qualtrics XM and then analyzed in the software program Statistical Package for the Social Sciences (SPSS). To examine the impacts of a humorous science-based message on audience likelihood to seek out similar media, a two-condition, between subjects, online experiment was conducted. The proposed hypotheses:

Hypothesis 1 (H1): Media users who are exposed to a humorous science message will be more likely to experience a positive emotion.

Hypothesis 2 (H2): Media users who are exposed to a humorous science message will be more likely to participate in information engagement in the future.

Hypothesis 3 (H3): Media users who experience relatively more positive emotion when exposed to a humorous science message will be more likely to participate in information engagement in the future.

4.1 Hypothesis Testing

An ANOVA was conducted for H1 to determine if Positive Emotion was different for the experimental condition groups. Support was found for H1 indicating those exposed to a humorous message are more likely to experience a positive emotion. Participants were classified into two groups: Humor (n = 56) and No humor (n = 55). There were no outliers, as assessed by boxplot; Positive Emotion scores were normally distributed for Humor with a skewness of 0.269 (SE = 0.322) and kurtosis of -0.562 (SE = 0.634) and for No humor with a skewness of 0.094 (SE = 0.333) and kurtosis of -1.183 (SE = 0.656). There was homogeneity of variances, as assessed by Levene's test for equality of variances (p = .221). Participants who were exposed to the humor condition (M = 3.48, SD = 1.46) were more likely to experience positive emotion than

those who were exposed to the No Humor condition (M = 2.76, SD = 1.22), with a mean increase of 0.072, 95% CI [2.871, 3.398], p = .008 (Figure 3).

Figure 3. Bar chart indicating the differences in Mean for Positive Emotion by condition.

An ANOVA was conducted for H2 to determine if exposure to a humorous science message made media users more likely to participate in Information Engagement. Support was found for H2 indicating exposure to a humorous science message did affect Information Engagement. There were no outliers, as assessed by boxplot; Information Engagement scores were not normally distributed for the Humor condition with a skewness of 0.534 (SE = 0.322) and kurtosis of -0.689 (SE = 0.634) and for the No humor condition with a skewness of 0.203 (SE = 0.333) and kurtosis of -1.157 (SE = 0.656). The assumption of homogeneity of variances was violated, as assessed by Levene's test for equality of variances (p = < .001). Participants who were exposed to the humor condition (M = 3.18, SD = 1.63) were more likely to participate in

Information Engagement than those who were exposed to the No Humor condition (M = 2.59, SD = 0.98), with a mean increase of 0.59, 95% CI [2.618, 3.182], p = .029.

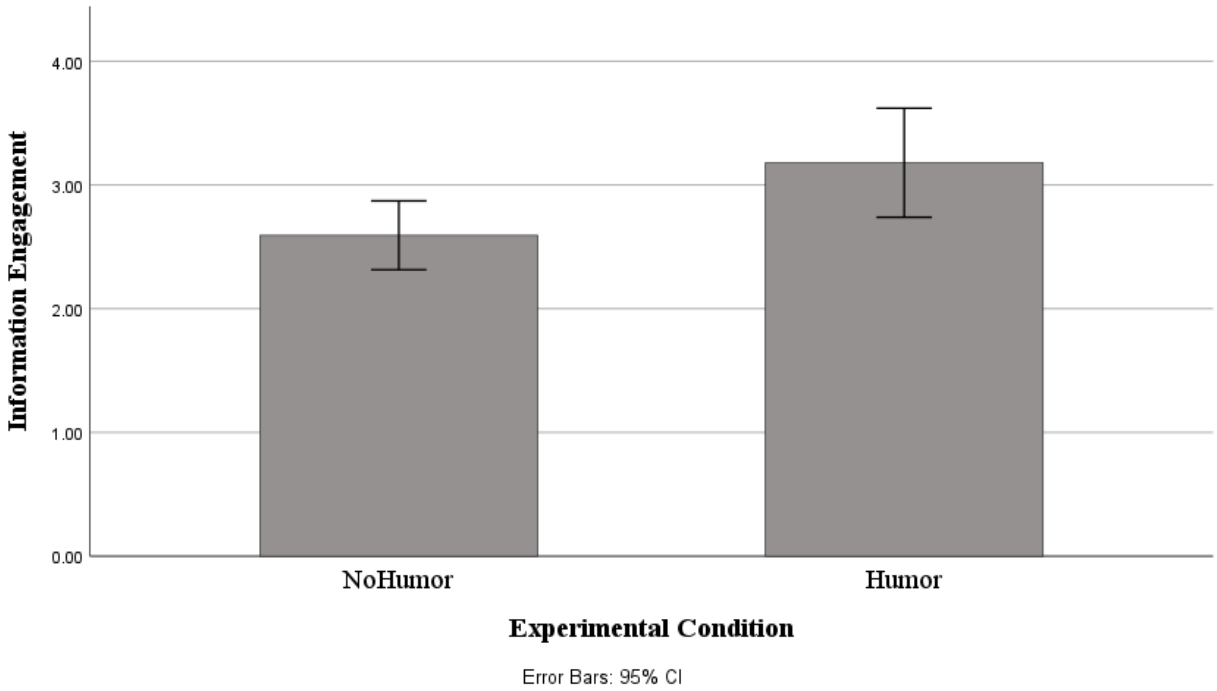

Figure 4. Bar chart indicating the differences in Mean for Information Engagement by condition.

For H3 a mediation analysis, Hayes Process Macro Mediation Analysis - Model 4, was performed to assess the mediating role of Positive Emotion on the linkage between exposure to a humorous science message and the likelihood to participate in information engagement in the future (Figure 5). Support was found for H3 indicating those who experience a positive emotion are more likely to participate in information engagement in the future. This suggests humor is a driver of information engagement.

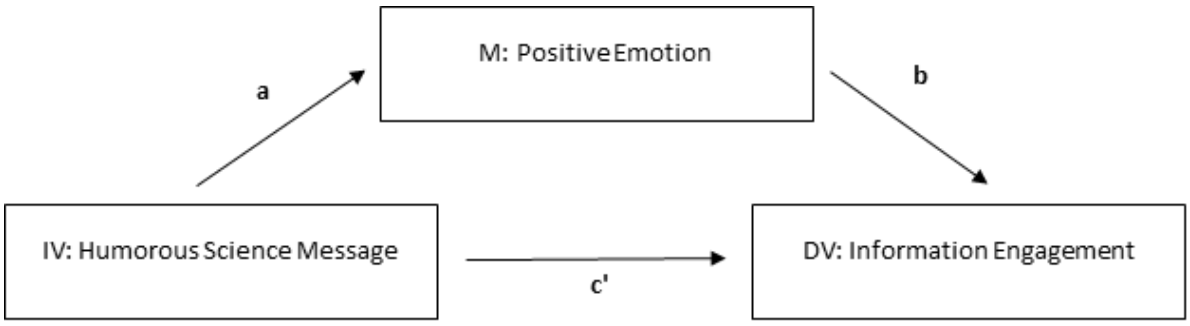

Figure 5. Mediation analysis conceptual diagram.

Mediation analysis results revealed that the total effects (c′ + a*b) of a humorous science message on Information Engagement was significant (b = 0.5864, t = 2.2171, p = 0.0288). The direct effect (c') indicates with the inclusion of the mediating variable (Positive Emotion), the impact of a humorous science message on Information Engagement became insignificant (b = 0.2314, t = 0.9695, p = 0.3345). The indirect effect (a*b) of a humorous science message on Information Engagement through Positive Emotion was found significant (b = 0.4995, t = 5.8087, p = < .001). This shows that the relationship between a humorous science message and Information Engagement is fully mediated by Positive Emotion. Mediation analysis summary is presented in Table 2.

Table 2. Mediation analysis summary.

Relationship	Total Effect	Direct Effect	Indirect Effect	Confidence Interval		t-statistics	Conclusion
				Lower Bound	Upper Bound		
Humorous Science Message-> Positive Emotion-> Information Engagement	0.5864 (0.0288)	0.2314 (0.3345)	0.4995 (< .001)	0.099	0.668	5.8087	Full Mediation

CHAPTER 5. DISCUSSION

The current state of being able to exchange accurate and effective science-based messages with the general public is an ever-increasing concern for scientists and science communication practitioners. Science information as a whole has become known as a controversial topic because it often invokes political beliefs and social values when it is presented in the media. This has resulted in audiences being cautious about engaging with scientific messages.

Although humor is thought to be a useful strategy when communicating science-based information on social media, research on its effectiveness is still growing. The goal of this project was to contribute empirical evidence to the limited pool of literature and outreach tactics that exist regarding the application of humor science-related social media messages. To achieve this goal, I conducted an experiment which measured if positive emotion was invoked when exposed to a humorous science-related message; whether exposure to humorous science-related messages have a direct effect on information engagement; and if experiencing a positive emotion impacted greater levels of information engagement.

The current literature suggests a media users' engagement is driven by emotion and when a positive emotion is experienced, the individual is more likely to seek out the action that created that feeling again. This information led me to postulate if a positive emotion can be triggered through a humorous science-based social media post, the media user could be more likely to broaden their science-related social media exposure. The results suggest that individuals exposed to a humorous message are more inclined to experience positive emotions and those who did are more inclined to participate in information engagement in the future. Indicating that humor plays a significant role in driving information engagement.

These findings indicate a clear correlation between exposure to humorous messages and the likelihood of experiencing positive emotions. Furthermore, individuals who indeed experienced these positive emotions were also more likely to engage with similar media in the future. This suggests that humor serves as a powerful facilitator for fostering both a positive emotional response and subsequent active engagement with information from media users. In essence, humor emerges as a significant factor influencing and driving information engagement, calling attention to its importance in science communication strategies.

5.1 Theoretical Framework Application

The theoretical framework of Broaden-and-Build theory (Frederickson, 1998) argues positive emotions provide individuals with the opportunity to broaden their scope of thought-action response and build on their subconscious scripts, or schemas formed by the brain. The results of this project support this theory as participants assigned to the humor condition reported as having higher likelihood for information engagement, that is to seek out or share similar messages on social media.

Research on brain activity has shown positive emotions take longer to process (schema), compared to negative emotions which trigger instincts and therefore are processed much faster (heuristic). For example, if one were on a hike and encountered a bear, the brain will instinctively identify the danger and respond with a thought-action script telling them to remove themself from the dangerous situation. On the other hand, if while hiking one feels safe and enjoys the overall experience, they are able to engage more consciously with their environment. Then when future hiking opportunities arise, they will associate hiking with positive emotions making it more likely they will engage in the activity again. Repeating the activity with

continued enjoyment will result in the brain's creation of new instinctive actions (heuristics) and hiking will henceforth become associated with triggering positive emotions.

Similarly, if media users continue information engagement with humorous science-based messages their brains undergo a process of building new thought-action scripts associated with scientific information. These scripts represent cognitive patterns that become ingrained through repeated exposure, associating humor with the consumption of scientific content. Consequently, when individuals encounter subsequent humorous science-based messages, these newly formed scripts are automatically activated. As a result, they are more inclined to participate in information engagement, as the humor serves as a trigger for their interest in scientific topics. This phenomenon underscores the role of humor in not only capturing attention, but also in facilitating cognitive associations that promote continued engagement with scientific information.

Moreover, when individuals interact with humorous science-based messages, the algorithm of the social media platform detects their interest and subsequently starts delivering comparable content to their feed. This process occurs through incidental exposure, which in the context of a digital environment refers to when a user encounters content unintentionally or accidentally while engaging in other activities (Weeks & Lane, 2020). Over time, as users repeatedly encounter similar messages, their media consumption habits are influenced, leading to the possibility of increased interest in scientific information. In essence, this mechanism of exposure and repetition plays a pivotal role in shaping a media user's preferences and fostering a greater engagement with scientific content within the digital environment.

Additionally, the results indicate the stimulus aligned with a significant number of participants self- and/or affect-management practices, thus making them more likely to

participate in information engagement with similar messages in the future. The framework of the SESAM model (Knobloch-Westerwick, 2015) argues media users select media messages to regulate their self-concept (self-schemas, personal standards) along with affective and cognitive states and behaviors (a preferred emotional state).

Participants assigned to the humor condition which employed benign humor, that is without political or social value contexts, reported a high likelihood to participate in information engagement on social media platforms. This highlights the effectiveness benign humor (harmless, non-threatening, or inoffensive) can have and the potential for using this type of humor to help science-based messages align with media users self- and/or affect-management practices. This suggests that benign humor serves to trigger a positive affect. The implications of these findings offer valuable insights for researchers into the impact benign humor has on emotional responses. By recognizing the impact of harmless, non-threatening, or inoffensive humor on an individual's affective state, researchers can gain a deeper understanding of how humor type can shape the selection of one's media content. Ultimately, these insights empower both scientists and science communication practitioners with the tools to craft and optimize messages that resonate more effectively with a broad audience.

5.2 Implications for Existing Research

The stimuli for the humor condition in this project contained a combination of wordplay and anthropomorphism because based on previous studies, this combination has been found to produce higher engagement intentions. The results of the current project are consistent with previous studies that also used this humor combination when examining science-related information engagement on social media. This combination of humor within a social media context is not commonly utilized, thus making the project a valuable addition to the limited

collection of research. There is a growing recognition of the importance of humor in science communication on social media, which is why researchers are exploring diverse strategies to engage audiences with scientific content in digital spaces. The results of this project provides researchers and practitioners with additional insights and perspectives on how humor can be applied to effectively communicate scientific concepts in online environments. Future research is needed to better understand the effectiveness of benign humor when compared to other types of humor such as satire, irony, sarcasm, or dark humor. This research could involve experimental studies comparing the impact of different types of humor on positive affect, qualitative focus groups or individual interviews to explore perceptions regarding different types of humor.

The humor applied to the stimuli was intently created to be benign. That is, I attempted to ensure political and social values were not the focus of the humor due to previous studies highlighting how aggressive types of humor have increased potential to offend and be off-putting. Aggressive types of humor have the potential to trigger negative emotions resulting in decreased engagement with science-based information. As the goal was to examine possible new tactics that scientists and science communication practitioners can use to engage audiences, the use of aggressive humor was avoided. Despite the stimuli's benign nature, the results indicate participants did experience a positive emotion when exposed to it. The implications of these findings might suggest that humans have a natural inclination towards finding positivity in their environment, even when it is not explicitly presented as such. It could also hint at the power of subtle cues or small gestures in influencing an individual's emotional state.

A goal of the current project included adding to the pool of existing research concerning humorous science-based messages on social media, yet the stimulus was limited in its re-creation of a social media environment. The stimuli were screen-captures of the Instagram post which

accurately recreated the way participants would encounter the image within the platform, however, social media metrics and comments were intentionally excluded to control for social cues. For future studies there is potential for exploration into stimuli that integrate benign humor within varying contexts, including scenarios featuring positive, negative, and neutral comments. By presenting participants with diverse sets of stimuli, researchers can examine how the presence of benign humor accompanied by various perceptions, attitudes, and emotional responses across a spectrum impacts the triggering of a positive affect and likelihood of information engagement. These qualitative approaches can provide an understanding of how individuals perceive and respond to humorous science-based messages within different social contexts, shedding light into underlying mechanisms that are driving their reactions.

5.3 Limitations / Future Research

Limitations of the current project's stimuli includes the use of benign humor. Incorporating humor when delivering science-based information is a risky and sometimes difficult endeavor which can quickly backfire when not carefully applied. In an effort to remain non-threatening coupled with the consideration of participants level of scientific background, exposure, and knowledge- no risks were taken with the stimulus. The art and humor used were intended to reach a broad spectrum of individuals. Future research might look more closely at the potential benign humor has in getting diverse audiences to engage with scientific content in online environments. By exploring this dynamic further, researchers can uncover insights into how humor, when employed strategically and with sensitivity, can bridge communication gaps for scientific information among a wide range of individuals.

In future studies it is critical to explore the effects of benign humor on a variety of scientific contexts, mainly those which hold negative cognitions, such as climate change.

Climate change is not merely a scientific issue but also a deeply politicized and culturally contested phenomenon. Humor possesses unique communicative potential in that it can serve as a tool to engage audiences, enhance message retention, and facilitate comprehension. Understanding how humor, especially of a non-threatening nature, influences perceptions, attitudes, and behaviors towards politically and socially charged scientific subjects can offer valuable insights.

It is critical to explore the integration of benign humor into emotionally charged topics, to examine if the humor type makes the scientific information more palatable and less daunting for individuals who might otherwise be disengaged or overwhelmed by the severity of the subject matter. Examining the effects of humor within the context of cognitions such as denial or cognitive dissonance, which are often associated with climate change, can highlight strategies for navigating these barriers. Benign humor has the potential to disarm psychological defenses, reduce resistance to new information, and foster a more receptive mindset among audiences.

Humor can serve as a bridge across ideological divides fostering constructive dialogue, and collaboration among diverse stakeholders. By examining how humor influences perceptions of scientific consensus and willingness to engage in collective action, researchers can contribute to the development of more inclusive and effective strategies for science communication. By deepening our understanding of the role of humor in shaping attitudes, beliefs, and behaviors, scholars can advance efforts to communicate scientific knowledge and foster engagement.

The findings of this project raise additional questions about other potential factors that could impact the results and should potentially be incorporated into future research. By including individual-level cognitive factors that might make one more susceptible to an emotional response to humor we can deepen our understanding of why people react differently. Some individuals

may be more emotionally sensitive or reactive than others, predisposing them to stronger emotional responses to certain types of humor. For example, individuals with higher levels of science literacy may feel more emotionally invested in scientific topics or issues, leading to a stronger emotional response when encountering humor science-based messages. This emotional investment may stem from a sense of personal relevance or identification with scientific themes, where science-literate individuals may be more sensitive to the accuracy and authenticity of scientific information presented in humor. Making humor that distorts or misrepresents scientific facts or principles a trigger for negative emotional reactions, such as frustration. Understanding how these and other individual differences in emotional sensitivity interact with humorous stimuli can provide insights into why people vary in their reactions. Future research could incorporate measures of individual-level cognitive factors into experimental designs to assess their impact on emotional responses to humor. This might involve manipulating cognitive variables or measuring individual differences before exposing participants to the stimuli.

Although participate demographic data was gathered (Table 1), it was not used in the analyses. Yet individual characteristics such as political beliefs, level of scientific literacy, cultural background, and religious conviction influence the reception and effectiveness of humor within the exchange of scientific information. The results of this study highlight the potential of benign humor when paired with scientific information, particularly in amplifying audience engagement on social media platforms. The incorporation of humor into scientific content showed to be effective in fostering a sense of enjoyment (positive emotion) among participants. This emotional response not only captured the attention of participants but also fostered heightened curiosity, as results indicated a likelihood of continued engagement with scientific information in the future. By infusing benign humor with science-based messages,

scientists and science communication practitioners can navigate barriers to accessibility by making complex information more appealing to the audience. This approach not only facilitates the sharing and seeking out of science-based messages, but also cultivates a positive atmosphere for scientific discourse within digital spaces.

Leveraging humor within scientific communication strategies holds promise for fostering a more inclusive and engaging online environment. By tapping into the appeal of humor, science communicators can encourage knowledge-sharing and ultimately rebuild the strained relationship between the public and scientific information. Yet to expand our knowledge on benign humor's impact in the presence of individual characteristics, future research should expand on the exploration of whether other types of humor may be moderated by these factors. For example, political beliefs can significantly shape an individual's perception and reaction to scientific information presented with humor. People with differing political affiliations may interpret humorous scientific messaging through contrasting lenses, impacting their willingness to accept or reject the communicated content. Cultural background also plays a crucial role in shaping humor preferences and interpretations. Humor is deeply embedded in cultural contexts, with norms and values dictating what is considered amusing or offensive. Therefore, the cultural background of an audience can significantly influence how benign humor paired with scientific information is perceived and received. Religious doctrines may intersect with scientific narratives influencing attitudes and receptivity.

Given the multifaceted nature of these demographic factors and their potential impact on the reception of humor, future research should also explore how benign humor paired with more controversial topics is received among diverse demographic groups. By conducting analyses that consider the interplay between humor, scientific information, and individual

characteristics, researchers can gain deeper insights into the nuances of audience reactions. This understanding is key for creating effective communication strategies and ensuring humor enhances, rather than detracts from, the exchange of scientific information across varied demographic contexts.

Additionally, the findings of this project raise questions about the application of humor with scientific information within contexts other than mass communication, such as interpersonal communication. Further research should explore the combination of benign humor with controversial scientific topics in non-mediated face-to-face or small group settings and explore communication dynamics that may not be evident in mass communication channels. This would assist in providing science communicators with insight into how benign humor is perceived among individuals who do not share the same perspective on a topic. Examining the role of benign humor in interpersonal communication settings would offer valuable insights for science communicators seeking to engage diverse audiences. It would also assist in developing knowledge on the application of benign humor so it may be utilized as a tactic in relationship-building and conflict management situations. Understanding how benign humor influences the receptivity of scientific information among individuals with differing viewpoints can inform more effective communication approaches aimed at bridging communication gaps and fostering constructive dialogue. Research into the intersection of benign humor and scientific communication in interpersonal contexts promises to enrich our understanding of effective communication strategies, enhance science outreach efforts, and facilitate constructive dialogue in an increasingly polarized world. By delving into these uncharted territories, researchers can unlock valuable insights that empower scientists and science communicators to advance the public's engagement with scientific information.

A limitation of the results to consider is participant algorithm literacy, or knowledge of how digital technologies and platforms utilize algorithms, such as social media and search engines. Individuals with higher algorithm literacy will be more familiar with how algorithms influence the content they encounter in digital spaces, including scientific content. Individuals with higher levels of algorithm literacy may be more attuned to the role of algorithms in shaping their online experiences, including incidental exposure, making them more resistant to the influences of repeated exposure. Algorithm-literate individuals will also be aware of the potential political or social value biases inherent in algorithmic systems. Humor that reflects or exaggerates these biases, whether intentionally or unintentionally, may evoke a negative emotional response such as concern, skepticism, or outrage. Future research could investigate how individuals with varying levels of algorithm literacy perceive and interact with algorithmically mediated content in online environments. Research such as this could inform discussions about the design and deployment of algorithmic systems.

Method limitations of the chosen instrument, survey, includes the lack of mediation and self-reported responses. To account for survey-fatigue questions were kept short and low in quantity (21 questions total). Additionally, the survey flow was formatted so questions featuring multiple choice and matrix responses were arranged to directly follow one another. Future studies may find value in employing alternative methodologies that facilitate researchers in eliciting more comprehensive responses from participants concerning the stimulus and the emotion it elicits. This could involve focus groups or qualitative interviews conducted in naturalistic settings. By employing these methodologies, researchers can delve deeper into what participants are experiencing while gaining richer insights into the multifaceted nature of emotional responses. These alternative approaches would not only enhance our understanding,

but also offer opportunities to capture the complexities of human emotion in relation to humorous science-based content, thereby contributing to the advancement of knowledge in the field.

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APPENDICES

Appendix A: Survey Questions

Q1: How do you feel right now?

1	4	7
Not at all	Moderately	Very much

____Interested	____Playful
____Excited	____Alert
____Enthusiastic	____Inspired
____Active	____Attentive

Q2: How do you feel right now?

1	4	7
Not at all	Moderately	Very much

____Distressed	____Upset
____Irritable	____Hostile
____Fearful	____Ashamed
____Guilty	____Nervous

Q3: This post is...

1	4	7
Not Humorous	Neither	Humorous

Q4: This post is...

1	4	7
Not Funny	Neither	Funny

Q5: This post is...

1	4	7
Not Playful	Neither	Playful

Q6: This post is...

1	4	7

	Not Amusing	Neither	Amusing

Q7: This post is...

1	4	7
Not Entertaining	Neither	Entertaining

Q8: Rate the maximum amount you felt at any point while looking at the post.

1	4	7
Not at all	Moderately	Very much

____Elated	____Happiness
____Enthusiastic	____Lively
____Euphoric	____Playful

Q9: Rate the maximum amount you felt at any point while looking at the post.

1	4	7
Not at all	Moderately	Very much

____Annoyed	____Anxious
____Distressed	____Nervous
____Fearful	____Irritable

Q10: After seeing this post, how likely are you to use the Web to search for science information in the future?

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q11: After seeing this post, how likely are you to "Follow" this account so you could updates and new posts from them on your social media feed?

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q12: After seeing this image, how likely are you to send this post to a peer?

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q13: After seeing this image, how likely are you to send this post to a loved one?

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q14: If you came across this post on the social media platform you most often use, how likely are you to share the post?

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q15: For this question please pick response option five.

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q16: After seeing this post, how likely are you to pay closer attention to science-based posts on social media?

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q17: After seeing this post, how likely are you to follow more science-based accounts on social media?

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q18: After seeing this post, how likely are you to pay closer attention to science-based accounts on social media?

1	4	7
Extremely Unlikely	Neither	Extremely Likely

Q19: What is your age?

a) 18 - 24

b) 25 - 34

c) 35 - 44

d) 45 - 54

e) 55 - 64
f) 65 or older

Q20: How would you describe your political view?

a) Extremely liberal
b) Liberal
c) Slightly liberal
d) Moderate
e) Slightly conservative
f) Conservative
g) Extremely conservative

Q21: Where were you born?

a) North America
b) Central America
c) South America
d) Europe
e) Africa
g) Australia
h) Pacific Islander
i) Caribbean Islands
j) Other
k) Prefer not to say

Appendix B: IRB Consent Email Example

Dear Participant,

My name is Ashley Patterson and I am a researcher from Colorado State University in the Journalism and Media Communication department. We are conducting a research study on humors role in online message seeking. The title of our project is, 'Make 'Em Laugh: Humors Role in Seeking Science-Based Messages'. The Principal Investigator is Dr. Ashley Anderson and I am the Co-Principal Investigator.

We would like you to take an anonymous online survey. Participation will take approximately 15 - 20 minutes. Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participation at any time without penalty.

We will not collect your name or personal identifiers. When we report and share the data to others, we will combine the data from all participants. While there are no direct benefits to you, we hope to gain more knowledge on how humor impacts a person's message seeking tendencies. If you choose to participate, you will be compensated with 1% extra credit added to your overall grade in your Spring 2024 Journalism and Media Communication course.

It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential (but unknown) risks.

To indicate your consent to participate in this research and to continue to the survey, please click here: <insert link>.

If you have any questions about the research, please contact Ashley Patterson at ashley.patterson@colostate.edu or Dr. Ashley Anderson at ashley.a.anderson@colostate.edu. If you have any questions about your rights as a volunteer in this research, contact the CSU IRB at: CSU_IRB@colostate.edu; 970-491-1553.

Dr. Ashley Anderson	Ashley Patterson
Associate Professor	Graduate Student