RUNNING HEAD: Humor, likability, and motivation to follow science on social media

Following Science on Social Media: The Effects of Humor and Source Likability

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Abstract

Science communicators have been encouraged to use humor in their online engagement efforts. Yet, humor's effectiveness for engaging people with science remains an open question. We report the results of an experiment designed to elicit varied levels of mirth in respondents, which was positively associated with perceived likability of the communicator and motivation to follow more science on social media. Further, mirth and perceived likability serially mediated the effect of the experimental manipulation on motivation and factual science knowledge served as a moderator. This indicates that, while humor might be an effective means of reaching audiences, downstream effects are likely to vary depending on individuals' knowledge.

Keywords: humor, mirth, Twitter, social media, science, engagement

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A well-known article in science education (Falk & Dierking, 2010) argues that one way to increase public understanding of science is for people to engage with science in informal settings, including social media. However, relatively few do so; only one in six Americans actively seek and frequently consume science news (Pew Research Center, 2017). With audiences increasingly going online for science information (National Science Board, 2018), scientists and their institutions are leveraging social media to communicate with broad audiences (Pew Research Center, 2015). The question of best practices to strategically communicate science remains one that should be empirically investigated.

While humor has been recommended for science communication (Baram-Tsabari & Lewenstein, 2013; Goodwin & Dahlstrom, 2014), there is relatively little empirical evidence that it is an effective strategy for engaging people with science and conflicting thoughts on whether it might help or hinder science communication efforts. On the one hand, humor is viewed as a means of making content engaging and heightening the attention of audiences, perhaps even building a sense of community among those who are in on the joke. It is a potential pathway for expanding the audience for science and making science more accessible. On the other, attempts at humor can alienate those who do not "get" the joke, while also reinforcing problematic stereotypes about what science is and who conducts it. Certain types of humor might also play into criticisms of scientific superiority when jokes poke fun at lay audience understanding of scientific concepts and topics (Riesch, 2015).

Notably, perspectives in a prior issue of this journal have opened a discussion on the effects of humor in science communication (Pinto et al., 2015; Riesch, 2015). Our study aims to contribute to this area of research by offering empirical evidence for humor's role in science

communication on social media. Specifically, we use an experiment embedded in an online survey to examine how humor can influence people's perceptions of scientists who communicate on Twitter as well as motivate individuals to follow more science on social media. Accordingly, after a brief examination of extant theories and typologies of humor, our review of the literature delves into the persuasive effects of humor on behavioral intentions and perceptions of the source of a message. While our experiment also involves the manipulation of social media metrics associated with the science message, this study is focused on the influence of humor, not the social normative cues offered by likes and retweets.

Literature Review

Humor in Science on Social Media

There are many types, or techniques, of humor. In advertising research, a content analysis of over 300 humorous television commercials identified 7 categories into which humor types cluster (Buijzen & Valkenburg, 2004). These categories are slapstick, surprise, irony, clownish humor, satire, misunderstanding, and parody. Others, in synthesizing research, have identified 11 forms of humor: irony, satire, sarcasm, over- and understatement, self-deprecation, teasing, replies to rhetorical questions, clever replies to serious statements, double entendre, transformations of well-known sayings, and parody (Martin, 2010).

Funny science content is common on social media, including the hashtags #overlyhonestmethods, #fieldworkfail, and #reviewforscience, which have become particularly popular among those in the scientific community. Such hashtags are used to identify satirical posts about science, primarily related to scientific methods (for an empirical analysis of #overlyhonestmethods, see Simis-Wilkinson et al. 2018). We began this project by conducting a preliminary content analysis to empirically examine the types and relative volumes of humor

present in science content on Instagram and Twitter. Among the categories of humor found,[1] wordplay, satire, and anthropomorphic humor were most prevalent. In the present study, we opted to focus on wordplay and anthropomorphism as these humor types are easily manipulated without altering other aspects of the surrounding content.

Anthropomorphic humor is the attribution of human characteristics to animals or objects that lack human qualities (Buijzen & Valkenburg, 2004). Wordplay, which consists primarily of puns, is the humorous use of words that evoke second meanings and involves playing with meanings of words or different words with similar pronunciations. Before examining the effect of humor types on our downstream variables, we first establish that a science message designed to be funny, relative to a non-humorous one, causes viewers to perceive or experience humor.


hor has many conceptualizations and operationalizations. Often, survey respondents are asked to indicate the extent to which they perceive humor in a stimulus they have viewed (Eisend, 2009; Nabi, 2016). In other words, humor is often conceptualized and operationalized as how much mirth or amusement people experience when viewing content. While it has also been measured by categorizing stimuli by the presence or absence of humorous features (Duncan & Nelson, 1985), mirth is a more appropriate operationalization of the psychological response to humor for the present study as it embodies an affective response to multiple humor types (Gulas & Weinberger, 2006). Unlike laughter, mirth does not restrict the definition of humor response to physiological reactions. Thus, we conceptualize and operationalize humor as a psychological, instead of a physiological, response and measure the extent to which participants perceive the stimulus to be funny.

[1] The results of this content analysis are reported elsewhere (Authors, 2019).

H1: Compared to respondents exposed to the no humor condition, those in the (a) anthropomorphism, (b) wordplay, and (c) combined (anthropomorphism + wordplay) humor conditions will experience more mirth.

Factual Knowledge as a Moderator

Humor theorists generally propose three cognitive processes related to the recognition, appreciation, and comprehension of humor, or "getting the joke" (Speck, 1991; Suls, 1983). These are (i) incongruity resolution, (ii) tension relief or arousal safety, and (iii) humorous disparagement. Although some scholars distinguish between joke recognition and appreciation (i.e., one might recognize a joke but not appreciate it, or fail to find it funny; Ritchie, 2018), we do not distinguish between recognition and appreciation or comprehension. In the present work, we focus on incongruity resolution as a theoretical underpinning as it is the framework best supported by empirical evidence (Uekermann et al., 2007).[2] The incongruity resolution model was first proposed by Suls (1972) and is a problem-solving approach to processing funny information. In the first stage of this two-stage model, a viewer encounters an incongruity, usually between the punchline of the joke and their expectations about the information. In the second stage, the information consumer engages in a form of problem-solving in which they reconcile the incongruity. In this model, the content of the funny message activates a body of contextual knowledge used to interpret the information (Suls, 1972, 1983).

Several theoretical frameworks for understanding humor elicitation and appreciation also identify knowledge as integral to the process (Wyer & Collins, 1992). A recent framework, the encryption model of humor (Flamson & Barrett, 2008), is based on relevance theory (Sperber & Wilson, 1995) and proposes that knowledge is the encryption key that unlocks and allows people

[2] For detailed explanations of arousal safety and humor disparagement processes, see Speck (1991).

to make sense of jokes, i.e., the encrypted message. Humor in this model represents a signal of common knowledge, values, and attitudes. In this sense, knowledge is key to appreciating and producing humor. In other words, the extent to which a viewer finds a joke to be funny depends on whether they possess the encryption key, or knowledge, to "get the joke." Importantly, proponents of the encryption model highlight that it is not at odds with the incongruity resolution model. Instead, incongruity is one means of encryption and signaling shared knowledge among humor producers and receivers.

Empirical evidence supports that knowledge is an integral contextual factor in joke appreciation. In a case study of young people's responses to cartoons about the issue of gay marriage, El Refaie (2011) found that enjoyment of the joke was partly dependent on background knowledge of the consumers. Evidence for knowledge as a moderator of humor appreciation can also be found in studies of political satire. In a Dutch study examining people's attitudes toward budget cuts on public broadcasting, the availability of background knowledge was found to moderate the effect of satire on perceived humor and people's political preferences (Boukes et al., 2015). Given extant evidence, we hypothesize that the extent to which participants find our stimulus materials to be funny will depend on their levels of science knowledge.

H2: Factual knowledge moderates the effect of the (a) anthropomorphism, (b) wordplay, and (c) combined humor conditions, relative to that of no humor, on experienced mirth such that those with higher levels of knowledge will experience more mirth.

Humor, Perceived Source Likability, and Persuasion

Research on the effects of humor and mirth on behavioral intentions have been primarily conducted in the context of entertainment (e.g., Futerfas & Nan, 2017), health communication (e.g., Nabi, 2016), advertising (e.g., Yoon, 2015), and environmental communication (Skurka et al., 2019). In entertainment media, researchers exposed female viewers to one of three conditions—a humorous entertainment narrative about unprotected sex, a version of the narrative without humor, or a control condition unrelated to unprotected sex (Futerfas & Nan, 2017). The humorous narrative was found to reduce intentions to engage in unprotected sex. A meta-analysis of humor in advertising found collective evidence for humor's impact on behavioral intentions, specifically purchase intentions (Eisend, 2009). Recent scholarship that supports this conclusion has examined the effect of humor in online video advertisements (Goodrich et al., 2015) and in Snapchat (a multimedia social media app) ads (Phua & Kim, 2018). In an examination of McDonald's ads, researchers found that intentions to share the ad with others were positively impacted by humor (Sabri & Michel, 2014). In health communication, humor has been found to indirectly influence cancer self-examination behavioral intentions by reducing anxiety and improving attitudes toward self-exams (Nabi, 2016). Additionally, recent work on climate change shows that humor can increase intentions to engage in climate activism relative to an off-topic control message (Skurka et al., 2019).

The current study focuses on motivation to follow more science on social media as an outcome of the persuasive impact of a funny message. The participatory nature of social media allows its users to actively engage with experts to access new ideas in specific fields. Twitter enables individuals to stay abreast of scientific and technological advances by receiving updates from whatever set of subject experts they choose to "follow." Features of content have been

shown to motivate individuals to follow social media accounts. For example, Perrault et al. (2019) identified five factors that motivate students to follow their college's health center accounts, including incentives, relevance, knowledge of the existence of the account, message aesthetics, and popularity. Pertinent to the present work, respondents mentioned that "funny posts" and "fun articles" posted on the social media account serve as motivations for following it. In another study using Instagram, reasons such as "it is fun" and "entertaining" were identified as motivators for following political leaders on Instagram (Parmelee & Roman, 2019).

There is also evidence that the humorousness of a scientific message predicts people's intentions to engage with such content (Authors, 2020). Given the existing evidence, we hypothesize:

H3: Respondents who experience relatively more mirth will have greater motivation to follow more science on social media.

Humor can impact how audiences make sense of a message as well as things connected to that content (e.g., message source; Gulas & Weinberger, 2006). In the context of advertising, humor has been found to result in both lower- and higher-order outcomes (Duncan & Nelson, 1985). Lower-order outcomes are concerned with audiences' immediate evaluation of a message, while higher-order outcomes include actions or cognitions activated in response to viewing humorous material. Substantial evidence points to a relationship between humor and lower-order outcomes, such as attitudes toward an advertisement, attention paid to an ad, positive affect, and ad recall (Duncan & Nelson, 1985; Eisend, 2009; Sabri, 2012; Weinberger et al., 1995).

Of specific interest to the present study is research showing humor influences one's evaluation of the source of that humor (Markiewicz, 1974; Sternthal & Craig, 1973). The relationship between humor and source likability is relatively consistent. Humor has been linked

to more favorable teacher evaluations (Bryant et al., 1980), increased liking of educational materials (Bryant et al., 1981) and educational television programs (Zillmann & Bryant, 1980), increased liking of ads (Duncan & Nelson, 1985), and higher favorability scores for brands (Duncan & Nelson, 1985). In particular, inoffensive humor has been associated with attraction and the building of rapport between individuals (Wilson, 1979). When someone makes another person laugh, the recipient associates the source of humor with the pleasure of laughing. As a result, they view the source as more likable (Graham et al., 1992). Humorous people are generally rated more favorably than others, a finding that has been replicated across diverse contexts (Wanzer et al., 1996), including in experimental approaches where speeches were designed to vary based on the presence or absence of jokes (Gruner, 1967, 1970). Given the findings noted above, we propose:

H4: Respondents who experience relatively greater mirth will perceive the source of the Twitter conversation, i.e., the scientist, as more likable.

Audience perceptions of the communicator have long been recognized as an important influence on the effectiveness of communication (Hovland & Weiss, 1951). Among the various desirable attributes of message sources, communicator likability plays an arguably decisive role in the persuasive impact of a message. Often conceptualized as an affective evaluation linked to an object (Roskos-Ewoldsen & Fazio, 1992), perceived source likability is associated with traits that make a person likable in a general sense, but that are not necessarily relevant to the person's expertise or status as an authority on the topic at hand (Stone & Eswara, 1969). Researchers have consistently found that communicators who were perceived as attractive and likable were more likely to influence audiences' views through explicitly expressed intentions to persuade (Mills & Aronson, 1965; Reinhard et al., 2006).

Roskos-Ewoldsen and Fazio (1992) argued that the persuasive effect of source likability is moderated by its accessibility from memory. In other words, the more accessible the source's likability is, the greater its impact on attitudinal changes. They propose mechanisms that might underpin the persuasive impact of source likability, once it is activated from memory (see also Roskos-Ewoldsen, Bichsel, & Hoffman, 2002), based on the heuristic-systematic (HSM; Chaiken, 1980) and elaboration likelihood models (ELM; Petty & Cacioppo, 1986). The likable traits of the communicator may act as heuristic cues for attitudinal judgments (Basnyat & Lim, 2018). For instance, Basnyat and Lim found that young women in Singapore relied on source likability as a heuristic cue when deciding whether to seek the HPV vaccination. When a source's likability is more accessible from memory, heuristic processing becomes more likely, which in turn has an impact on whether people will agree with the message (see Roskos-Ewoldsen et al., 2002; Roskos-Ewoldsen & Fazio, 1992). In fact, Chaiken and Eagly (1983) found that, in both video and audio conditions, persuasive messages from likable sources were more likely to motivate attitudinal changes because personal attributes were more salient for heuristic processing. Interestingly, the persuasive effect of messages from unlikable sources was strongest in the written communication condition, possibly because the relatively weak source cues in that condition led to systematic processing instead.

Most empirical studies have noted a positive link between the perceived likability of the communicator and the persuasive impact of the communication messages (e.g., Basnyat & Lim, 2018; Mills & Aronson, 1965; Reinhard & Messner, 2009). Importantly, persuasive impact is not limited to attitudinal judgments such as product and company evaluations, but can be translated into behavioral intentions such as purchase intentions (Reinhard & Messner, 2009). In the context of this study, we propose that:

H5: Respondents who perceive the source of the science tweet as relatively more likable will be more motivated to follow more science on social media.

Taken together, our hypotheses and research question link our antecedent and consequent variables in a path model that is moderated by factual knowledge. Thus, we test a conditional effects model:

RQ1: Is the effect of the (a) anthropomorphism, (b) wordplay, and (c) combined conditions, relative to that of no humor, on individuals' motivation to follow more science on social media moderated by factual knowledge and mediated, serially, by mirth and likability?

Method

Data were obtained through an experiment embedded in an online survey fielded in October 2018 using opt-in panels from Qualtrics, which randomly selects respondents from its online market research panel partners (Qualtrics, 2014). We used a quota sample that matched the 2013 US Census American Community Survey in terms of age, gender, and geographic region. Individuals were notified via panel real-time software, email, or text and invited to participate in the survey for incentives.[3] Some 1,543 panelists started the survey; 1,530 completed it, yielding a completion rate of 99.2 percent. A response rate cannot be calculated as we do not know how many individuals were invited to participate. This is a result of using Qualtrics' real-time software in addition to email or text invitations. While a non-probability quota sample is not optimal, it is suitable for addressing our hypotheses and research questions.

[3] Qualtrics incentives vary as each respondent selects a specific reward when they opt-in to a panel. These rewards include cash, airline miles, gift cards, sweepstakes entrance, vouchers, among others (Qualtrics, personal communication).

Six respondents were excluded from analysis due to missing data resulting in a final sample size of 1,524.

Experimental Design and Measures

The main experiment employed a 4 (humor type) × 2 (social media metrics) between-subjects design. Social media metrics were manipulated by changing the number of retweets and likes associated with the original tweet. In the low social media metrics condition, the original post had 3 retweets and 5 likes; the post in the high social media metrics condition had 288 retweets and 480 likes. A secondary experiment concerning the measurement of factual science knowledge consisted of two conditions; one in which knowledge was measured on a 3-point scale ("True," "False," and "Don't Know") and another that employed a 5-point scale ranging from "Definitely true" to "Definitely false." In the analysis presented here, we controlled for the *social media metrics* (0 = "low metrics," 1 = "high metrics") and *knowledge scale* (0 = "3-pt scale," 1 = "5-pt scale") *manipulations* by including two dummy variables.[4] For both the primary and secondary experiments, respondents were randomly assigned to experimental conditions.

Although we report the effects of the humor manipulation on respondents' levels of experienced humor, or *mirth*, elsewhere (Authors, 2020), we briefly repeat these results here for convenience. The level of humor induced by a message is subjective. This results in an important methodological choice: While we manipulate the type of humor in the experimental stimuli, using the humor type conditions as the independent variable would not necessarily account for differences in the amount of humor that respondents might perceive (Duncan & Nelson, 1985). Indeed, individuals might respond to the same funny message in different ways. Therefore, we use *mirth* a mediating variable as it is the psychological state experienced by respondents as a

[4] The secondary experiment on knowledge had no effect on the composite measure of factual knowledge used in the present analysis, although there were some differences between individual knowledge items (Authors, 2020).

result of the experimental conditions and we are interested in the downstream effects of this psychological state (O'Keefe, 2003).

Participants were randomly exposed to one of eight screenshots of a conversation on Twitter about science. Both an image and text were included to reinforce the humor manipulation. Each condition contained one response to the original post by a fictional user, Kasey Chase, that was consistent with the humor type condition. In all conditions, the Twitter conversation was started by Dr. Jamie Devon, a fictional scientist. All names in the manipulation were gender ambiguous.

The four humor conditions were *no humor*, *anthropomorphism*, *wordplay*, and *combined*, which was a combination of anthropomorphic humor and wordplay. In the no humor condition, the text of the post was altered to contain a science fact. We strived to keep the number of words in the post consistent (18-20 words not including hashtags) between conditions. Anthropomorphism was manipulated in the image of the post; it included a mouth, eyes, and arms on the atoms. The wordplay manipulation occurred in the text of the post. The combined humor condition consisted of both text and image manipulations. Experimental conditions can be found in the Appendix.[5]

After exposure to the stimulus, respondents were asked questions designed to assess humor evoked by the Twitter conversation as well as perceived popularity of the tweet and motivation to follow more science on social media. All variables used in this study were measured after exposure to the stimulus.

[5] The combined humor condition, which was the original joke drawn from Twitter, showed two anthropomorphic atoms having a conversation. Atom 1 states, "I think I've lost an electron." In response, Atom 2 asks, "Are you sure?" Atom 1's response is a play on words that has multiple meanings: "Yes, I'm positive." One meaning refers to the loss of an electron (a negative ion) resulting in a more positive atom while another meaning refers to Atom 1 affirming that it has lost an electron.

Mirth was operationalized by asking respondents to indicate how they would describe the Twitter conversation on five, 7-point semantic differential scales (not humorous-humorous, not funny-funny, not playful-playful, not amusing-amusing, not entertaining-entertaining). We averaged these items to create an index (Cronbach's $\alpha = .937$, $M = 4.49$, $SD = 1.89$).

Perceived source likability was an averaged index of four items (Cronbach's $\alpha = .92$, $M = 4.85$, $SD = 1.43$) asking respondents to consider the scientist who started the Twitter conversation and rate their agreement with the following statements on a 7-point Likert scale (1 = "Strongly disagree," 7 = "Strongly agree"): (i) This person seems friendly; (ii) This person seems likable; (iii) This person seems warm; (iv) This person seems approachable.

We operationalized *factual knowledge* by asking respondents seven questions about general science knowledge. The seven knowledge questions were selected from those used in the National Science Board's Science and Engineering Indicators (National Science Board, 2018): "The center of the Earth is very hot" (true), "The continents have been moving their location for millions of years and will continue to move" (true), "All radioactivity is man-made" (false), "Electrons are smaller than atoms" (true), "Lasers work by focusing sound waves" (false), "It is the father's gene that decides whether the baby is a boy or a girl" (true), and "Antibiotics kill viruses as well as bacteria" (false). Possible response categories were "Definitely true," "Likely true," "Likely false," "Definitely false," and "Don't know." Correct responses, regardless of whether the respondent chose the "Definitely" or Likely" option, were summed to create a 7-point index of *factual knowledge* ($M = 3.85$, $SD = 1.78$).

Motivation to follow more science on social media was measured by asking respondents the extent to which the Twitter conversation (i) motivated them to pay more attention to science in social media, (ii) motivated them to follow more scientists on social media, and (iii) motivated

them to pay closer attention to updates from scientists on social media (1 = "Not at all," 7 = "Very much;" Cronbach's $\alpha = .97$, $M = 3.58$, $SD = 2.04$).

Data Analysis

All analyses were conducted using IBM SPSS Statistics 26. We addressed our research questions and hypotheses using a conditional effects model with two serial mediators (Model 83; Figure 1) with the PROCESS 3.3 add-on for SPSS (Hayes & Matthes, 2009). Since our independent variable is nominal and multicategorical, we included the "mcx" option with indicator coding in our model (for more information, see the PROCESS 3.3 documentation).

[Insert Figure 1 about here]

To probe significant interactions in the model, we used floodlight analysis (Spiller et al., 2013), which uses the Johnson-Neyman (JN) technique (Johnson & Neyman, 1936). The SPSS add-on, PROCESS 3.3, is unable to conduct a floodlight analysis when the independent variable is multicategorical because deriving regions of significance for an interaction becomes highly complex (for a detailed explanation, see Hayes & Montoya, 2017). In the present analysis, we are interested in the interactions between a specific humor condition and factual knowledge influencing mirth rather than an omnibus floodlight analysis. Therefore, we follow the procedure outlined in Hayes and Montoya (2017) for conducting pairwise inferences using the JN method, and PROCESS Model 83 with 10,000 bootstrap samples.

Results

We find support for H1a through H1c. Relative to a message with no humor, a message constructed with (a) anthropomorphic humor ($B = .926$, $SE = .129$, $p < .001$), (b) wordplay ($B = 1.269$, $SE = .129$, $p < .001$), and (c) a combination of the two humor types ($B = 1.684$,

SE = .129, $p < .001$) positively predicted mirth (Table 1). Although factual knowledge did not moderate the effect of the anthropomorphic humor condition on mirth (H2a; B = .018, SE = .074, $p = 804$), knowledge did moderate the effect of the wordplay (H2b; B = .203, SE = .073, $p = .006$) and combined ( ; B = .258, SE = .074, $p = .001$) humor conditions on mirth (Figure 2). We probed the significant interactions and found that in the interaction between the wordplay condition and factual knowledge, there was a region of significance—the conditional effect was significant among respondents who scored above .322 on knowledge, which constituted 94.6% of the sample. Given that knowledge scores were calculated by summing the number of items respondents answered correctly, only those who got *none* of the factual science knowledge answers correct were excluded from this interactive effect. In the interaction between the combined humor condition and knowledge, the conditional effect was significant among those in the combined humor condition at all scores of factual knowledge.

[Insert Table 1 about here]

[Insert Figure 2 about here]

Regarding H3, we find that respondents who experienced more mirth had higher motivation to follow more science on social media (B = .209, SE = .026, $p < .001$). Mirth also positively predicted perceived likability (H4; B = .396, SE = .018, $p < .001$). With H5, we posited that perceived likability would positively impact individuals' motivation to follow more science on social media. Indeed, the results of our model show support for H5 (B = .748, SE = .033, $p < .001$).

Our research questions, RQ1a, RQ1b, and RQ1c, ask whether the proposed conditional effect is significant for each humor condition. We find support for significant moderated mediation for two of the three humor type conditions: wordplay (index of moderated

mediation = .060, BootSE = .021, CI [.020, .102]) and the combined (index of moderated mediation = .077, BootSE = .021, CI [.037, .119]) conditions. The index of moderated mediation for the anthropomorphism condition was .005 with a bootstrapped standard error of .023 and confidence interval [-.040, .051].  the confidence intervals of the indices of moderated mediation for the wordplay and combined conditions do not include zero indicate that these conditional effects are significant.

Discussion

We investigated the impact of different types of humor, and the mirth experienced from those humor types, on people's perceived likability of scientists who share such content on social platforms. Further, we measured the effect this has on individuals' motivation to follow additional science content on social media. Our results show that those experiencing greater mirth after exposure to humorous content reported higher favorable likability ratings toward the scientist who communicated that content and greater motivation to follow science content on social media platforms. Likability was positively related to motivation, as well, with the variable serving as a mediator in the relationship between mirth and motivation. Further, we found evidence that factual knowledge levels moderated several of the uncovered relationships. Before delving into the implications of these findings, we first outline some limitations of the present work.

First, this work relied on data from a non-probability sample. We obtained a quota sample that demographically matches the 2013 US Census American Community Survey. While this sample does not allow us to generalize our findings to the American adult population, it is suitable for our experimental approach and addressing the causal relationships between our

variables of interest. Further, it is worth noting that our sampling approach means not all our respondents were Twitter users, or even social media users. While our dependent variable of interest focuses on one's intentions to follow more science and scientists on social media, it should not be problematic for non-users, as they could still be motivated to get on social media given the content they viewed, or provide a "not at all" response concerning their future intentions. Additionally, non-users of social media are randomly distributed across conditions and we do not expect such respondents to bias the effect of the experiment on the outcome variables. Of course, a related challenge is that one's motivation to follow more science on social media does not necessarily translate into actual behavior. However, given extant theories (Ajzen, 1991; Fishbein & Ajzen, 1975) and robust support of the intention-behavior relationship (e.g., Eagly & Chaiken, 1993), we are confident that, for some respondents, self-reports of motivation to follow science on social media will translate into action. Future research should consider replicating and extending our experimental design to examine how the behavioral intention resulted from perceived likeability can be translated into actual behavioral change.

A second limitation involves the artificiality of the experimental manipulation. Our survey participants were only able to view a screenshot of a single tweet with an accompanying comment. They were not permitted to interact with the content or navigate to other content online, and what they viewed was not tailored to their personal information diets, as it would be in a real-world setting. This artificiality presents ecological validity concerns. To allay these concerns, we built our experimental stimulus materials from actual Twitter content. Further, they were designed to be functionally equivalent across conditions to isolate causality in the relationships we investigated. That is, they were designed to differ only in terms of the presence or absence of different types of humor without the introduction of unique arguments or content

across conditions. Attempts to enhance the ecological validity of the findings would come at the expense of our ability to make definitive causal claims, a tradeoff that was deemed problematic. Thus, we chose to prioritize functional equivalence in our experiment.

A final limitation concerns the humor types we employed in our experimental design. A content analysis that we conducted as part of this project revealed that satire was one of the more popular forms of science humor content on social media. However, we designed our experimental manipulations around wordplay and anthropomorphism. Attempting to create a functionally equivalent satirical message proved quite difficult since satire has inherent negativity to it that wordplay and anthropomorphism do not. Additionally, satire is complex, subjective, and can elicit responses unintended and unanticipated by the joke-teller (Gilbert, 2013; Gring-Pemble & Watson, 2003). Future research should focus on testing alternative humor types, such as satire and sarcasm, as these types of biting humor can have consequences on people's attitudes and behavioral intentions (e.g., Anderson & Becker, 2018; Becker & Anderson, 2019; Bore & Reid, 2014).

Despite these limitations, our analysis suggests that humor is a viable means of engaging audiences with science content, at least on Twitter. Humor has been endorsed as a tool for science communication by institutional organizations (American Society for Cell Biology, 2019; Science Riot, 2018) and scholars (Baram-Tsabari & Lewenstein, 2013; Sumners et al., 2016) alike. However, it remains an understudied, but growing, focus of empirical work. Those studies that have investigated the impacts of humorous science content have generally done so with stimulus materials that vary markedly across conditions. Our study explored how functionally equivalent pieces of social media content, designed to vary only in terms of the presence and type of humor, can impact perceptions of communicator likability and motivations to follow

additional science content. That we employed functionally equivalent frames is a significant contribution to the literature on framing (Cacciatore et al., 2016).

Our finding that mirth was positively associated with the likability of the scientist who posted the content is consistent with a large body of literature. That literature has consistently demonstrated that humor can enhance things like teaching evaluations (Bryant et al., 1980; Bryant & Zillmann, 1989), educational materials (Bryant et al., 1981), and educational television programs (Zillmann & Bryant, 1980). The advertising literature has uncovered similar positive links between humor and perceptions of ads and brands (Duncan & Nelson, 1985). Yet, despite some evidence that portrayals of scientists in popular culture no longer conforms to the stereotypical "mad" scientist (Haynes, 2016), scientists continue to struggle with how they are perceived by non-scientists, which may be indicative of a communication challenge between scientists and lay audiences. The mediation analysis in the present study revealed that experienced mirth influenced the likability of the communicator, which in turn, impacted one's drive to follow more science content online. This suggests that humor serves to humanize scientists, which in turn, opens audiences to hearing what they have to say more generally. This process satisfies several of the major goals of effective science communication. Of course, our stimulus materials consisted of what best can be described as playful and innocuous humor. Future work is needed to better understand how more biting forms of humor, including sarcastic and satirical takes on science, impact audience perceptions.

That experienced mirth was a direct and positive predictor of motivation to follow science on social media expands our understanding of the value of humor as a tool for effective science outreach. Again, it is worth noting that our attempt at humor privileged consistency across conditions, rather than building the funniest, cleverest, or most surprising joke. This

speaks strongly of the potential for humor in science to induce mirth, a psychological state that, in turn, has downstream effects on communication outcomes. If the relatively simple addition of a pun or some human-like features to an image of atoms can serve to heighten mirth and subsequently increase one's motivation to engage with science content, how might more sophisticated attempts at humor, provided they remain positive in delivery and inoffensive, engage audiences? We believe this to be an especially fertile area for future research.

It is also worth noting that factual knowledge moderated the effects of the two conditions containing wordplay on mirth and that the moderated mediation models were only significant for these conditions. In other words, while science knowledge levels had no bearing on the levels of experienced mirth for those assigned to the no humor and anthropomorphic conditions, knowledge moderated the relationship between the wordplay and combined conditions on experienced mirth, which subsequently impacted perceived likability and motivations. This is not particularly surprising when analyzing the focus of humor across different conditions. In the anthropomorphic condition, the humor comes from the presence of human qualities in a pair of atoms. The joke requires no prior knowledge of science or even familiarity with atoms or their make-up. In contrast, the wordplay works best if the reader understands the components of an atom and what happens when there is an imbalance between protons and electrons, things that are likely correlated with our battery of knowledge items.

Future research should focus on identified gaps concerning the use of humor in science outreach. For instance, it is important to better understand how other types and combinations of humor fit the patterns identified here and perform relative to each other. Are negative and more biting forms of humor (e.g., satire and sarcasm) more or less likely to backfire? Does the addition of additional humor types intensify its effects? It is also important to garner a more

complete understanding of how different audiences process humorous content. How are trait characteristics like need for humor, need for cognition, or political ideology tied to outcomes of interest? Political ideology is especially pertinent when humor is used in controversial or politicized issues (e.g., LaMarre et al., 2009), such as climate change or the novel coronavirus. Finally, it is critical to explore how humor works across a variety of different issues. Might humor be a tool for cultivating interest in novel areas of science? And can it bridge divides across highly partisan science topics? While there is a growing literature on humor effects, we have only scratched the surface in terms of our understanding of how best to utilize it as a tool for science communication and outreach.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

American Society for Cell Biology. (2019). Best Practices in Science Communication. *ASCB*. https://www.ascb.org/science-policy-public-outreach/science-outreach/toolkits/best-practices-in-effective-science-communication/

Anderson, A. A., & Becker, A. B. (2018). Not just funny after all: Sarcasm as a catalyst for public engagement with climate change. *Science Communication*, *40*(4), 524–540. https://doi.org/10.1177/1075547018786560

Baram-Tsabari, A., & Lewenstein, B. V. (2013). An instrument for assessing scientists' written skills in public communication of science. *Science Communication*, *35*(1), 56–85. https://doi.org/10.1177/1075547012440634

Basnyat, I., & Lim, C. (2018). Perspectives of young Chinese Singaporean women on seeking and processing information to decide about vaccinating against human papillomavirus. *Women & Health*, *58*(7), 806–821. https://doi.org/10.1080/03630242.2017.1342741

Becker, A. B., & Anderson, A. A. (2019). Using humor to engage the public on climate change: The effect of exposure to one-sided vs. two-sided satire on message discounting, elaboration and counterarguing. *Journal of Science Communication*, *18*(04). https://doi.org/10.22323/2.18040207

Bore, I.-L. K., & Reid, G. (2014). Laughing in the face of climate change? Satire as a device for engaging audiences in public debate. *Science Communication*, *36*(4), 454–478. https://doi.org/10.1177/1075547014534076

Boukes, M., Boomgaarden, H. G., Moorman, M., & de Vreese, C. H. (2015). At odds: Laughing and thinking? The appreciation, processing, and persuasiveness of political satire. *Journal of Communication*, *65*(5), 721–744. https://doi.org/10.1111/jcom.12173

Bryant, J., Alan, D. B., Silberberg, R., & Elliott, S. M. (1981). Effects of humorous illustrations in college textbooks. *Human Communication Research*, *8*(1), 43–57. https://doi.org/10.1111/j.1468-2958.1981.tb00655.x

Bryant, J., Comisky, P. W., Crane, J. S., & Zillmann, D. (1980). Relationship between college teachers' use of humor in the classroom and students' evaluations of their teachers. *Journal of Educational Psychology*, *72*(4), 511–519. https://doi.org/10.1037/0022-0663.72.4.511

Bryant, J., & Zillmann, D. (1989). Using Humor to Promote Learning in the Classroom. In P. E. McGhee & M. Frank (Eds.), *Humor and Children's Development: A Guide to Practical Applications* (1st ed., pp. 49–78). Routledge.

Buijzen, M., & Valkenburg, P. M. (2004). Developing a typology of humor in audiovisual media. *Media Psychology*, *6*(2), 147–167.

Cacciatore, M. A., Scheufele, D. A., & Iyengar, S. (2016). The end of framing as we know it … and the future of media effects. *Mass Communication and Society*, *19*(1), 7–23. https://doi.org/10.1080/15205436.2015.1068811

Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology*, *39*(5), 752–766. https://doi.org/10.1037/0022-3514.39.5.752

Chaiken, S., & Eagly, A. H. (1983). Communication modality as a determinant of persuasion: The role of communicator salience. *Journal of Personality and Social Psychology*, *45*(2), 241–256. https://doi.org/10.1037/0022-3514.45.2.241

Duncan, C. P., & Nelson, J. E. (1985). Effects of humor in radio advertising experiment. *Journal of Advertising*, *14*(2), 33–64.

Eagly, A. H., & Chaiken, S. (1993). *The Psychology of Attitudes*. Harcourt Brace Jovanovich College Publishers.

Eisend, M. (2009). A meta-analysis of humor in advertising. *Journal of the Academy of Marketing Science*, *37*(2), 191–203. https://doi.org/10.1007/s11747-008-0096-y

El Refaie, E. (2011). The pragmatics of humor reception: Young people's responses to a newspaper cartoon. *Humor - International Journal of Humor Research*, *24*(1). https://doi.org/10.1515/humr.2011.005

Falk, J. H., & Dierking, L. D. (2010). The 95 percent solution: School is not where most Americans learn their science. *American Scientist*, *98*(6), 486–493. gft.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Addison-Wesley.

Flamson, T., & Barrett, H. C. (2008). The encryption theory of humor: A knowledge-based mechanism of honest signaling. *Journal of Evolutionary Psychology*, *6*(4), 261–281. https://doi.org/10.1556/jep.6.2008.4.2

Futerfas, M. L., & Nan, X. (2017). Role of humor in the persuasiveness of entertainment narratives on unprotected sexual behavior. *Journal of Health Communication*, *22*(4), 312–318. https://doi.org/10.1080/10810730.2017.1284285

Gilbert, C. J. (2013). Toward the Satyric. *Philosophy & Rhetoric*, *46*(3), 280–305.

Goodrich, K., Schiller, S. Z., & Galletta, D. (2015). Consumer reactions to intrusiveness of online-video advertisements: Do length, informativeness, and humor help (or hinder) marketing outcomes? *Journal of Advertising Research*, *55*(1), 37–50. https://doi.org/10.2501/JAR-55-1-037-050

Goodwin, J., & Dahlstrom, M. F. (2014). Communication strategies for earning trust in climate change debates. *Wiley Interdisciplinary Reviews: Climate Change*, *5*(1), 151–160. https://doi.org/10.1002/wcc.262

Graham, E. E., Papa, M. J., & Brooks, G. P. (1992). Functions of humor in conversation: Conceptualization and measurement. *Western Journal of Communication*, *56*(2), 161–183. https://doi.org/10.1080/10570319209374409

Gring-Pemble, L., & Watson, M. S. (2003). The rhetorical limits of satire: An analysis of James Finn Garner's Politically Correct Bedtime Stories. *Quarterly Journal of Speech*, *89*(2), 132–153. https://doi.org/10.1080/00335630308175

Gruner, C. R. (1967). Effect of humor on speaker ethos and audience information gain. *Journal of Communication*, *17*(3), 228–233. https://doi.org/10.1111/j.1460-2466.1967.tb01181.x

Gruner, C. R. (1970). The effect of humor in dull and interesting informative speeches. *Central States Speech Journal*, *21*(3), 160–166. https://doi.org/10.1080/10510977009363017

Gulas, C. S., & Weinberger, M. G. (2006). *Humor in Advertising: A Comprehensive Analysis*. M.E. Sharpe, Inc. http://ebookcentral.proquest.com/lib/utah/detail.action?docID=3060578

Hayes, A. F., & Matthes, J. (2009). Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behavior Research Methods*, *41*(3), 924–936. https://doi.org/10.3758/BRM.41.3.924

Hayes, A. F., & Montoya, A. K. (2017). A tutorial on testing, visualizing, and probing an interaction involving a multicategorical variable in linear regression analysis. *Communication Methods and Measures*, *11*(1), 1–30. https://doi.org/10.1080/19312458.2016.1271116

Haynes, R. D. (2016). Whatever happened to the 'mad, bad' scientist? Overturning the stereotype. *Public Understanding of Science*, *25*(1), 31–44. https://doi.org/10.1177/0963662514535689

Hovland, C. I., & Weiss, W. (1951). The influence of source credibility on communication effectiveness. *Public Opinion Quarterly*, *15*(4), 635–650.

Johnson, P. O., & Neyman, J. (1936). Tests of certain linear hypotheses and their applications to some educational problems. *Statistical Research Memoirs*, *1*, 57–93.

LaMarre, H. L., Landreville, K. D., & Beam, M. A. (2009). The irony of satire: Political ideology and the motivation to see what you want to see in The Colbert Report. *The International Journal of Press/Politics*, *14*(2), 212–231. https://doi.org/10.1177/1940161208330904

Markiewicz, D. (1974). Effects of humor on persuasion. *Sociometry*, *37*(3), 407–422. JSTOR. https://doi.org/10.2307/2786391

Martin, R. A. (2010). *The Psychology of Humor: An Integrative Approach*. Elsevier Academic Press.

Mills, J., & Aronson, E. (1965). Opinion change as a function of the communicator's attractiveness and desire to influence. *Journal of Personality and Social Psychology*, *1*(2), 173–177. https://doi.org/10.1037/h0021646

Nabi, R. L. (2016). Laughing in the face of fear (of disease detection): Using humor to promote cancer self-examination behavior. *Health Communication*, *31*(7), 873–883. https://doi.org/10.1080/10410236.2014.1000479

National Science Board. (2018). *Science and Engineering Indicators 2018* (NSB-2018-1). National Science Foundation. https://www.nsf.gov/statistics/2018/nsb20181/assets/nsb20181.pdf

O'Keefe, D. J. (2003). Message properties, mediating states, and manipulation checks: Claims, evidence, and data analysis in experimental persuasive message effects research. *Communication Theory*, *13*(3), 251–274. https://doi.org/10.1111/j.1468-2885.2003.tb00292.x

Parmelee, J. H., & Roman, N. (2019). Insta-politicos: Motivations for following political leaders on instagram. *Social Media + Society*, *5*(2), 2056305119837662. https://doi.org/10.1177/2056305119837662

Perrault, E. K., Hildenbrand, G. M., McCullock, S. P., Schmitz, K. J., & Dolick, K. N. (2019). Hashtag health: College health on social media and students' motivations to follow, interact, and share their social media content. *Health Promotion Practice*, *20*(5), 721–729. https://doi.org/10.1177/1524839919853820

Petty, R. E., & Cacioppo, J. T. (1986). The Elaboration Likelihood Model of Persuasion. In R. E. Petty & J. T. Cacioppo (Eds.), *Communication and Persuasion: Central and Peripheral Routes to Attitude Change* (pp. 124–205). Springer New York. https://doi.org/10.1007/978-1-4612-4964-1_1

Pew Research Center. (2015). *How Scientists Engage the Public*.

Pew Research Center. (2017). *Science News and Information Today*. http://assets.pewresearch.org/wp-

content/uploads/sites/13/2017/09/20120848/PJ_2017.09.20_Science-and-News_FINAL.pdf

Phua, J., & Kim, J. (Jay). (2018). Starring in your own Snapchat advertisement: Influence of self-brand congruity, self-referencing and perceived humor on brand attitude and purchase intention of advertised brands. *Telematics and Informatics*, *35*(5), 1524–1533. https://doi.org/10.1016/j.tele.2018.03.020

Pinto, B., Marçal, D., & Vaz, S. G. (2015). Communicating through humour: A project of stand-up comedy about science. *Public Understanding of Science*, *24*(7), 776–793. https://doi.org/10.1177/0963662513511175

Qualtrics. (2014). *ESOMAR 28: 28 Questions to Help Research Buyers of Online Samples*.

Reinhard, M.-A., & Messner, M. (2009). The effects of source likeability and need for cognition on advertising effectiveness under explicit persuasion. *Journal of Consumer Behaviour*, *8*(4), 179–191. https://doi.org/10.1002/cb.282

Reinhard, M.-A., Messner, M., & Sporer, S. L. (2006). Explicit persuasive intent and its impact on success at persuasion: The determining roles of attractiveness and likeableness. *Journal of Consumer Psychology*, *16*(3), 249–259. JSTOR.

Riesch, H. (2015). Why did the proton cross the road? Humour and science communication. *Public Understanding of Science*, *24*(7), 768–775. https://doi.org/10.1177/0963662514546299

Ritchie, G. (2018). The Process of Joke Comprehension. In *The Comprehension of Jokes: A Cognitive Science Framework* (pp. 16–30). Routledge. https://abdn.pure.elsevier.com/en/publications/the-comprehension-of-jokes-a-cognitive-science-framework

Roskos-Ewoldsen, D. R., Bichsel, J., & Hoffman, K. (2002). The influence of accessibility of source likability on persuasion. *Journal of Experimental Social Psychology*, *38*(2), 137–143. https://doi.org/10.1006/jesp.2001.1492

Roskos-Ewoldsen, D. R., & Fazio, R. H. (1992). The accessibility of source likability as a determinant of persuasion. *Personality and Social Psychology Bulletin*, *18*(1), 19–25. https://doi.org/10.1177/0146167292181004

Sabri, O. (2012). Taboo advertising: Can humor help to attract attention and enhance recall? *Journal of Marketing Theory & Practice*, *20*(4), 407–422. https://doi.org/10.2753/MTP1069-6679200404

Sabri, O., & Michel, G. (2014). When do advertising parodies hurt?: The power of humor and credibility in viral spoof advertisements. *Journal of Advertising Research*, *54*(2), 233–247. https://doi.org/10.2501/JAR-54-2-233-247

Science Riot. (2018). *What Scientists Can Learn from Comedians*. https://www.scienceriot.org/2018/07/what-scientists-can-learn-from-comics/

Simis-Wilkinson, M., Madden, H., Lassen, D., Su, L. Y.-F., Brossard, D., Scheufele, D. A., & Xenos, M. A. (2018). Scientists joking on social media: An empirical analysis of #overlyhonestmethods. *Science Communication*, *40*(3), 314–339. https://doi.org/10.1177/1075547018766557

Skurka, C., Niederdeppe, J., & Nabi, R. (2019). Kimmel on climate: Disentangling the emotional ingredients of a satirical monologue. *Science Communication*, 1075547019853837. https://doi.org/10.1177/1075547019853837

Speck, P. S. (1991). The humorous message taxonomy: A framework for the study of humorous ads. *Current Issues and Research in Advertising*, *13*(1–2), 1–44. https://doi.org/10.1080/01633392.1991.10504957

Sperber, D., & Wilson, D. (1995). *Relevance: Communication and Cognition* (2nd ed.). Oxford, UK ; Cambridge, Mass: Blackwell.

Spiller, S. A., Fitzsimons, G. J., Lynch, J. G., & Mcclelland, G. H. (2013). Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression. *Journal of Marketing Research*, *50*(2), 277–288. https://doi.org/10.1509/jmr.12.0420

Sternthal, B., & Craig, C. S. (1973). Humor in advertising. *Journal of Marketing*, *37*(4), 12–18. JSTOR. https://doi.org/10.2307/1250353

Stone, V. A., & Eswara, H. S. (1969). The likability and self-interest of the source in attitude change. *Journalism Quarterly*, *46*(1), 61–68. https://doi.org/10.1177/107769906904600109

Suls, J. (1972). A two-stage model for the appreciation of jokes and cartoons: An information-processing analysis. In J. H. Goldstein & P. E. McGhee (Eds.), *The Psychology of Humor: Theoretical Perspectives and Empirical Issues* (pp. 81–100). Academic Press.

Suls, J. (1983). Cognitive Processes in Humor Appreciation. In *Handbook of Humor Research* (pp. 39–57). Springer, New York, NY. https://doi.org/10.1007/978-1-4612-5572-7_3

Sumners, C. B., Bako, A. T., Fabian, O., Martel, I., Molar-Candanosa, R., & Gastel, B. (2016). Communicating science with integrity, effectiveness, humor, and more: Some highlights of the 2016 AAAS Annual Meeting. *Science Editor*, *39*(1), 1–4.

Uekermann, J., Daum, I., & Channon, S. (2007). Toward a cognitive and social neuroscience of humor processing. *Social Cognition*, *25*(4), 553–572. https://doi.org/10.1521/soco.2007.25.4.553

Wanzer, M. B., Booth-Butterfield, M., & Booth-Butterfield, S. (1996). Are funny people popular? An examination of humor orientation, loneliness, and social attraction. *Communication Quarterly*, *44*(1), 42–52. https://doi.org/10.1080/01463379609369999

Weinberger, M. G., Spotts, H., Campbell, L., & Parsons, A. L. (1995). The use and effect of humor in different advertising media. *Journal of Advertising Research*, *35*(3), 44-. Academic OneFile.

Wilson, C. P. (1979). *Jokes: Form, Content, Use, and Function*. Published in cooperation with European Association of Experimental Social Psychology by Academic Press.

Wyer, R. S., & Collins, J. E. (1992). A theory of humor elicitation. *Psychological Review*, *99*(4), 663–688. https://doi.org/10.1037/0033-295X.99.4.663

Yeo, S. K., Su, L. Y.-F., Cacciatore, M. A., McKasy, M., & Qian, S. (2020). Predicting intentions to engage with scientific messages on Twitter: The roles of mirth and need for humor. *Science Communication*, *42*(4), 481–507. https://doi.org/10.1177/1075547020942512

Yoon, H. J. (2015). Humor effects in shame-inducing health issue advertising: The moderating effects of fear of negative evaluation. *Journal of Advertising*, *44*(2), 126–139. https://doi.org/10.1080/00913367.2015.1018463

Zillmann, D., & Bryant, J. (1980). Misattribution theory of tendentious humor. *Journal of Experimental Social Psychology*, *16*(2), 146–160. https://doi.org/10.1016/0022-1031(80)90005-0

Tables and Figures

Table 1. Estimated coefficients, standard errors, and *p*-values from PROCESS Model 83 (N = 1,524).

	Mirth		Perceived likability		Motivation to follow more science on social media	
	Coefficient (SE)	*p*	Coefficient (SE)	*p*	Coefficient (SE)	*p*
Constant	3.408 (.113)	< .001	3.451 (.099)	< .001	-.724 (.170)	< .001
Social media metrics manipulation	.174 (.091)	.055	-.065 (.063)	.305	.042 (.081)	.609
Knowledge scale manipulation	.037 (.091)	.683	-.025 (.063)	.699	-.008 (.081)	.919
Anthropomorphism	.926 (.129)	< .001	-.393 (.092)	< .001	-.334 (.118)	.005
Wordplay	1.269 (.129)	< .001	-.445 (.093)	< .001	-.273 (.120)	.023
Combined	1.684 (.129)	< .001	-.470 (.095)	< .001	-.517 (.123)	< .001
Factual knowledge	-.035 (.054)	.511	—	—	—	—
Mirth	—	—	.396 (.018)	< .001	.209 (.026)	< .001
Perceived likability	—	—	—	—	.748 (.033)	< .001
Anthropomorphism × Knowledge	.018 (.074)	.804	—	—	—	—
Wordplay × Knowledge	.203 (.073)	.006	—	—	—	—
Combined × Knowledge	.258 (.074)	.001	—	—	—	—
	R^2 = .125		R^2 = .249		R^2 = .401	
	$F(9, 1520) = 24.1$, $p < .001$		$F(6, 1523) = 84.1$, $p < .001$		$F(7, 1522) = 145.6$, $p < .001$	

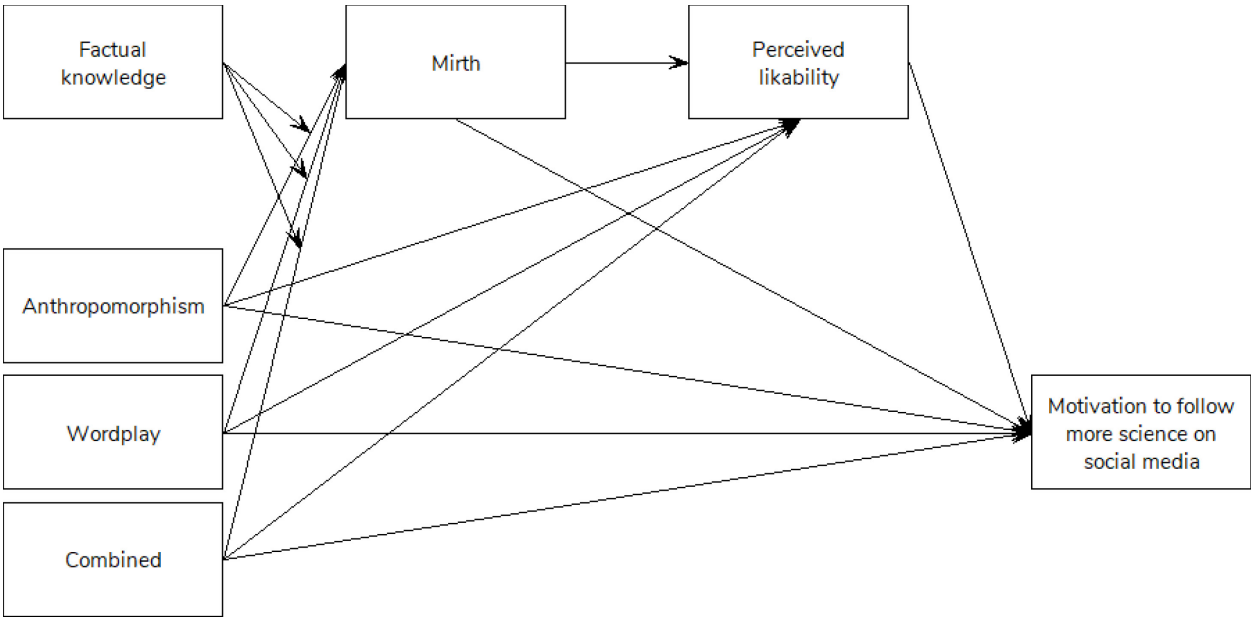


Figure 1. Conceptual model (PROCESS Model 83) with multicategorical independent variable, *humor type*.

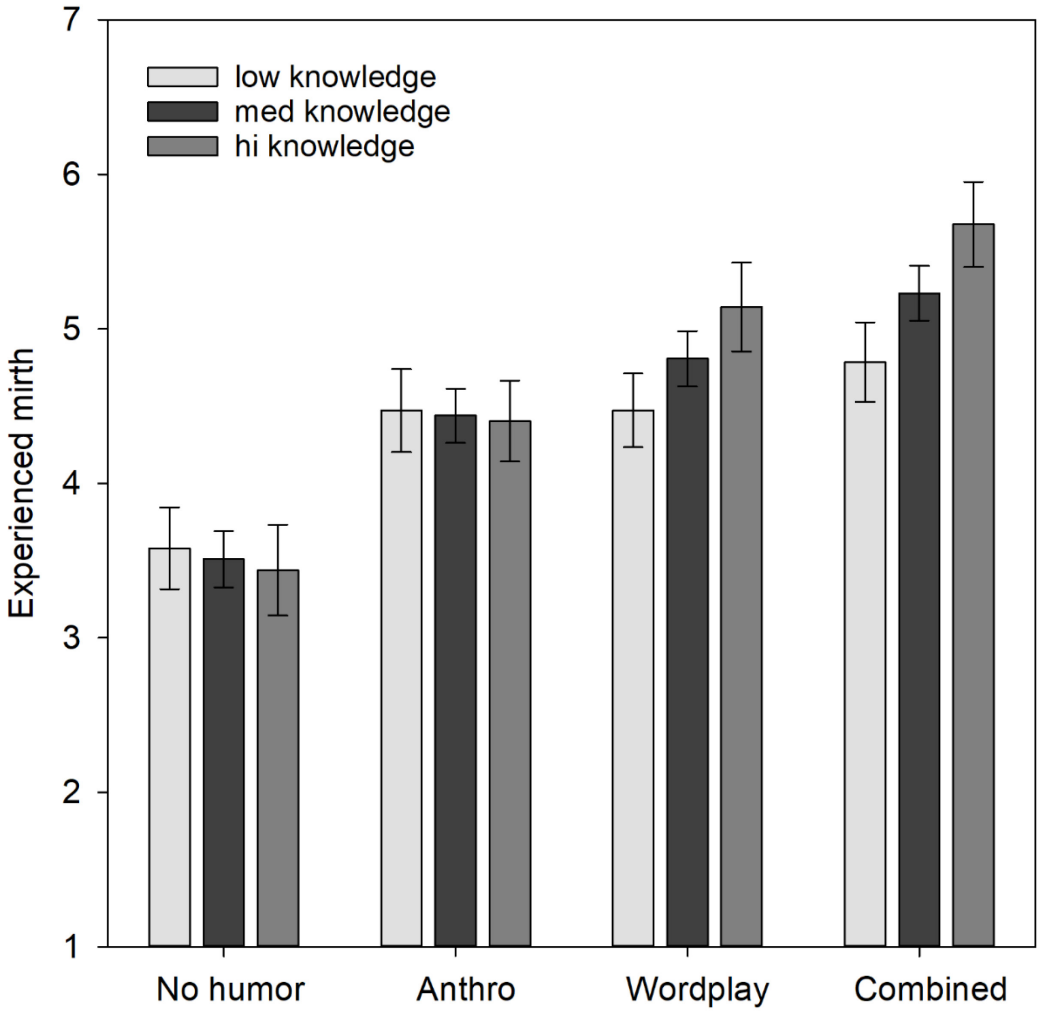
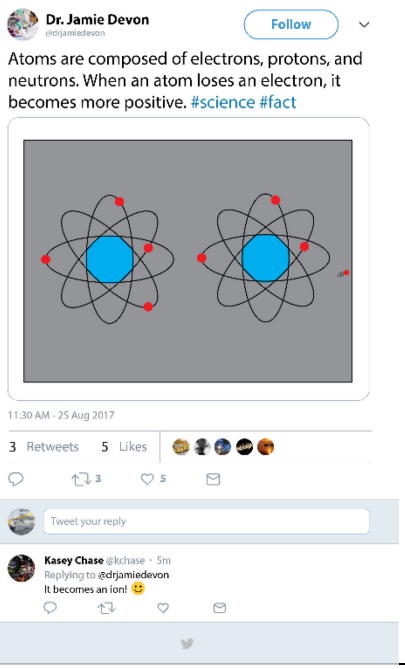
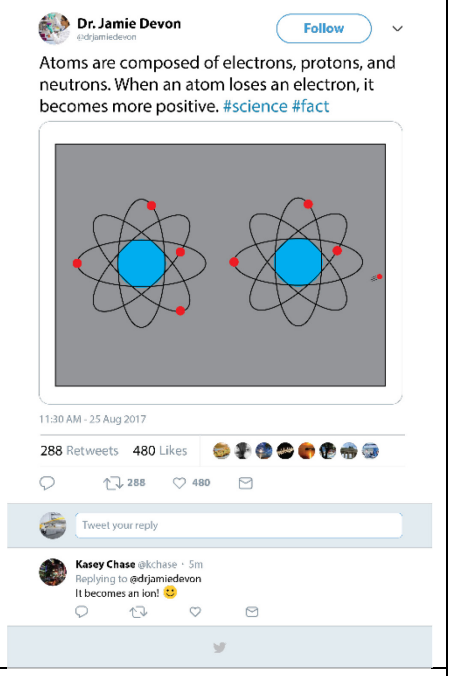
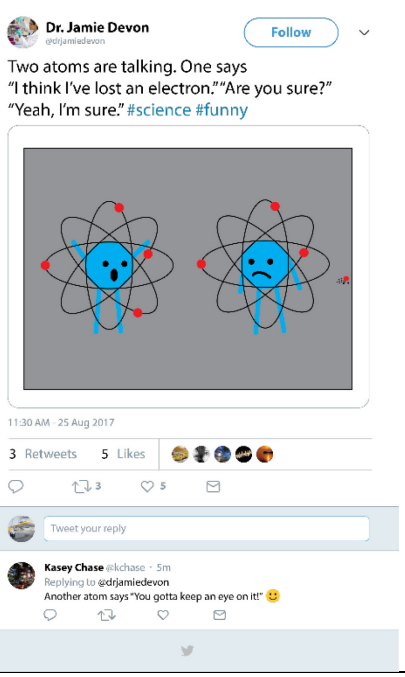
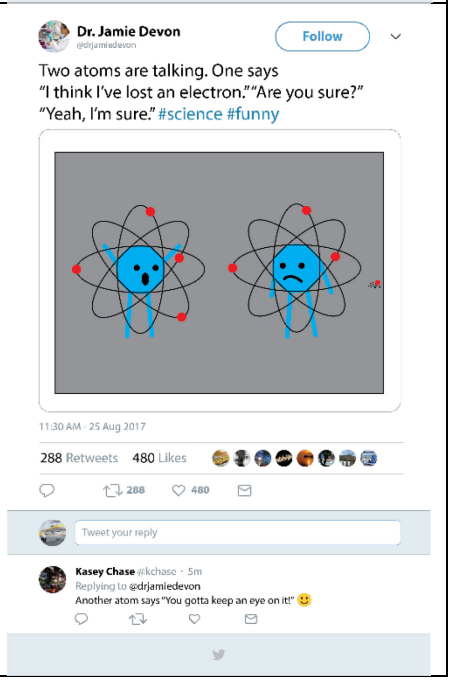
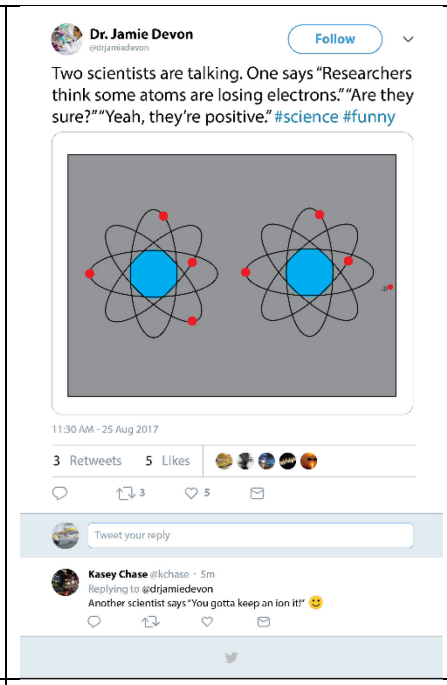
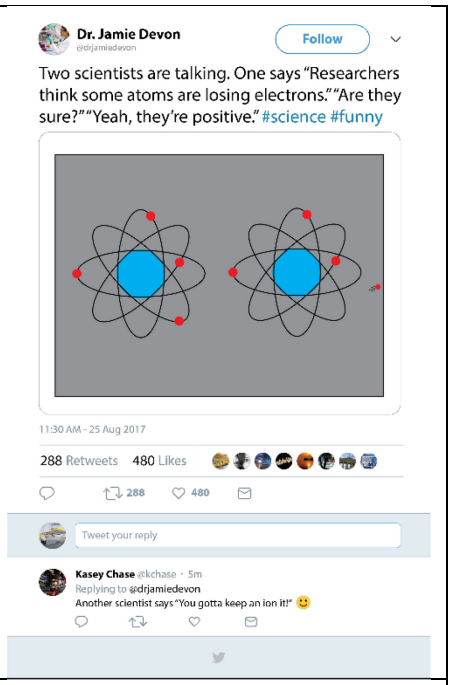


Figure 2. Effect of moderation of *factual knowledge* by *humor type* on *experienced mirth* (*N* = 1,524). Error bars represent 95% confidence intervals based on 10,000 bootstrap samples.

Appendix

	Low social media metrics	High social media metrics
No humor		
Anthropomorphism		

Wordplay		
Combined