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Wit meets wisdom: the relationship between satire and anthropomorphic humor on scientists' likability and legitimacy

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Abstract

We conducted an experiment examining public response to scientists' use of different types of humor (satire, anthropomorphism, and a combination of the two) to communicate about AI on Twitter/X. We found that humor led to increased perceptions of humor, measured as increased mirth. Specifically, we found that combining anthropomorphism and satire elicited the highest levels of mirth. Further, reported mirth was positively associated with the perceived likability of the scientist who posted the content. Our findings indicate that mirth mediated the effects of the humor types on publics' perceptions that the scientist on social media was communicating information in an appropriate and legitimate way. Overall, this suggests that scientists can elicit mirth by using combining satire and anthropomorphic humor, which can enhance publics' perceptions of scientists. Importantly, publics' responses to harsh satire were not examined. Caution should be exercised when using satire due to potential backfire effects.

Keywords

Digital science communication; Public engagement with science and technology; Public perception of science and technology

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1 ▪ Introduction

Public opinion polling shows that Americans are divided in their opinion of the rapid development of AI and are wary of policymakers' ability to regulate it appropriately [Smith & Anderson, 2017]. Amid concerns that traditional public communication efforts of scientists and policymakers may be falling on deaf ears, a disproportionate amount of communicating power may be falling on opinion leaders who lack expertise about the very topics they discuss [NORC at the University of Chicago, 2024; Lupia et al., 2024; Mannino et al., 2021].

The growth of online and social media platforms has impacted where publics are learning about science [Funk et al., 2017; Su et al., 2022]. It has also shifted how news content — science or otherwise — is structured given the growing popularity of hyperlinks, opportunities for audience interactivity, and preferences for multimedia content when telling a story [Bossard et al., 2013; Deuze, 2003; Su et al., 2022]. All told, these changes have pushed some to argue that among the best practices for reaching new audiences is to produce content that "goes viral" online [Bossard et al., 2013].

Simultaneous to this shift in the media landscape — and undoubtedly exacerbated by the Covid-19 pandemic — declines in public confidence in science have been observed [Kennedy et al., 2022; Kennedy & Tyson, 2023]. Of course, science is not the only institution facing public skepticism [Lupia et al., 2024] and many of the declines in public confidence in science are concentrated among specific subsets of the population. For example, Republicans have shown some of the largest shifts in views with those reporting a great deal of confidence in the scientific community dropping from about 44% of Republicans in 2006 to just 22% of Republicans in 2022 [NORC at the University of Chicago, 2024]. During that same timeframe, the percentage of Democrats who reported a great deal of confidence in the scientific community actually rose from 46% in 2006 to 53% in 2022 [NORC at the University of Chicago, 2024].

Indeed, the inability of scientists to effectively communicate with publics has already been linked to societal harm [see Wolfe et al., 2013], and it arguably poses an even bigger threat as emerging, technologies, such as artificial intelligence (AI), grow at unprecedented rates. Declines in confidence have been said to coincide with an increase in publics who are eager to seek out alternative opinion leaders on social media for information; unfortunately, when this non-expert information is inaccurate, it has the potential to spread, which can lead to undue societal harm [Pang & Ng, 2017]. Thus, there is a need to examine how to increase the effectiveness of scientists' online public communication tactics to ensure online publics are adequately informed.

One offered approach aimed at increasing science communication effectiveness is the use of humor [Baram-Tsabari & Lewenstein, 2013; Su et al., 2022; Yeo et al., 2022]. While some of the benefits of using humor in science communication have been established, in particular its role of raising awareness, increasing publics' knowledge, and persuasion effects in some context [see Kaltenbacher & Drews, 2020; Skurka et al., 2022], much remains to be learned. For example, a recent public opinion poll reports that only 29% of Americans are confident that scientists will act in the public's best interest — down 10% from before the COVID-19 pandemic [Kennedy et al., 2022]. Perhaps the public will be more receptive to scientists replacing their stoic professionalism with quippy humor when discussing science content online. Indeed, a humor-based approach would represent a contrast to the serious nature of

science, particularly as we further distance ourselves from the global COVID-19 pandemic, while also fitting better with the more light-hearted tone that surveys consistently show users want in social media content [Hiebert, 2024; Karlovitch, 2022; Marketing Charts, 2022]. At the same time, while many scientists have public Twitter/X accounts [Ke et al., 2017], and communicating science or health-related information on social media has been identified as a successful tactic [Tsao et al., 2021], there remains concern that using social media to communicate science information will not always be well-received [Lee et al., 2023].

This study provides insights into how scientists can use humor and social media when communicating about scientific topics — in this case, AI. This work examines how different types of humor in a cartoon shared by a scientist on Twitter/X are associated with viewers' perceptions of humor, measured as mirth, and their perceptions of the scientist who posted the content, and belief in the appropriateness and legitimacy of the content itself as a source of scientific information. Specifically, we chose to examine publics' responses to satire and anthropomorphism as a recent content analysis of Twitter and Instagram revealed that anthropomorphism and satire, along with wordplay, were the most common humor types used in social media science content [Su et al., 2022]. The present work serves as both a conceptual replication of previous studies that have looked at humor's impacts on factors like source likeability and the validity of communicated science content. But it also builds upon this previous research by isolating different humor types to determine if a more biting satirical form of humor, as compared to a more harmless and playful form of anthropomorphic humor, differently influences the degree to which audiences will consider short-form, social media content to be a legitimate source of information.

2 ▪ Literature review

2.1 ▪ *Approaches to humor*

Scholars recognize multiple types of humor, including anthropomorphism and satire. [Martin, 2007]. However, the conceptualization of humor is contentious, as scholars have struggled to describe the social and psychological processes that underlie humor [Geiger, 2007]. Classical psychological theories (relief, superiority, and incongruity theories) attempt a broad conceptualization to provide a comprehensive account of humor [Martin, 2007]. *Relief theories* [Spencer, 1949] suggest that humor is elicited when one experiences a release of tension from repressed drives. In this view, humor is primarily a tool for individuals to release arousal, such as a speaker opening a speech with a joke to put oneself and the audience at ease [Meyer, 2000]. Like relief theories, *superiority theories* deal with a drive to fulfill a social or interpersonal need. However, superiority theorists focus on the self-enhancement that occurs when one successfully elicits a humorous response [Lintott, 2016]. The Aristotelian view of humor oftentimes ties laughter to an expression of malice toward a target [Martin & Ford, 2018]. However, not all humor is malicious. Humor takes many forms and is often playful [Morris, 2009], as seen in recent portrayals of presidential candidate Kamala Harris and her running mate Tim Walz on late-night shows, like *Saturday Night Live*, which seem to primarily focus on an exaggerated impression of the former's laugh and the latter's folksy personality rather than anything more critical of their character or personality.

Relief and superiority theories offer explanations for how humor fulfills interpersonal needs, but they fail to address the cognitive process that occurs when an individual perceives

something as humorous. *Incongruity theories* examine how individuals find humor when exposed to content that surprises them and violates social norms in a comfortable, benign way [Berger, 1987]. Incongruity theories seek to explain the structure of the cognitive processes that occur when an attempt at humor is made. These theories assert that when individuals encounter humor, they first detect incongruity, before engaging in cognitive processes to find a resolution. Only once an individual resolves the incongruity do they perceive humor (i.e., mirth). For instance, knock-knock jokes begin with a seemingly nonsensical interaction but elicit a response after the joke teller reveals the hook that provides the necessary information for the audience to resolve the incongruity [Veatch, 1998]. Although these theories of humor all provide meaningful insight into the processes that underlie humor, the focus of this study is rooted in the cognitive appraisals that occur after humor is elicited. Therefore, guided by previous research in the field [Sparks & Lang, 2015; Yeo et al., 2020], we will use the framework of incongruity theories of humor to examine an individual's cognitive and affective responses to incongruous content.

2.2 ▪ *Humor types*

We chose to examine anthropomorphism and satire as research suggests they are commonly used in science content on social media platforms [Su et al., 2022]. Previous research indicates using multiple types of humor can increase positive appraisals of scientists and the content they share, [Yeo et al., 2020]. Thus, we also combined anthropomorphism and satire to form a third humor condition referred to as the "combined" humor condition. Additionally, we inserted the humor appeals into a cartoon embedded in a Twitter conversation. The decision to use an embedded cartoon was two-fold: comedic cartoons have been shown to be an effective tool in science communication and are widely shared via social media [Farinella, 2018], and they offer visual cues that are common to anthropomorphic humor and verbal cues common to satirical appeals [Abraham, 2009].

The origins of our first humor type — satire — can be traced to the third century BCE. Today, satire is the most ubiquitous type of humor in media and can be understood as "[t]he critical impulse manifesting itself in some degree of denigration, almost invariably through attempted humor" [Condren, 2012]. Satirical appeals in media are often characterized as either *Horatian* or *Juvenalian*. Horatian satire is considered a light-hearted comedy that seeks to provide commentary about the general human condition. For example, *The Simpsons* [Groening & Kogen, 1995] often employs *Horatian* satire to poke fun at popular culture events, such as creating a season finale and premiere (and between seasons advertising campaign), entitled "Who Shot Mr. Burns?" that spoofed the "Who Shot J.R.?" cliffhanger and advertising campaign from the popular 1980s evening soap opera *Dallas*. Notably, there is empirical evidence that indicates Horatian style satirical appeals in mass media, such as late-night talk shows, can promote positive engagement with scientific content.

In contrast, Juvenalian satire is a darker comedy style that invokes laughter that is "meant to wound and not heal" [Martin & Ford, 2018]. For example, the renowned American comedian, writer actor, producer, and television host Stephen Colbert's controversial address at the 2006 White House Correspondents' Association Dinner. In his speech, Colbert makes several sharp criticisms of the president's approval ratings, including the following:

> Now, I know there are some polls out there saying that this man has a 32% approval rating. But guys like us, we don't pay attention to the polls. We know that polls are just a collection of statistics that reflect what people are thinking in "reality". And reality has a well-known liberal bias [Colbert, 2006]

Colbert's speech is still discussed as one of the most controversial addresses [Cillizza, 2015]. It received both harsh criticism and glowing praise, characteristic of *Juvenalian* satire. Given that this work seeks to provide a practical contribution by providing insights into best engagement practices for scientists on social media, we employed only *Horatian* satire to reduce the risk of backfire effects (negative affective responses or confusion). Additionally, by utilizing Horatian satire we were able to create stimuli that critiques AI and its impact on society in a light-hearted comedic manner that maintains greater consistency with the anthropomorphic condition.

Anthropomorphic humor is defined as the act of giving animals or objects human-like characteristics, emotions and even complex personalities to elicit humor [Epley et al., 2007]. Human beings' proclivity for understanding non-human entities by anthropomorphizing them was first discussed in ancient Greece, where poets and scholars critiqued the tendency to ascribe human qualities to religious deities [Lesher, 2001]. Today, insurance brands such as Geico and Allstate employ anthropomorphic humor in their advertisements using mascots (i.e., the gecko for Geico and personifying the idea of chaos in the form of Allstate's "Mayhem"). These anthropomorphic appeals elicit humor by presenting non-human entities acting human — an example of incongruency and a violation of our expectations, which have been found to foster a positive emotional connection to the brand [Cohen, 2014].

Technology brands like Microsoft often use this humor to type to improve the experiences of users [Shifman & Blondheim, 2010]. "Clippy", the Microsoft office assistant, discontinued in 2003, was an early attempt at using anthropomorphic humor to help users navigate technological complexities [Maedche et al., 2016]. Since 2003, use of anthropomorphic humor has increased and is widely used in AI products such as Amazon's Alexa [Lopatovska, 2020], and has been found to increase trust in technology and enhance understanding of complex topics [Cheng et al., 2022]. Importantly, for anthropomorphism to effectively cultivate trust and likability, the public must find the appeal humorous [Zhang et al., 2021]. Thus, the present study first examines responses to the humorous appeals before investigating any possible downstream effects.

As anthropomorphism and satire both seek to elicit humor in unique ways, developing a more nuanced understanding of how different types of humor — such as those used in social media content — can evoke varying reactions from viewers offers potentially valuable insights into how different forms of humor might be most effectively employed in science communication. This includes exploring whether content that incorporates humor generally receives more positive responses than content that lacks such an attempt.

2.3 ▪ *Responses to humor*

The most common response associated with any type of humor is laughter. However, focusing solely on laughter as an indicator of humor ignores the varying psychological

responses to humor outlined in incongruity theory [Weinberger & Gulas, 1992]. Therefore, to accurately measure the unobservable psychological response to the humor types, a measurement of mirth is used. Mirth measures 'perceived humor', and is defined as a "distinctive emotion that is elicited by the perception of humor" [Martin, 2007, p. 8].

Mirth taps into a host of discrete emotions, such as amusement, playfulness, and levels of entertainment, to garner a fuller sense of how audiences have responded to a humorous stimulus. This conceptualization recognizes that responses to humor are prompted by exposure to stimuli, exists on a spectrum of intensity, and is temporally bound [Peifer, 2018]. Further, it recognizes that people can have a positive response to humorous stimuli without eliciting an audible laugh. Science communication researchers have found mirth to be a reliable way to measure perceived humor when examining the presence of humor in science and environmental communication [Yeo et al., 2021]. With the above information in mind, we propose:

H1: Participants in the (a) anthropomorphism, (b) satire, and (c) combined humor conditions, relative to those in the no humor condition, will report higher levels of mirth.

Historically, empirical studies have investigated how using humor can enhance or detract from a message. Only recently have researchers begun to explore how using different types of humor may elicit varying levels of mirth from individuals [Yeo et al., 2022]. Therefore, prior to examining the downstream effects of using humor to communicate about science on social media, we explore how the different types of humor may affect individuals experiencing mirth levels and ask the following:

RQ1: Do different types of humor (anthropomorphism, satire, and anthropomorphism and satire combined) used by scientists to communicate with publics on social media affect reported mirth levels?

2.4 ▪ *Humor and likability*

Through incongruity theory, researchers have identified that a response to humor occurs on three levels: the cognitive, emotional, and physiological levels [Berger, 1987]. The cognitive level deals with information processing thresholds. The emotional stage requires individuals to process emotion. Finally, the physiological aspect is the observable effects of someone successfully cognitively and emotionally processing humor [Ruch, 2001]. Humor engages a larger cognitive response compared to other emotional appeals — e.g., fear or hope — sustains attention, and encourages active messaging processing [Nabi et al., 2007]. Additionally, researchers found that non-verbal humor such as cartoons, require more cognitive processing than verbal jokes [Samson et al., 2008]. The increased cognitive processing needed to perceive humor also promotes message engagement and prompts individuals to actively process the message [Petty & Briñol, 2015]. Through this increased message engagement, humor can break down personal barriers and allow room for individuals to consider new or opposing perspectives [Meyer, 2000]. These effects occur, in part, because humorous messages require more cognitive processing and limit an individual's ability to form counterarguments with information embedded in the humor [Young, 2008].

Additionally, humor has been shown to increase likability of a source [Gulas & Weinberger, 2006]. Scholars have conceptualized likability as a persuasion tactic and a form of

"self-presentation" [Cialdini, 1993]. It has been closely linked to physical appearance and is thought to be increased by self-association. Public praise, compliments, and even laughter are thought to increase likability [Reysen, 2005]. Individuals' information processing is deeply connected to how likable they perceive the source [Du Plessis, 1994]. The ability of humor to increase positive attitudes toward a source is well-documented, which helps explain why public figures like politicians, talk show hosts, and advertisers rely on humor to garner favor with their audiences [Walther-Martin, 2015; Weinberger & Gulas, 1992]. Moreover, patients whose doctors regularly use humor have lower stress levels and hold more favorable attitudes toward their physician [Bennett, 2003]. A focus on scientists is less common, however, researchers have found that experienced mirth following exposure to a humorous cartoon posted by a scientist was a positive predictor of the perceived likability of that scientist [Yeo et al., 2021]. Given the relationship between humor and source perception, we hypothesize:

H2: Participants who report greater mirth will be more likely to perceive the source of the tweet as more likable.

Taken together, H1 and H2 propose a mediation model that predicts exposure to different humor types used in science communication content on social media impacts how funny they perceive the post (reported mirth level), which in turn is linked to how likable participants perceive the scientist posting the science content to be (see Figure 1). Thus, we predict:

H3: Reported mirth levels mediate the relationship between humor types used in the Twitter communication and perceived likability of the scientist.

Brands, political candidates, and social media influencers often rely on being likable to maintain publics' attention and trust [Dumitrescu et al., 2015; Martensen et al., 2018; Tran et al., 2023]. The likability of a candidate has been shown to influence voting behaviors more than publics perceptions of the candidate's competence or integrity [Laustsen & Bor, 2017]. Similarly, brands and influencers leverage their likability to cultivate longstanding loyalty in their consumers and followers [Chang, 2014; Taillon et al., 2020]. As with brands and political candidates, likable scientists on social media can garner greater public engagement with their social media content [Yeo et al., 2021]. Notably, increasing public engagement with scientists and the scientific content they share is a top communication priority for groups like the American Association for the Advancement of Science [2024]. Additionally, many social science researchers emphasize the importance for scientists to build good will to enhance public trust in scientific experts [Simis et al., 2016; van der Linden, 2021].

However, likability is only one factor in determining the effectiveness of scientists using humor to communicate about science on social media. Perceived likability focuses on qualities of the messenger (i.e., the scientist making the post to social media) and reveals how publics feel about a scientist using humor (i.e., sharing a science-focused joke on social media). It is equally important to investigate how the format of the message (i.e., the social media post with satirical and/or anthropomorphic humor) impacts how legitimate and appropriate publics perceive the science communication itself to be.

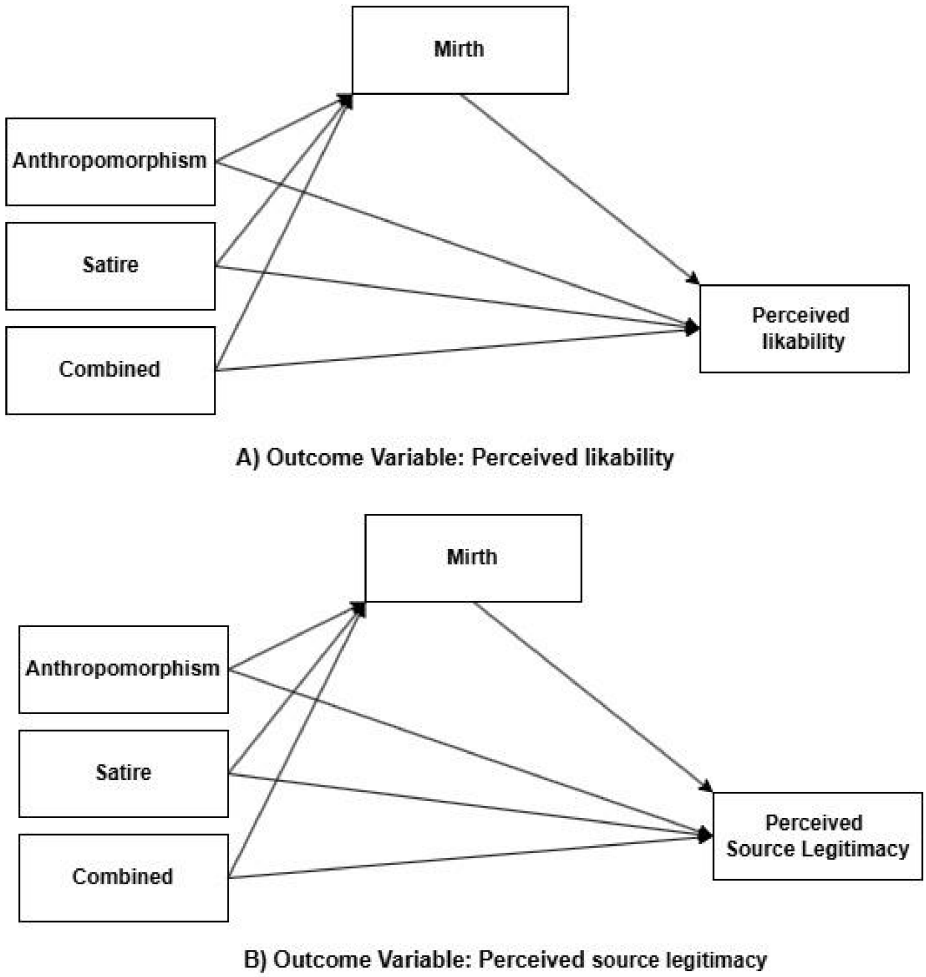

Figure 1. Conceptual model (PROCESS Model 4) with humor type as a multicategorical variable.

2.5 ▪ *Humor and source legitimacy*

Humor is widely used in persuasive messaging and is often seen in the rhetoric used by popular late-night shows such as *The Daily Show* and in political campaigns [Martin, 2007]. The value of humor in these venues lies in its ability to engage the audience in a unique non-threatening way, which lowers individual's threat perception, and increases the likelihood that they will actively process information [Berger, 1987]. Communication researchers have found empirical evidence of the effectiveness of humor to communicate complex and divisive topics — e.g., HPV vaccines and climate change — without alienating audience members [Kaltenbacher & Drews, 2020; Skurka et al., 2022]. For such topics, humor has been shown to be an effective tool to broaden the audience and enhance public engagement with science and scientists [see Boykoff & Osnes, 2019; Su et al., 2022].

While findings suggest that humor is effective in communicating many scientific topics, it is important to note that how science is communicated and presented in media can significantly impact publics' willingness to accept the information as valid [Kohl et al., 2016]. Using humor in traditional and social media science content can be complex because the humor must be appropriate and the attempt at incongruity needs to fit within the context of

the topic [Oring, 2011]. Additionally, research in political and strategic communication indicates that a failed humor attempt can detract from the message of a campaign, leading the audience to perceive the message to be less appropriate or legitimate [see Fugate, 1998; Peifer, 2018].

Recently, science communication scholars have explored the effects of stand-up comedy by scientists on audience feelings of mirth, and in turn, acceptance of the scientist as a valid source of scientific information [Yeo et al., 2020]. Overall, they found that perceptions that the information was valid were mediated by feelings of mirth and the perceived expertise of the scientist. This initial finding is encouraging, but more work is needed to (a) understand how perceptions may change when the scientist is sharing science related content (e.g., a funny cartoon about AI) on a public communication platform that is open to anyone (e.g., social media, such as Twitter/X) rather than in an environment where the speaker had presumably been vetted (e.g., as a professional stand-up comedian booked to do a show) and (b) examine the effects that specific humor types (in our case, anthropomorphism and satire rather than the mixture of humor types one would experience in a stand-up comedy set) might have on publics' acceptance of the information source as appropriate and legitimate. Indeed, while no two jokes are alike, it is reasonable to question whether different types of humor might suggest different characteristics about the joke teller. For example, a scathing satirical criticism of AI's impact on society might suggest the joke teller is well-informed and clever, while an anthropomorphic drawing of a talking computer might not cultivate the same feelings of knowledge or wittiness about the joke teller.

Overall, as positive responses to humor (i.e., mirth) have been shown to have many downstream effects in science communication including increasing positive perceptions of the presentation of information [Yeo et al., 2021], it is predicted that publics who experience more mirth will be more likely to rate the presentation of the information as appropriate and legitimate (see Figure 1). Specifically, we propose:

H4: Participants who report greater mirth will be more likely to perceive the Twitter conversation as a more legitimate and appropriate source of information.

Connecting H1 with H4 we pose a second mediation model that again posits that reported mirth level will act as a mediator. Specifically, this model predicts that reported mirth level will mediate the relationship between participant exposure to different humor types used in science communication content on social media (a Twitter conversation with embedded humorous cartoons) and participant perceptions that the funny Twitter conversation was an appropriate and legitimate form of science communication — i.e., *perceived source legitimacy*. Therefore, we predict:

H5: Reported mirth levels mediate the relationship between humor types used in the Twitter communication and perceived source legitimacy.

3 ▪ Methods

The data were gathered through an online survey with an embedded experiment in October of 2020. Quota sampling was implemented using the U.S. Census data (2018) to ensure the sample was representative of the U.S. (N = 6,652). Participants were recruited via Qualtrics panel software and received a small incentive for their participation. Due to the recruitment

method, a response rate cannot be determined as Qualtrics does not divulge the number of individuals invited to participate. This study focuses on how scientist communicate about AI, only the data from participants who viewed a Twitter conversation about AI were examined ($n = 2{,}212$, $M_{age} = 49.69$, $SD_{age} = 16$, 44.95% female, 76.85% white).

3.1 ▪ *Experimental design*

A 4 (humor types) ×2 (social media metrics) between-subjects experimental design was implemented to examine the hypotheses and research question. Participants were randomly assigned to one of eight screenshots of a Twitter conversation about AI started by Dr. Jamie Devon, a fictional scientist (see Figure 2 or Open Science Framework [OSF][1] to view stimuli). The original Tweet featured a cartoon containing a joke adapted from existing internet content about AI and self-driving cars. Two fictional users continued the conversation to strengthen the manipulation, with all usernames being gender-neutral to control for gender-related effects.

The four humor types were no humor (control condition), anthropomorphism, satire, and combined — i.e., both anthropomorphism and satire. In the control condition, the text, hashtags, and image were modified to convey the same information without humor. The post length was kept constant, with a maximum difference of six words, across conditions. Social media metrics were manipulated through the number of retweets and likes. However, this study focuses on the perceptions of scientists' use of humor on social media to communicate about AI and not post engagement, the metrics manipulation variable was used as a covariate in data analysis (high metrics condition coded as high).

Before exposure, participants were asked about their attitudes toward science, AI, and humor. After viewing the Twitter conversation, they answered questions designed to gauge their reactions (e.g., mirth), perception of the fictional scientist (e.g., perceived likability), and view of the Twitter conversation (e.g., perceived source legitimacy).

3.2 ▪ *Dependent measures*

Perceived likability was measured by adapting the Reysen likability scale [2005]. Participants indicated how warm, likable, friendly, and approachable the scientist, Dr. Jamie Devon, seemed using a 7-point Likert-type scale (*1 = strongly disagree*, *7 = strongly agree*) (Cronbach's $\alpha = .91$, $M = 4.80$, $SD = 1.45$).

Perceived source legitimacy adapted from the news parody orientation scale [Peifer, 2018], and was measured by averaging two items that asked participants how much they agree or disagree with the following statements on a 7-point Likert-type scale (*1 = strongly disagree*, *7 = strongly agree*): "This Twitter conversation serves as an appropriate source of science information" and "This Twitter conversation is a legitimate source of science information" (Pearson's $r = .82$, $p < .001$; $M = 3.39$, $SD = 1.88$).

Mirth was operationalized by asking participants to indicate how they would describe the Twitter conversation using seven-point semantic differential scales (e.g., not humorous-humorous, not funny-funny) adapted from [Nabi et al., 2007]. (Cronbach's $\alpha = .92$, $M = 4.53$, $SD = 1.71$).

1. https://osf.io/vs8rt/?view_only=906e1b3eee7e4c16ada759d7ca3810b5.

Figure 2. Stimuli conditions.

3.3 ▪ *Data analysis*

Using IBM SPSS Statistics 27 we conducted Analysis of Covariance controlling for social media metrics to address RQ1 and H1a–c. All other hypotheses were addressed by analyzing two mediation models (Model 4) in Hayes PROCESS 3.3 [Hayes & Matthes, 2009] with 10,000 bootstrap samples. The multicategorical independent variable option was used in both models. Social media metrics were controlled in analyses. An $\alpha = .01$ was used to indicate significance to guard against Type 1 error.

4 ▪ Results

Data supported H1a through H1c; compared to the no humor condition, anthropomorphic humor, satire, and the combination of anthropomorphism and satire positively predicted reported mirth levels. Further, ANCOVA testing showed humor type significantly affected mirth ($F(3, 2,207) = 9.405$, $p < .001$, $\eta^2 = .013$). Participants in the no humor condition reported the lowest levels of mirth, followed by those in the anthropomorphic and satirical conditions. Consistent with previous research, participants in the combined humor condition reported the highest levels of mirth [Speck, 1991; Yeo et al., 2022]. Further pairwise comparisons showed differences across all conditions except for the anthropomorphism and satire only conditions.

Regarding H2, findings indicated that participant mirth levels were positively associated with the perceived likability of the scientist who started the Twitter conversation ($B = 0.48$, Standard Error [SE] $= 0.05$, $p < .001$). We also found mirth to be a significant mediator between the experimental conditions and perceived likability of the scientist posting the science content thereby lending support for H3. With respect to our final two hypotheses, data showed that participants who reported higher levels of mirth were more likely to perceive the information source as legitimate (H4) ($B = 0.46$, $SE = 0.02$, $p < .001$), and that mirth was a significant mediator of this relationship (H5) (see Table 1).

Table 1. Estimated Coefficients, Standard Errors (SE), and p-values from mediation models, PROCESS Model 4 (N = 2,212).

	Mirth		*Perceived likability*		*Perceived source legitimacy*	
	Coefficient (SE)	*p*	Coefficient (SE)	*p*	Coefficient (SE)	*p*
Constant	4.267 (0.08)	< .001	2.78 (0.88)	< .001	1.89 (0.11)	< .001
Social media metrics manipulation	-0.03 (0.07)	.705	0.02 (0.52)	.669	-0.08 (0.06)	.225
Anthropomorphism	0.32 (0.10)	< .001	-0.19 (0.07)	.009	-0.32 (0.09)	< .001
Satire	0.32 (0.10)	< .001	-0.19 (0.08)	.009	-0.20 (0.09)	.024
Combined	0.53(0.10)	< .001	-0.32 (0.07)	< .001	-0.33 (0.02)	< .001
Mirth	—	—	0.48 (0.05)	< .001	0.46 (0.02)	< .001
Perceived likability	—	—	—	—	—	—
	$R^2 = 0.13$		$R^2 = 0.30$		$R^2 = 0.22$	
	$F(4, 2,207) = 7.09$ $p < .001$		$F(5, 2,206) = 191.29$ $p < .001$		$F(5, 2,206) = 123.69$ $p < .001$	

Table 2. Indirect effects for *alternative* mediation models, PROCESS Model 4 (N = 2,212). 10,000 bootstrap samples for bias-corrected bootstrap confidence intervals.

	Coefficient (SE)	99% Confidence interval
Indirect effects		
Anthropomorphism → Likability → Mirth	-0.02 (0.05)	[-0.16, 0.12]
Satire → Likability → Mirth	-0.02 (0.05)	[-0.16, 0.12]
Combined → Likability → Mirth	-0.04 (0.06)	[-0.19, 0.10]
Indirect effects		
Anthropomorphism → Perceived source legitimacy → Mirth	-0.05 (0.03)	[-0.12, 0.03]
Satire → Perceived source legitimacy → Mirth	-0.01 (0.03)	[-0.10, 0.06]
Combined → Perceived source legitimacy → Mirth	-0.02 (0.03)	[-0.10, 0.05]

4.1 ▪ *Alternative models*

Our findings are consistent with both our hypothesized mediation models, showing that mirth significantly mediates the relationship from our experimental conditions to both the perceived likability of the scientist and the perceived validity of the scientific information shared. However, guided by Morgan and Shanahan [2017], we also tested alternative models, where perceived likability and source legitimacy mediated the relationship between exposure to the different humorous Twitter conversations and reported mirth levels (i.e., humor types, perceived likability, mirth; and humor types, perceived source legitimacy, mirth). Analyses did not support these alternative models (see Table 2), strengthening the validity of our hypothesized models existing assumptions of the role of humor and source perceptions [see Kaltenbacher & Drews, 2020; Peifer, 2018].

5 ▪ Discussion

This study examined how a scientist using anthropomorphism and satire to communicate about AI on Twitter was related to mirth levels, the likeability of the scientist and the perceived legitimacy of the Twitter conversation as an information source. Overall, this study provides evidence that mirth can both have positive impacts on the likeability of a communicator, as well as enhancing perceptions that the message is an appropriate and legitimate source of scientific information, something that has not been studied in the context of social media posts from scientists.

Before reviewing the findings further, it is necessary to discuss the limitations of the existing study. First, we used a non-probability sample, limited to the United States, that potentially suffers from self-selection bias. However, the quota sample was large and constructed to represent the United States population based on demographic quotas. It is also an appropriate sample for experimental work focused on building theory [Sudman, 1966], as is the case with the present study. Of course, we must highlight that humor and responses to humor differ culturally [Jiang et al., 2019]. Therefore, we encourage readers, particularly those outside of the U.S., to interpret these results with caution and with their own cultural tendencies toward humor in mind.

The artificiality of a fictional experimental manipulation is a second limitation. The experimental conditions contained a screenshot of a manufactured Twitter conversation

thereby posing a threat to ecological validity. However, while the content of the original tweet was manufactured, it was adapted from existing humorous science content on social media. Moreover, using manufactured content heightened experimental control and allowed researchers to more closely investigate the target manipulation of humor type. Additionally, while the purpose of this study was to investigate how the publics perceive scientists and the communications they share in informal public spaces (social media), Twitter, now X, has undergone significant structural changes since these data were collected [Mac & Hsu, 2023], which of course means they cannot be captured in this work.

Focusing on the content of the cartoon itself, the humor appeal was focused on the development of AI, specifically referencing self-driving cars, somewhat limiting what claims can be made regarding overall perceptions of the communication of AI development. User comments were added to balance the focus on self-driving cars that referenced the top concern regarding the development of AI, the potential of a job shortage [Smith & Anderson, 2017]. Additionally, there are multiple ways to use anthropomorphism and satire to elicit humor [Epley et al., 2007]. Therefore, these results may not be readily generalizable to a broader array of humorous content containing anthropomorphic and (Juvenalian) satirical appeals. This last point is particularly important given the rise of programs like ChatGPT, which have sparked discussions on the future and potential dangers of AI [Marr, 2023].

A last note on potential limitations involves the method used to analyze our data. While mediation models are commonly used in social science research to examine the indirect effects, the relationships they predict are correlational and not causal [Chan et al., 2022]. Our mediation models showed strong relationships, and by anchoring them in theory we can draw some causal inferences from the data. Furthermore, guided by [Morgan & Shanahan, 2017] we conducted post-hoc tests on alternative models that examined different variable formations. None of those models were significant, which helped to strengthen our claims. Still, the study findings should be interpreted cautiously and not taken as a casual explanation.

Despite these potential limitations, the study offers meaningful insights into the use of anthropomorphism, satire, and social media in science communication. Most importantly, our study findings have implications for scientists and science communicators as they continue to communicate scientific issues to publics that have been said to be losing trust in scientists [Kennedy et al., 2022]. Our findings show that by eliciting mirth, scientists on social media platforms can increase their overall likability. This is not necessarily surprising as research has demonstrated a positive correlation between perceptions of funniness and one's likeability [Yeo et al., 2021]. However, it is perhaps intuitive to think that being viewed as funny might cause audiences take someone less seriously as a source of legitimate scientific information. After all, it is reasonable to think that the most serious person in debates about serious scientific topics — and not the funniest — is the one to be listened to. However, our findings push back somewhat against this idea, albeit with a solely American audience. We find that a funny communication, and the person responsible for sharing that communication, can be viewed as an appropriate and legitimate source of information for an American audience. And importantly, this finding from our work was demonstrated in the context of an unknown and fictional scientist sharing a cartoon via social media, rather than in the context of well-known talk show host or popular comedian speaking to an audience of fans or followers.

There is, of course, a downside to this finding, as it suggests that a funny enough communicator can insert themselves into debates where their knowledge is lacking. Our respondents were given almost no background about the scientists who posted the cartoon, outside of their credentials as a "Dr." as listed within their name on Twitter and our introduction to the stimulus, which told participants they would be viewing "a screenshot of a Twitter conversation started by a scientist". Nevertheless, a simple humorous cartoon, along with a few playful user comments served to elevate not just the likeability of the poster, but the appropriateness and legitimacy of the cartoon as a piece of social commentary. If such small attempts at humor — perhaps coupled with a simple heuristic cue, like the title "Doctor" being placed at the front of one's name — can enhance the status of a communicator or a piece of communication as a valid source of scientific information, what does that say about the nature of debates taking place around the important scientific topics of the day? Might this be used by disingenuous actors to cultivate a following and push anti-science agendas?

Beyond these important findings, researchers have just recently begun to explore the different humor types in science communication [see Kaltenbacher & Drews, 2020]. This work adds to the growing body of knowledge by comparing three humor conditions, anthropomorphism, satire, and a combination of the two. As expected, results showed that the combined anthropomorphism and satire condition elicited the highest level of mirth. Furthermore, these results replicated previous work [Yeo et al., 2020], indicating that using multiple types of humor can increase perceived humor and increase positive downstream effects, this time in areas outside of cultivating a stronger interest in science. Overall, the relative conditional effects indicate that using humor in science communication can do more than earn a laugh or goodwill in the form of likability; it can also increase perceptions that the scientist/communicator is communicating information in an appropriate and legitimate way.

Finally, our study results raise additional questions about the use of different types of humor in science communication on and off social media. Perhaps these findings would differ if the topic — AI — were changed or if humor was communicated through a different social media platform or a different communication modality altogether. Similarly, perhaps a different satirical remark — whether wittier or perhaps more aggressive — might have produced different impacts on our variables of interest. Additionally, the role individual characteristics play in perceptions of humor and source likability should be explored further. More extensive research of these concepts would add to the body of knowledge and provide insights into best practices for using social media and humor in science communication efforts.

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