Funny, Felt, Familiar:
Memetic Communication, Trust in Science, and Risk Perception in Short Video-Based Social Media

by

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DISSERTATION ABSTRACT

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Scientists are becoming more present on social media, not only to gain public visibility as experts in their fields but also to champion accurate science. While many have used microblogging and online discussion forums, the growing prominence of visual and short-form content has led to the emergence of platforms like TikTok as a new frontier for science communication. Through memes, skits, challenges, and video remixes, TikTok scientists are redefining public engagement with scientific topics. However, the influence of these communication strategies on audience perceptions of trust and risk remains largely unexplored. Amidst evolving public views on science and changing patterns of information consumption, understanding novel forms of communication is crucial to guide scientists using emerging platforms to maximize scientific reach and impact.

In two studies, this dissertation focuses on memetic science communication and examines the psychological mechanisms underlying the effects of engagement with short science videos. Study 1, an observational study, explored the message characteristics associated with engagement on TikTok videos. A dataset of 12,335 science-related videos was compiled from prominent science content creators, from which a random sample of 1,025 videos was examined. Multilevel models, controlling for content creator as a random intercept, were used to analyze multimodal message characteristics and their association with views, likes, shares, and comments. This analysis revealed three consistent predictors of social media engagement: the reappropriation and remixing of other media content, the use of humor, and the imitation of

social media storytelling templates and styles—all hallmarks of meme-based communication. These findings suggest that memetic communication plays a significant role in driving audience interaction on TikTok.

Building upon these results, Study 2 employed a between-subjects experiment (N=610) among 18- to 25-year-old U.S. residents to understand the psychological mechanisms behind the effects of memetic elements on measures of trust and risk perceptions. Drawing from theories of humor, affect, psychological distance, and the stereotype content model, three message treatments were developed that varied in "memetic-ness." Structural equation modeling revealed that meme-heavy videos elicited negative affective responses, more humorous reactions, and more abstract mental construal compared to the other conditions, on average. Moreover, trust measures were directly associated with (positive) affect, humor, and level of abstraction, and only humor had direct associations with risk perception. Mediation analysis showed that meme-heavy videos had indirect positive associations with trust measures through affect, and had indirect negative associations with risk perception through humor.

This dissertation advances the fields of media psychology and science communication by examining an emerging media platform and novel communication styles that shape perception and social judgment. It provides empirical evidence on the implications of using short videos on perceptions of trust and risk, and offers evidence-based recommendations for scientists seeking to use TikTok for science communication. More broadly, the results underscore the necessity for science communicators to adopt audience-centered approaches, creatively leveraging social media platforms to bridge the gap between scientific expertise and public understanding.

Keywords: science communication, risk communication, social media, humor, affect, psychological distance, trust, risk perception

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CHAPTER I: INTRODUCTION

Social media has reshaped science and risk communication, transforming interactions among scientists, media, and the public (Brossard & Scheufele, 2013). It has become a critical tool for disseminating information during crisis events like natural disasters (Crowe, 2011), mobilizing communities for social movements (Literat & Kligler-Vilenchik, 2023), and seeking information about topics and issues (Saks & Tyson, 2022). Through the networked design of social media, scientists can disseminate information with fewer or no bureaucratic barriers and gatekeepers, with instantaneous speeds in multimodal formats (e.g., video, photos, and live Q&As), and direct engagements with various publics (Dudo, 2015; Jia et al., 2017; Liang et al., 2014). Such features make social media an essential component of any science communication endeavor (Van Eperen & Marincola, 2011).

However, the role of social media lies not only in its function to disseminate information efficiently and engage audiences. It also opens new ways to represent science, making technical topics more 'human,' accessible, and relevant to audiences (Koivumäki et al., 2020). Indeed, platforms have created opportunities for scientists to communicate about their work in novel ways. On TikTok, women scientists can share their research findings while presenting the behind-the-scenes of their work and other aspects of their lives, and provide expert advice to audiences, all of which enabled these scientists to challenge gender stereotypes (Huber & Baena, 2023). Research has also shown how Twitter (now X) allows scientists to communicate outside their fields, bringing science-related issues to other domains (e.g., politics) and engaging with audiences outside their disciplines (Jünger & Fähnrich, 2020).

As scientists integrate social media platforms in their communication efforts, research has examined how to best use platforms and suggested online practices such as matching video

duration with style/content, leveraging on relevant/current issues, and strategically selecting hashtags as ways to maximize viewership and engagement in science topics (Zawacki et al., 2022). Researchers have also explored the effects of various elements, such as numeric information (Peters et al., 2024), narratives (Opat et al., 2022), and humor (Yeo et al., 2021), and the use of various formats such as video (Finkler & Leon, 2019) and podcasts (Opat et al., 2022) in science communication.

Social media and memetic communication

One of the emerging ways to communicate science in social media is through memes, often in the form of visuals with humorous and evocative captions or videos referencing other content. Memes have become indispensable to people's online experience, with latest data indicating that they are the third most-shared type of content on social media (Enberg, 2021). They have been used to rapidly diffuse information, from political commentary to conspiracy theories (Smith, 2021), as well as scientific topics such as emerging drugs (e.g., Brown, 2020) and risks that come with emerging technologies like vaccines (e.g., MacDonald & Brianna, 2023).

In recent years, the short video-based platform TikTok has skyrocketed as a social media platform that promotes video-based memetic content (e.g., dance performances, online challenges, and lip syncs). It serves as a venue for creators producing scientific content – from science-based performances to educational videos that become viral and remixed by other users (Zeng et al., 2021). In the last three years, the platform has estimated that around 10 million videos on science, technology, engineering, and mathematics (STEM) have been published globally. Due to the proliferation of science-related content on the platform, TikTok has launched a dedicated STEM feed available for users worldwide (TikTok, 2024)

TikTok and video-based social media represent the second generation of social media (the first generation represented by Facebook and Twitter, where text-based or static images served as the dominant mode of communication); on TikTok, users communicate through performance or bodily movements (e.g., pointing hands to images or texts, using accentuated facial reactions, overacting and reappropriating scenes from movies or TV) (Gerbaudo & Moreno, 2023). The rise of TikTok and other video-based platforms like Instagram Reels and YouTube Shorts, along with the development of features such as the STEM feed, demonstrates how the memetic communication of science has become useful in both entertaining and educating audiences on these platforms. While scholars have noted the use of memetic strategies in generating interest and engagement among young audiences, such content "blurs the line between formal and informal, professional and unprofessional communication" (Brown, 2020, p. 5). This deviation from traditional communication strategies raises questions about best practices in science communication and its impact on public understanding of related risks.

Understanding memes

The term 'memes' was coined in 1976 by Richard Dawkins, an evolutionary biologist, to refer to small units of culture that spread through imitation. In his essay 'The Selfish Gene,' Dawkins posits that memes take on the form of songs, catchphrases, and clothing, which spread in culture and compete for attention. Distinct from internet memes, cultural memes refer to cultural artifacts or ideas and they hold information or possess certain affordances that make them replicable. To illustrate, an advertising jingle can become a meme as others can easily replace words or lyrics or mix them with similar songs. As memes self-replicate through space and time, they evolve and adapt to different contexts and become different from what they originally started (Kien, 2019; Shifman, 2013). Moreover, only those that fit into the socio-

cultural environment can spread (Shifman, 2013). Memetics, or "the theoretical and empirical science that studies the replication, spread, and evolution of memes," grew as a research focus a decade later, even leading to the establishment of the Journal of Memetics in 1997 (Shifman, 2013, p. 10).

The allusion to evolutionary biology is widely used to characterize memes, with scholars studying how cultural memes spread under various social conditions (Shifman, 2013). Scholars also use the metaphor of epidemiology to describe memes, looking at virality as their key characteristic. Both metaphors, while referring to different dimensions of memes, capture how they reproduce and survive in digital media: becoming viral and mutating as users re-purpose and remix content and surviving in digital spaces as users co-opt and re-signify their meaning to fit within the current social and political milieu (Kien, 2019). Indeed, the role of remixing separates the memes, in Dawkins' definition, from contemporary usage of internet memes.

Internet memes

Internet memes are digital artifacts emerging from the networked architecture of digital media and its participatory cultures. The essence of internet memes lies not just in their virality (or distributive capacity), but in their features that drive individuals to copy or remix them (or memetic capacity). The transformative and remixable characteristic of memes separates them from other forms of viral content (Dynel, 2016). As online users perform the dual roles of consumers and producers of content (prosumers) in their online participation (Kien, 2019; Shifman, 2012), these forms of content become viral not only because digital media affords them to be easily spread but also because such spread is performed in response to current technological, cultural, and social events (Dynel, 2016; Shifman, 2012).

Internet memes are also distinct from other digital communications because they refer to groups of objects online rather than discrete units. Memes, as a collective unit, share common content, or ideas embedded in the artifact. These contents are also packaged in a similar form, which can be visual, aural, textual, or all. Memes are often shared to represent the stance or position of the user in [re]producing the meme. Therefore, a meme is not a discrete form of content that goes viral in digital media; its form lies in its relation and reference to other artifacts in digital spaces and objects in popular culture. Internet memes can be defined as digital content characterized by its shared awareness of other units that are shared, imitated, and mutated by other users in digital media platforms, and are used to promote ideas and influence discourses (Kien, 2019; Shifman, 2013; Wiggins, 2019).

Milner (2016) operationalizes internet memes by identifying their five characteristics: *multimodality*, where multiple communication modes, such as videos, photos, and music, are integrated into one piece of content; *reappropriation*, or referencing existing elements into one's content, often those found in popular culture; *resonance*, or the use of elements that enable the audience to relate to its content, often through the use of humor and emotional symbols and messages, as well as slang/coded language; *collectivism*, or engagement with the social aspect of memes and connection with larger communities, evident in the use of template formats, use of trendy discourse styles and scripts, and participation in online challenges; and *spread*, which can be viewed through a meme's popularity in digital media, often measured through metrics such as spread and likes. These characteristics also separate memes from other content genres like news and funny videos, as these genres are often created as self-contained products without the referential and imitational characteristics that memes embody.

It is worth noting that the concept of internet memes has largely been based on image macros, or visuals with superimposed text, which served as the prominent internet meme. However, the emergence of video-based platforms such as TikTok has led to the spread of video-based memes, which have recently become widespread in the contemporary social media landscape (Gerbaudo & Moreno, 2023). While video-based memes carry the characteristics outlined by Milner, they also represent new styles of memetic communication known as "embodied memetic" (Gerbaudo & Moreno, 2023), where bodily movement or performance becomes the multimodal means of expression that reappropriate, resonate, and spread in digital media. The rise of video-based memes can also be attributed to the structures of TikTok and other video-based platforms. In their work, Zulli and Zulli (2022) argue that TikTok is designed around memetic content creation and consumption rather than fostering social linkages: initial content exposure is based on personal interests and not on interpersonal connections, features and icons promote sharing, imitation, and replication over following or making friends, and content creation and distribution norms resonate with or are similar to other videos.

Logics of memetic communication

Three logics are at play when looking at user participation in socio-political discourse through meme-ification or memetic communication (Shifman, 2012). First, the economy-driven logic forwards that easily replicable content has a better chance of succeeding in the attention economy of digital media. Algorithms are more likely to suggest derivatives of existing content, as well as content that latches on to current trends in digital spaces. Creating memes requires relatively minimal effort (Leiser, 2022), and platforms offer ways to easily remix content through templates. Memes also fit within consumption patterns in the modern media environment. Through bite-sized formats and easily digestible content, memes dominate the attention economy

and “say much in a few words” (Leiser, 2022, p. 244) while making the experience of consumption enjoyable and entertaining (Leiser, 2022). Thus, online users are incentivized to create and use memes due to the ease of making them and their effectiveness in delivering information in an entertaining manner.

Second, the social logic of participation propounds that memes are compatible with contemporary identity construction through ‘performative agency’ (Kien, 2019, p. 11) and networking. Memetic communication succeeds in constructing online identities by signaling online users’ creativity and literacy in digital spaces. It also enables users to connect with others as they remix others’ content (Shifman, 2012). Memes create feelings of belonging in a community as they evoke a shared understanding of an issue or concept. It enables users to connect with others who share similar worldviews (Leiser, 2022). At the same time, memes can serve as a vehicle for self-expression in digital spaces and enable users to participate openly in discourses, especially when sharing memes anonymously and creating image macros that do not require putting one’s face into the content.

Finally, cultural and aesthetic logic argues that memetic practices are shaped not only by what happens within platforms but also by larger cultural norms and spheres. Meme-ification in digital media reflects other sites of cultural production (Shifman, 2012). The participatory culture of social media governs the use of memes and memetic communication to participate in discourses (Wiggins & Bowers, 2015). Creating derivative works and refashioning media and artefacts in digital media from a constellation of cultural resources is also akin to fandom cultures (Lanier & Fowler, 2013). Internet memes thus serve as cultural articulations in networked environments.

Memes in science and risk communication

In the classroom, memes enhance the teaching of scientific and technical concepts. Image macros have been used in instruction to generate enjoyment and amusement while learning due to their humorous way of delivering technical information. Researchers using memes for learning found that using memes in instruction helps generate interest and motivation among students, as well as provides an opportunity for students to demonstrate what they have learned throughout the course more relevant manner (Kath et al., 2022). In psychology, teachers have integrated memes into class assignments to enhance students' skills in science communication and found promising results of their motivational and engaging impacts on student learning (Riser et al., 2020). By asking students to make memes to convey findings from a scientific journal, students not only gained competencies in knowledge translation, but they created non-disposable or renewable assignments, as memes can be used outside the classroom by sharing them in digital spaces while facilitating learning within the classroom (Clinton-Lisell & Kelly, 2024; Riser et al., 2020). Outside psychology, educators have used memes to enhance engagement in topics such as physiology (Subbiramaniyan et al., 2022) and chemistry (Underwood & Kararo, 2020), demonstrating the usability of memes in translating technical topics across other fields.

The potential of memetic content in promoting essential skills such as critical thinking has also been explored by scholars in the broader field of social sciences. Using memes as stimuli in developing critical arguments, students are encouraged to think deeply about current issues vis-à-vis the content they regularly see in digital spaces (Wells, 2018). Memetic content has also been analyzed in classrooms to hone students' media literacy skills (Domínguez Romero & Bobkina, 2021; Elmore & Coleman, 2019). Integrating memes in classrooms not only to

develop practical and technical abilities (e.g., knowledge translation and science communication) but also critical skills (e.g., media literacy and argumentation) signals the pervasiveness of memes and memetic communication in modern information environments.

Outside the classroom, memetic communication has been employed in public communication to spread ideas, engage audiences, and mobilize people into action. Institutions have also engaged in memetic communication to promote technologies online, and literature in health communication can offer directions on using public memetic communication. To illustrate, during the COVID-19 pandemic, the Baltimore City Health Department used memes to encourage vaccinations (Elwood, 2021). Here, the government office used image macro formats featuring funny everyday conversations that tackle COVID-related myths. Such meme-based strategies have become viral and have been lauded for being ‘authentic’ compared to other vaccination campaigns (Gilbert, 2021)

Scholars have suggested that using memes can meet audiences where they are. Memes' visual appeal and relatability can make them effective channels for health and risk communication (Headley et al., 2022). By leveraging the informal and casual character of memes, communicators can reach skeptical audiences of scientific technologies like vaccines (Alvelos et al., 2024). The strategic use of fact-based memes and deployment of memetic communication offers the possibility of reaching wider audiences, particularly vulnerable populations with low literacy levels, through the spread of relatable visuals within networked environments (Headley et al., 2022). However, dissenters of scientific technologies also use memes strategically to advance their agendas (Harvey et al., 2019), like critiquing emerging technologies such as genetically modified organisms (Clancy & Clancy, 2016) and vaccinations (Harvey et al., 2019). In either case, both proponents and opponents of technological advances

exploit the visual language of memes and the globality of digital media to transcend linguistic and geographic barriers and reach large audiences (Clancy & Clancy, 2016).

Much of the scholarly work on memes has proposed their potential, but not much has tested their actual effects on perceptions about science and risk, despite their prevalent use in communicating these issues. A recent systematic review by Occa et al. (2024) of 35 studies on the use of memes in health communication found that most studies on memes were atheoretical and exploratory, with many focusing on COVID-19. The researchers attributed these characteristics to the emergent nature of memes in health communication and the fact that most researchers who appear to be interested in memes are outside the field of health communication research (Occa et al., 2024).

Experimental research by Wasike (2022) provides an example of how memetic communication influences perceptions of credibility, with findings suggesting that memes from expert sources and memes with an objective tone are both associated with perceived credibility (Wasike, 2022). Exposure to different types of memes (based on presence of meme image and funny caption), which may not necessarily be science-based, was found to be associated with information processing, self-efficacy, and emotion (Myrick et al., 2022). In a study by Zhang and Pinto (2021), participants exposed to climate change memes did not have significantly higher climate risk perceptions but were more likely to engage in climate change campaigns than before exposure to memes (Zhang & Pinto, 2021).

The mechanisms through which memes produce different effects on science and risk perceptions compared to other content genres, such as news and explainer videos, remain largely unexplored. Furthermore, communication theories commonly employed in science and risk communication research appear to be underutilized in the study of memes. Moreover, scholarly

work on the effects of memetic communication has primarily focused on static images. Examining memetic communication beyond this format presents a rich and underexplored area of research, especially considering the rise of visual media platforms like TikTok and Instagram, and the prevalence of memetic short video content on these platforms.

The current study

Science communicators face the challenge of engaging audiences in the current information landscape where the use of social media serves as a prominent channel. Memetic communication, the language of social media, thus warrants a more systematic investigation, especially as more scientists and institutions engage in this form of communication online. Declining trust in science (Kennedy & Tyson, 2023; Mills, 2023) and social institutions (Oshin, 2023) as well as emerging information environments dominated by younger segments speaking in their generational and platform vernaculars (Zeng et al., 2021) further underscore the need to study memetic communication as a tool for science communication. In the language of memes, this dissertation responds with "challenge accepted" to Shifman's call to take memes seriously and asks two broad questions: (1) What do memes (or memetic communication) accomplish for science communication? and (2) What psychological mechanisms can explain the effects of memes?

Across two studies. this examination aims to reveal the socio-psychological mechanisms explaining the role of memetic communication in science and risk communication. In Study 1, we examine memetic communication "in the wild" through observational research of publicly available TikTok videos, analyzing the multimodal characteristics and memetic elements they contain, and test how such elements are associated with video engagement (views, likes, shares, and comments). Informed by the results of Study 1, we then report results of a between-subjects

experiment in Study 2, where we designed three video treatments varying in memetic-ness and tested how exposure shaped perceptions of trust based on measures of warmth and competence, and perceived risks of a scientific issue. Together, these studies offer theory- and evidence-based insights into the role and utility of memetic strategies in science and risk communication.

CHAPTER 2: MEMETIC COMMUNICATION AND MULTIDIMENSIONAL ENGAGEMENT ON TIKTOK

Scientists are increasingly recognizing the need to engage with social media to gain public visibility as experts in their specific fields and to serve as champions and advocates of accurate science broadly. There is a growing need for scientists to actively participate in online conversations, especially given the rise of new actors, some of whom may misrepresent and manipulate scientific information to pursue their own strategic and potentially nefarious interests (Faehnrich, 2021; Mojarad, 2017).

Scientists have found platforms like Reddit and Twitter (now X) as venues where they can interact with diverse audiences through forums and message threads, as well as connect with other scientists and talk about each other's work (Insall, 2023). However, the rise of visual and short-form content has led to the emergence of platforms like TikTok as a new frontier for science communication. Evidently, TikTok presents a unique opportunity for scientists to reach new audiences, particularly Generation Z, who constitute the platform's primary user base (Smith, 2024). Yet, scientists lack guidance on how to use TikTok effectively (Rein, 2023).

Some scientists have taken to copying trends on TikTok and through memes and short-form videos. They redefine what it means to be a scientist by sharing what happens behind the scenes of their work and reveal the frustrations, challenges, and roles they play and experience outside of laboratories (Zeng et al., 2021). Scientists are also expanding what it means to communicate scientific information itself. While traditional formats such as lecture-style explanations of research papers and video demonstrations of scientific experiments and procedures are used by scientists on TikTok, they are also engaging in creative video explorations featuring everyday topics such as the science of lip gloss (Dr. Blitz, 2024) or the

mechanics of toilet flushing (JaDropping Science, 2024), and applying novel, memetic approaches, like skits, dance challenges, and lip syncs, making science look fun and approachable (Zeng et al., 2021). This communicative style is facilitated by TikTok's affordances, which promote creative content production through its easy-to-use, platform-native video editing tools, remixing of multimodal elements through its duet and stitch features, and imitation of current trends that are widely distributed through the platform's algorithms (Zulli & Zulli, 2022).

In this study, we explore the landscape of science communication on TikTok and examine the various elements that shape people's engagement with short science videos on the platform. We situate this study within an era where scientists must compete with other sources of scientific information, such as influencers, and consider the changing mechanisms of information distribution, such as platform algorithms, to reach audiences (Faehnrich, 2021). By understanding message elements and communicative practices prevalent in short science videos, our research aims to provide recommendations and help scientists develop effective strategies to reach diverse audiences.

TikTok as a science communication platform

TikTok is an online platform owned by the Chinese company ByteDance, primarily used for creating and sharing short video content, or videos that are less than five minutes long (Kaye et al., 2021). It rose to global prominence in 2019 and currently serves as the most used short-video platform, followed by Instagram Reels, Facebook Videos, and YouTube Shorts (Ceci, 2024). TikTok is known as the platform for Generation Z, as they constitute its largest demographic user base. While TikTok is marketed as an entertainment platform (Sherman, 2022), young users consider it one of their top sources for news and information (Flynn, 2024).

One of the distinctive characteristics of TikTok is its recommendation algorithm, which engages users in an endless stream of personalized videos within the platform's For You Page (FYP) and provides them with a unique platform experience. For scientists and science communicators, the algorithm offers the opportunity to 'go viral' even among new users and reach young audiences as they disseminate science to various audiences (Rein, 2023). Indeed, TikTok has skyrocketed in popularity as venue for science communication (Zeng et al., 2021), with an estimated 10 million videos about science, technology, engineering, and mathematics (STEM) published globally as of 2024, prompting the launch of a dedicated STEM feed on the platform (TikTok, 2024). This feature provides scientists with a specialized venue to reach self-selected populations and continuously build relationships with receptive science audiences.

TikTok communication can be characterized as a 'meme-centered media practice' (Zeng et al., 2021, p. 3239), enabled by tools on the platform that facilitate content creators' use of trending sounds and templates, remixing other users' content (through the 'stitch' or 'duet' features, where content creators can use others' videos as part of their own, either by displaying them side by side or integrating them as clips within their content), and applying filters and effects created by other users to their own videos (Herrman, 2019; Zulli & Zulli, 2022). These features encourage imitation and replication, hallmarks of memetic communication, at the platform level, creating a unique norm and style of content creation and communication within TikTok (Zulli & Zulli, 2022). Thus, successful TikTok content creators are able to participate in trends and, broadly, follow the norm of imitation and replication through the platform's remix features (Hautea et al., 2021).

TikTok content deviates from communication on other social media platforms through its focus on short videos. Unlike Facebook and X, which are centered on social network building,

TikTok focuses on creative content production (Huber et al., 2022; Zulli & Zulli, 2022). Evident in its platform features, TikTok enables (science) content creators to infuse a wide array of multimodal elements (music, text, video clips, sound effects, video filters) that provide affective meaning to the educational information they share (Hautea et al., 2021; Huber et al., 2022; Zeng et al., 2021).

TikTok communication also emphasizes performance or bodily movements of the content creator (e.g., dancing, re-enacting popular media scenes, gesturing to in-video elements, exaggerated facial expressions), placing the content creator at the center of the message and breaking down the 'officiality' and distance typically felt toward authority figures (Gerbaudo & Moreno, 2023). Another way such distance can be bridged is through 'calibrated amateurism,' or an aesthetic where content creators appear spontaneous or unfiltered, building rapport with their audiences to foster an air of relatability and authenticity (Abidin, 2017). In TikTok science videos, this can be seen in the use of everyday products in science experiments (e.g., @chemicalkim using an old soda bottle and droppers to demonstrate buoyancy and gas laws) (Zeng et al., 2021), as well as scientists' 'unserious' and playful self-presentation, personal self-disclosures, videos featuring their lives outside the laboratory, and 'candid' and emotional responses toward issues.

While these strategies can engage audiences, they also deviate from normative expectations about science communication (Brown, 2020), giving rise to new ways to represent science and scientists, and new strategies to foster trust among audiences.

Social media logic and platform vernaculars

How do these norms emerge, and why do scientists have to engage them in the first place? A useful perspective is the concept of media logic, which refers to the "assumptions and

processes for constructing messages within a particular medium" (Altheide, 2004, p. 294), including the format and style of communicating a message. Media logics contend that different media operate with codes or conventions that audiences recognize (Altheide, 2016). These conventions emerge from the varying technological affordances of media, their different users, and the socio-cultural, economic, and regulatory dynamics that shape the editorial decisions made by media institutions in disseminating information (Altheide, 2004).

Media logics emphasize how the medium (such as social media) and message formats (such as short videos) shape expectations regarding content and its audiences (Luik et al., 2025). It also highlights how communicators online can attain legitimacy by adhering to the logics of the medium. Therefore, according to media logics, scientists should lean towards creative remixing and multimodal communication, participation with popular trends and communication styles, networking and engagement with other users, and understanding engagement metrics. These actions all correspond to social media's logics of programmability, popularity, participation, and datafication of social media (van Dijck & Poell, 2013), which drive the "rhythm, grammar, and format" (Altheide, 2004, p. 294) of messages on social media to legitimize their status and content within this medium (Luik et al., 2025).

Rhythm, grammar, and format can also be conceptualized as platform vernaculars, which relate to the popular genres and forms of communication on social media (Gibbs et al., 2015). Similar to media logics, platform vernaculars emerge from the technological affordances of social media, as they facilitate certain forms of expression or participation in online spaces. But technological affordances do not, in and of themselves, lead to the emergence of vernaculars. Vernaculars are established through widespread adoption and use of genres and forms as users interact with platforms and their features (Gibbs et al., 2015). Moreover, because social media

platforms are not homogenous, are developed for specific uses (Hermida & Mellado, 2020), and have their own affordances, each platform has its own vernaculars, giving rise to unique mediated practices (Gibbs et al., 2015).

To illustrate, one of the vernaculars of Instagram is its higher appreciation for the aesthetic qualities of images and enhancement filters and forms of interaction centered around imagery (Hu & Kidd, 2024). Instagram vernaculars center on positive, inspirational, and idealized imagery (Vicari & Ditchfield, 2024). TikTok, while another visual platform, instead centers on authenticity and rawness, often containing alternative discourses that focus less on positivity or inspiration and more on unfiltered humor and playfulness (Vicari & Ditchfield, 2024). When (science) content is communicated across platforms, headlines and images tend to be adjusted, and other elements are added across platforms to ensure their posts' alignment with the affordances, characteristics, and vernaculars of each platform (Verstappen & Opgenhaffen, 2024).

Scientists and science communicators must then understand social media logics and platform vernaculars to maximize their visibility and reach their audiences. Perhaps, effective science communication in contemporary media environments goes beyond crafting clear and understandable messages, but also "learn[ing] the rules" (Cheplygina et al., 2020, p. 4) of social media platforms. Indeed, in an examination of tweeting practices of scientists, researchers found that those using X and 'building buzz' around their work by interacting with other actors online (such as reporters) tend to have higher h-indices, demonstrating how scientists' adherence to Twitter's logic of social interaction can augment the impact and extend the reach of their work (Liang et al., 2014). Meanwhile, in a study which explored TikTok for geoscience communication, researchers recommend making short videos, using TikTok's remix features

(such as green screen backgrounds and image overlay effects), and replicating styles of other engaging TikTok videos (i.e., tuning in to platform trends) to maximize audience reach and engagement (Zawacki et al., 2022).

By adhering to the logics of social media and using the vernaculars of TikTok, scientists can enhance their institutional/scientific authority and gain legitimacy, especially amid declining trust in science (Kennedy & Tyson, 2023; Lupia et al., 2024). Social media logics and platform vernaculars also serve as useful conceptual frameworks to examine how the use of social media strategies, such as memetic communication, produces positive outcomes for both scientists and their audiences. Understanding them is central in light of the changing media landscape, where science communication is not solely performed by experts (i.e., scientists, science journalists, and other science communication professionals) or institutions (such as the media or government agencies). In the digital media landscape, nonexpert voices gain legitimacy and are on par with institutions and experts, sometimes even surpassing them in terms of information spread and engagement, as their content becomes more visible online due to algorithmic distribution (van Dijck & Alinejad, 2020).

Humor, affect, and perceived distance in memetic communication

Making content more visible is one of the obstacles of communicating on social media platforms. Given the plurality of voices online and the complexity of social media environments, one of the strategic and actionable approaches for science communicators is to strengthen their visibility on social media (Neeley, 2013). On TikTok, one of the ways to do this is by engaging in memetic communication, or the imitation, remixing, and repurposing of widely spread communication styles, messages, and formats, which include phrases, performances, images, or videos (Milner, 2016). Memetic communication serves as one of the vernaculars of TikTok, if

not its very essence, given the platform's design and affordances that promote creative remixing and imitation of trending content on the platform (Zulli & Zulli, 2022). Here, we discuss three attributes that shape its continued use as a vernacular on the platform, which are its humorous content (Taecharungroj & Nueangjamnong, 2015), affective meanings, and its referential elements that enable audiences to resonate with messages (Shifman, 2013).

Memetic messages gain traction on platforms like TikTok due to the features they contain that invoke humor and playfulness (Taecharungroj & Nueangjamnong, 2015). These features involve inviting others to participate and create their own memes (i.e., join in the fun and play), juxtaposition of two unexpected or incongruent elements in communication (e.g., use of puns, wordplays, or comic images for serious topics), or generation of laughter through feelings of superiority over others' silly or foolish actions (e.g., funny skits of relatable situations, self-mocking memes, participation in pranks) (Shifman, 2013). Prior work has consistently supported the role of humor in engagement about various topics, and its effectiveness is maximized when it is properly deployed in communications (Malodia et al., 2022). In the case of science communication, the use of wordplay and satirical humor on X was found to be significantly associated with likes, retweets, and replies to science posts (L. Y.-F. Su et al., 2022). Audiences who experienced greater mirth after being exposed to humorous science content that used wordplays and anthropomorphism of animals, also perceived scientists who posted about them as more favorable, and exhibited greater motivations to follow more science content in social media (Yeo et al., 2021, 2023).

Memes also serve as vehicles of affective meanings (Katz & Shifman, 2017). They are often used as reflections of peoples' affective states in online conversations (e.g., use of GIFs, reaction memes) (Flecha Ortiz et al., 2021), serving as proxies and channels through which

people represent and express themselves (Zeng et al., 2021). At the same time, their multimodality, combining textual and visual elements (e.g., image macros, or digital images with a superimposed text), or even aural elements (in he case of video-based memes), can facilitate understanding of memes' content and evoke affective responses (Ayele et al., 2025). During the COVID-19 pandemic, many online users turned to image macros to cope with the stress of the situation, and memes were found to be a source of validation and comfort for their own experiences (Akram & Drabble, 2022; Myrick et al., 2022). This emotional resonance generated through memes make them engaging, and audiences tend to act on these messages online, either by 'reacting' to it or sharing it (Taecharungroj & Nueangjamnong, 2015).

The ability of memes to elicit humorous responses, and their effectiveness as affective vehicles lies in their engagement with current trends and references to the 'inside jokes' of the internet (Akram & Drabble, 2022). By participating in meme cultures – either by creating memes themselves or sharing memes by others – users signal to their audiences that they are aware of the ongoings in the platform (Katz & Shifman, 2017; Leiser, 2022). In many ways, memetic communication enables message senders to meet audiences where they are in digital spaces and reduce distance felt by audiences from persons of authority (Gerbaudo & Moreno, 2023). Informal language in online memes can evoke perceptions of closeness and benevolence message sources (Schwabe et al., 2025), while calibrated amateurism can foster relatability and imply authenticity (Abidin, 2017). Meanwhile, the use of referential elements in memes signals a shared experience between users and their audiences (Katz & Shifman, 2017), while humor can increase perceived likability and expertise of communicators (Yeo, Anderson, et al., 2020). In other words, while the platform itself may encourage memetic communication, its effectiveness

and emergence as one of its vernaculars could also be understood as a function of humor and affect that facilitate connections between users and a shared social experience.

Study aims

Taken together, this research seeks to understand memetic communication on TikTok as an emerging way to communicate science, which is particularly relevant in an era of declining confidence in science (Kennedy & Tyson, 2023; Lupia et al., 2024), and the growing use of short video-based social media in science communication (Zeng et al., 2021). TikTok, as a platform that encourages memetic communication, serves as an illustrative case to understand memes beyond image macros, and offers insights on how to effectively communicate on social media platforms. Based on the theories of media logic and platform vernaculars, and guided by literature on humor, affect, and perceived distance, we ask the following questions:

RQ1: To what extent do science content creators employ memetic communication in short videos on TikTok?

RQ2: How do memetic communication elements shape engagement on short science videos on TikTok?

Methods

To examine the role of memetic communication in engagement, we employed a quantitative content analysis based on a standardized coding scheme (Appendix 1), examining for the presence of various memetic elements in TikTok videos produced by scientists and how such elements are linked to engagement on videos.

Data

Using the TikTok API, we first looked at content that used the hashtag #science to identify other hashtags used on TikTok science videos. From the top 100 most used hashtags, we

found other science-related hashtags #climate, #energy, #ai, #food, #gmo, #health, and #medicine that were frequently used alongside #science. We then created an initial list of science content creators by looking at users who posted TikTok videos using these hashtags[1] (N = 93) in combination with #science.

Next, we employed a network approach to augment the initial list. Using the TikTok API again, we identified other users followed by those in our initial list and calculated the degree of centrality[2] of each user to determine which science content creators are highly followed by users in our initial list. We removed users with less than 1M likes to focus our analysis on content creators with a sizable reputation on the platform. Our final list consisted of 114 science-focused content creators (see Appendix 2 for a list of these content creators). We then extracted videos posted by these content creators from January 1, 2024 to October 10, 2024 using the TikTok API (N = 12,335). These videos served as the corpus of text for the study, from which a random sample of 1,028 videos was drawn for manual content analysis[3]. Three of the videos, however, were removed as their links were inaccessible during analysis, leaving a final sample of 1,025.

Procedures

We developed a coding scheme based on Milner's logics of memetic participation (2016) and prior work on science memes on TikTok (Zeng et al., 2021). We enlisted an external coder to test for intercoder reliability with the study's first author. Training for content coding took place

[1] A user was included in the list if their profile page indicates that they are a scientist and/or has an advanced degree or engaged in scientific research, has multiple videos (more than four rows of content in their feed when viewed through the browser, and mostly posts research or science-related content upon viewing their page

[2] Total number of connections of an element in a network (Borgatti & Brass, 2019)

[3] While precise calculations of sample sizes are challenging for content analysis studies, we deemed this sample size as sufficient to capture variability in the message elements on the predefined coding categories, which we demonstrated through pilot testing and inter-coder reliability.

from October 13 to November 2, and after three rounds of training, individual pre-testing, and instrument revision and clarification, we achieved acceptable results across all study variables based on Krippendorf's alpha. Actual content coding was conducted from November 3 to 20. We also conducted retraining and reliability check after the coders examined 200 videos to minimize drift and ensure consistent reliability. The results of the intercoder reliability tests and final set of codes are found in Appendix 1.

Measures

We employed measures at the author and video-level extracted from the TikTok API as well as video-level characteristics coded through the manual content analysis. Meanwhile, the presence of message elements was measured as binary variables. We also used Linguistic Inquiry and Word Count (LIWC) (Pennebaker et al., 2022) to supplement our analysis based on textual data available in our data.

Independent variables

To examine content multimodality, coders examined the following elements: *presence of moving images* such as GIFs or video clips in the post, *presence of still images*, *presence of music*, *presence of text*, and *presence of other audio*, such as sound effects.

For reappropriation, coders examined any verbal *references to pop culture* (e.g., popular celebrities, television and movie shows, as well as their characters) in the video script, voice-over, and subtitles. Reappropriation also covered *integration of media elements that are not related to science*, such as actual images, videos, music, and sounds from television shows, movies, recorded events, etc.

For resonance, coders recorded for the *use of slang words* in the video scripts, voice over, and subtitles, the *use of humor* such as jokes and wordplay, the *use of conversational or plain*

language in speaking and explaining, and the *use of emotional and narrative-based* storytelling. We also used LIWC big words score to supplement the use of conversational language (m = 16.84, sd = 5.78) and LIWC emotionality score (m = 1.07, sd = 1.78) to supplement emotional language.

For collectivism, coders examined whether the content creator *used social media storytelling styles and formats*, such as "get ready with me" (filming the self while preparing for work or putting on make-up while sharing information) or "POV" (showing a scenario from a specific point-of-view, followed by a description of such scenario), green-screen storytelling (using the green-screen feature of TikTok), unboxing videos (opening a package and showcasing the contents to the audience), etc. Coders also examined whether the content creator *invited the audience to engage in a conversation* through the comment section or participate in the video challenge or produce their own similar content. Under this dimension, we also coded whether the content creator *engaged in an online challenge* or not but found that none of them participated in any TikTok challenge.

Aside from these four dimensions, we also coded for *calibrated amateurism*, or the presence of an 'unpolished' and non-professional feel in videos, indicated by awkward camera angles and lighting, shaky camera, noisy background, rough transitions, etc.

Controls

We also coded for the science field mainly covered in the video: health and medical sciences (36.98%), physical sciences (22.05%), life sciences (14.54%), social sciences (9.56%), mathematics and computer science (4.00%), science in general (6.05%), and not science-related (6.83%).

We also coded for the form of presentation employed by the content creator in their video, following definitions by Zeng et al. (2021): demonstrating a scientific procedure, experiment, or use of equipment or scientific process (8.69%), plain speaking or explaining a concept, process, research findings, or phenomenon in easy to understand language (78.68%), performing or engaging in dance routines, lip-syncs, or skits (6.04%), stitching with others or using the stitch function of TikTok (6.04%), and other presentation formats (8.57%), such as aesthetic science or focusing on the aesthetic or visual features of elements being features in the video (e.g., mushrooms). We also coded for the video length in seconds (m = 89.15, sd = 75.75).

Finally, we controlled author-level characteristics, extracted using the TikTok API. These characteristics are number of followers of author (m = 1,087,747.09, sd = 1,427,647.07), number of users followed by author (m = 711.23, sd = 863.69), number of likes of author (m = 44,548,386.40, sd = 98,232,228.10), and total number of videos posted by author (m = 1,738.76, sd = 1,267.52).

Table 1

Descriptive statistics of author characteristics

	Mean	SD	Min	Median	Max
Video count	1,738.76	1,267.52	21	1,098	3,915
Follower count	1,087,747.09	1,427,647.07	73	701,401	9,850,019
Following count	711.23	863.69	0	443	5,541
Likes count	44,548,386.40	98,232,228.10	1,109,647	18,116,998	627,476,441

Dependent variables

We used the video engagement metrics, namely, views (m = 261,879.25, sd = 1,145,366.21), likes (m = 20,984.40, sd = 104,015.67), shares (m = 933.46, sd = 5,355.69), and

comments (m = 345.95, sd = 1,181.42) recorded by and extracted through the TikTok API. Table 2 presents the descriptive statistics of the study outcome variables.

Table 2

Descriptive statistics of dependent variables

	Mean	SD	Min	Median	Max
View count	261,879.25	1,145,366.21	0.00	32,407.00	27,111,835.00
Like count	20,984.40	104,015.67	0.00	1,949.00	2,713,929.00
Share count	933.46	5,355.69	0.00	42.00	117,921.00
Comment count	345.95	1,181.42	0.00	59.00	18,688.00

Analytic plan

Consistent with prior work examining social media engagement metrics as outcome variables (Peters et al., 2024), we transformed our dependent variables (likes, shares, comments, and views) into per/day measurements to account for time as older TikTok videos may have more engagements than newer ones. We calculated the number of days between the posting date and data extraction date (October 10, 2024), and subtracted likes, shares, comments, and views by the difference score to create a per-day measure of these metrics. We also log-transformed these values using the formula ln(X+1).

We performed exploratory correlational analysis to examine for potential multicollinearity among study variables. The matrices are found in S3. Due to the strong correlation between reference to pop culture and reappropriation of non-science media (r = .70), we opted to combine these variables into a single reappropriation variable, where 1 indicates presence of pop culture or non-science media, and 0 indicating absence of both elements.

To answer RQ1, we used descriptive statistics to examine the memetic elements science content creators employed in their videos. To answer RQ2, we employed a multilevel approach,

where memetic characteristics are included as content-level predictors of views, like, shares, and comments, while accounting for content-creator level differences. A total of four models were created (likes per day, shares per day, comments per day, and views per day), each controlling for the content creator of each video as a random intercept. All models also controlled for video length, presentation type, and science field. All data transformations and analysis were carried out using R.

Results

RQ1. Use of memetic elements in science videos

Table 3 summarizes the percentage of posts containing memetic elements we coded in our research. Looking at multimodality, almost all of the posts analyzed had videos (98.83%) and text (95.41%), which are used as subtitles in videos or to integrate additional information alongside video or image graphics. Less than half (42.34%) integrated still images, and only around a third (32.39%) contained music. Only 8% of the videos integrated other non-music audio, such as sound effects, sound bites, or audio clips from other content.

In terms of reappropriation, we find that the posts did not use reappropriation as a memetic strategy in their content. Only 12.99% of posts referenced popular culture in their content, while 12.50% integrated non-scientific media as part of their content.

Most posts resonated with their audience via emotional and narrative storytelling (83.32%) and conversational language (89.07%). Around one in five (22.27%) employed humor in their post, while only 6.25% used slang words in their content.

For collectivism, around half of the posts (45.51%) employed imitation, using familiar social media storytelling styles and templates. These templates included green-screen edits, stitch videos, lip-syncing to trending audio, and use of storytelling templates (science in 60 seconds).

Around one in five posts (19.22%) invite audiences to engage with their content and create their own posts.

Finally, a large majority of the posts (85.76%) employed amateur storytelling self-presentation in their posts.

Table 3

Presence of memetic elements in science videos (N = 1,025)

Memetic characteristics	%	N
Multimodality		
Contains video	98.83	1,013
Contains still image	42.34	434
Contains music	32.39	332
Contains other audio	8.00	82
Contains text	95.41	978
Reappropriation		
Referenced pop culture	12.99	133
Reappropriates other media	12.50	128
Resonance		
Uses humor	22.27	228
Uses emotional and narrative storytelling	83.32	854
Uses conversational language	89.07	913
Uses slang	6.25	64
Collectivism		
Imitates social media storytelling	45.51	466
Invites users to engage	19.22	197
Calibrated amateurism	85.76	879

RQ2. Memetic elements and engagement in science videos

We created four multilevel models to explore how the use of memetic elements in science videos relates to engagement metrics. Subdimensions of multimodality, reappropriation,

resonance, collectivism, and calibrated amateurism were included as predictors, while other video characteristics such as post topic, length, and presentation format were included as controls. All models also included the post author as a random intercept. The coefficients for the key predictors are shown in Table 4, while the complete models are available in Appendix 3, containing the full set of coefficients for all covariates and controls. We also used continuous measures of the use of emotion in content (LIWC emotionality), use of conversational language (LIWC big words), and use of slang (% of slang words), instead of binary measures to provide more information and granularity in our analysis.

In terms of views, we find that reappropriation of other media was significantly associated with a lower number of views per day ($B = -0.43$, $p = .005$). This corresponds to an observed difference of 34.78% lower in average views per day, compared to videos that do not reappropriate other media. Meanwhile, imitating social media storytelling styles and templates was significantly associated with higher number of views per day ($B = 0.41$, $p < .001$), corresponding to an observed difference of 51.01% higher in average views per day, compared to videos that did not use such memetic elements.

When it comes to likes, we find that, on average, humor ($B = 0.24$, $p = .04$) and imitation of social media storytelling styles and templates ($B = 0.36$, $p = .001$) were significantly associated with higher likes per day. The use of humor corresponds to an observed difference of 27.5% higher in average likes per day, compared to those that do not use humor, while the imitation of social media storytelling styles and templates corresponds to an observed difference of 43.2% higher in average likes per day.

We also find that these elements were significantly associated with shares per day. Both the use of humor ($B = 0.28$, $p = .003$) and imitation of social media storytelling styles and

templates (B = 0.22, p = .01) were significantly associated with shares per day. The use of humor and imitation corresponded to an observed difference of 30.29% and 25.22% higher in average shares per day, respectively.

Finally, looking at comments, our models show that reappropriation, use of humor, and imitation of social media storytelling styles and templates had a significant association with the number of comments per day. Specifically, reappropriation had a significant negative association with the average number of comments per day (B = -0.17, p = .03), corresponding to an observed difference of 15.87% lower in average daily comments, compared to those without reappropriated pop culture content or non-science media. Meanwhile, the use of humor had a significant positive association with the average number of comments per day (B = 0.19, p = .003), corresponding to an observed difference of 21.22% higher in comments per day, compared to posts not containing humor. Similarly, imitation had a significant positive association with the average number of comments per day (B = 0.22, p < .001), corresponding to an observe difference of 24.95% higher in average number of comments per day compared to posts that do not imitate social media storytelling styles or templates.

In sum, we find that among all memetic elements included as independent variables in our models, imitation consistently had a significant positive association with all engagement metrics. Humor also turned out to be significantly positively associated with engagement, except for views, while reappropriation was significantly negatively associated with views and comments.

Table 4

Linear mixed models results for engagement variables

	Views	Likes	Shares	Comments
	B (SE)	**B (SE)**	**B (SE)**	**B (SE)**
Intercept	3.23 (1.49) *	0.88 (1.39)	-1.09 (1.13)	-0.19 (0.76)
LIWC word count	0.11 (0.16)	0.01 (0.15)	0.07 (0.12)	-0.03 (0.08)
LIWC big words	-0.05 (0.05)	-0.04 (0.04)	-0.01 (0.04)	-0.01 (0.02)
LIWC emotionality	-0.04 (0.05)	-0.02 (0.04)	-0.07 (0.03)	-0.04 (0.02)
% slang words	-0.02 (0.04)	-0.02 (0.04)	0.02 (0.03)	0.01 (0.02)
Contains video	0.89 (0.72)	0.96 (0.68)	0.49 (0.56)	0.41 (0.37)
Contains still image	0.04 (0.11)	0.00 (0.11)	0.05 (0.09)	-0.03 (0.06)
Contains music	-0.08 (0.12)	-0.04 (0.12)	0.12 (0.09)	0.01 (0.06)
Contains other audio	0.13 (0.18)	0.08 (0.17)	-0.04 (0.13)	0.05 (0.09)
Reappropriates other media	-0.43 (0.15) **	-0.27 (0.14)	-0.18 (0.11)	-0.17 (0.08) *
Uses humor	0.14 (0.13)	0.24 (0.12) *	0.28 (0.10) **	0.19 (0.07) **
Imitates soc. med storytelling	0.41 (0.12) ***	0.36 (0.11) **	0.22 (0.09) *	0.22 (0.06) ***
Invites users to engage	0.02 (0.11)	-0.11 (0.11)	-0.04 (0.09)	0.01 (0.06)
Calibrated amateurism	0.04 (0.19)	-0.05 (0.18)	0.05 (0.14)	0.04 (0.09)
R^2_m	0.25	0.28	0.19	0.20
R^2_c	0.66	0.68	0.40	0.49

** p < .05, ** p < .01, *** p < .001; Note: R^2_m refers to the marginal R^2 (variance explained by fixed effects), while R^2_c refers to the conditional R^2 (variance explained by the fixed and random effects). All models accounted for author characteristics, video topic, video presentation format, and difference scores, and models include authors of each video as a random intercept. Full models can be found in Appendix 3.*

Discussion

Amid declining confidence in science and the undeniable role of social media platforms as venues for scientific news and information, TikTok emerges as a platform for science communication where scientists and science content creators are redefining norms around science communication through memetic storytelling. Empirical research on effective communication strategies on this platform becomes necessary to guide scientists seeking to

maximize the reach and impact of their scientific work through TikTok. Drawing upon the lenses of media logics and platform vernaculars, and informed by the literature on humor, affect, and perceived distance in science communication, this study sought to examine science communication on TikTok and identify the (memetic) elements that drive engagement on short science videos on the platform.

Our findings show that science content creators employ a limited use of memetic elements defined by Milner (2016). While many of the TikTok posts were multimodal in nature, wherein users combined videos with texts, still images, or music, and engaged in communication that resonated with audiences through emotional and conversational language, less than half of posts contained elements of collectivism, characterized by content creators' imitation of social media storytelling styles and templates, and even less reappropriated other media. Both of these dimensions can be characterized as the hallmarks of memetic communication, as they relate to its referential aspects that signal a content creator's knowledge of the current trends and make memes effective vehicles of affect and humor in digital communication (Akram & Drabble, 2022). In other words, even though TikTok promotes memetic communication through its affordances and vernaculars, many science videos do not seem to use this style communicating scientific information.

We also explored how memetic elements shape engagement in short science videos. We found that collectivism had consistent positive and statistically significant associations with views, likes, shares, and comments (per day). We also found positive and statistically significant associations of humor with likes, shares, and comments (per day). Together with the positive associations of collectivism through imitation, these findings support the assertion that adhering to the logics of social media and its vernaculars is critical for effective communication online.

As a platform, TikTok promotes playfulness, creative content production (Vicari & Ditchfield, 2024), and memetic communication at the platform level through its overall features and design (Zulli & Zulli, 2022). However, science videos that reappropriate other media, either by referencing popular culture or remixing others' content, tended to have lower views and comments. Several mechanisms could be at work here: it is possible that videos that reappropriate other media may have limited comments as they may be referencing content familiar only to specific audiences (i.e., those who 'get' the reference), leading to fewer comments. It is also possible that referencing other content may have inadvertently influenced platform distribution made through TikTok's algorithm, especially since the algorithm also considers the information contained in a video (e.g., captions and sounds) in suggesting them to users (B. Smith, 2021), hence the altered number of views. In any case, more research is warranted to examine why such reappropriation of content, while still a method of memetic communication, yields lower views and comments.

Taken together, the answers to our two research questions suggest that not all science content "speaks" the memetic vernacular of TikTok, yet those that do have significantly higher social media reach and engagement. Based on the results of this observational study, we offer two broad recommendations for science communicators aiming to use TikTok to maximize their reach and impact:

First, science communicators must learn the language of TikTok. One of the best practices of digital communication is adjusting content based on the affordance, characteristics, and vernaculars of the platform where it is being published (Verstappen & Opgenhaffen, 2024), not simply cross-posting content without any consideration of the medium. On TikTok, this entails tuning in to the storytelling styles and trends that are being employed by its users and

applying those to one's content. This also entails exploring the various features in the platform that facilitate these trends, as the platform itself nudges users towards usage of these trends when it promotes certain effects and styles as "trending" through its video editing features. Zawacki et al. (2022) recommend this for communicating geoscience on TikTok; we agree and also expand this call for any science content creator, regardless of discipline. By exploring the affordances of TikTok, imitating trending storytelling techniques, and infusing them with one's own creativity and unique approach, science communicators can participate in on-going conversations on TikTok and be part of the stream of short videos being recommended to other users, heightening the possibility of reaching audiences outside of those who are already consuming scientific content.

Second, science communicators should lean towards playfulness and humor on TikTok. Our findings that humor can positively impact science communication efforts is well supported in the literature; content that generates mirth tend to be associated with higher information engagement on social media and greater motivations to follow more science content on the platform (L. Y.-F. Su et al., 2022; Yeo et al., 2021, 2023). On platforms like Twitter (X), humor tends to manifest as wordplay and puns given its primarily text-based modality, but visual platforms like TikTok can harness humor through alternative mechanisms such as comic images or funny skits, or remixing content that can lead to comical juxtapositions (e.g., lip syncing to trending movie audio while presenting scientific information).

Limitations and Conclusions

While our findings offer evidence-based recommendations, they are not without their limitations. First, we adopted a network approach to data collection as opposed to a purely keyword-based approach to generating the universe of content for analysis (e.g., Su et al., 2022).

On the one hand, although keyword-based methods might generate a larger dataset, they risk including videos merely containing keywords, rather than those fundamentally centered on scientific topics. On the other hand, our networked approach is subject to potential bias due to the initial seed users, and our reliance on network connections inadvertently may leave out relevant creators and their videos that are not linked with the network, potentially limiting the scope of the analysis. Nevertheless, our approach captured a diverse array of scientists across various fields and enabled a more focused analysis of science-related videos. Importantly, given that our approach primarily emanates from science-focused creators, our findings can be linked to science content creators *specifically* as opposed to general content creators who incidentally incorporate scientific information in their content.

Second, analyzing TikTok trends requires a wide understanding of the current trends on the platform. In social media parlance, one must be "chronically online" to grasp the references made within posts, particularly when coding ephemeral and trend-driven information. Furthermore, some of the trends on TikTok may be community-specific. Therefore, the coders can only document trends and styles with widespread, contemporary visibility, or ones they know themselves. Consequently, we may have overlooked trends and styles that have faded or were unfamiliar with the coders due to their highly niche nature. Reproducing this research under different time frames thus requires updating the codebook in line with contemporary trends. Nonetheless, rigorous inter-coder reliability analysis ensured a robust coding process capable of detecting the presence of trends in videos. Future research can explicitly address the dynamic and ephemeral characteristics of digital communication and investigate how specific memetic storytelling styles and templates (e.g., skits and dances challenges vs video explainers) can differentially impact reach and engagement.

Finally, our study is observational in nature, and while we find robust empirical evidence on how different message characteristics are associated with social media engagement, there are limitations inherent in correlational findings. We are also unable to establish causality due to the design of this research, as we are unable to rule out potential confounding variables like the specific contexts and timing of posts, the differential effects of these message elements across diverse audience characteristics, and the algorithmic factors that drive visibility and engagement. Experimental research is necessary to validate the observed effects, reveal the causal mechanisms leading to critical outcomes in scientific engagement (such as knowledge and attitude), and determine the robustness of these effects when controlling for similar content and information, as well as the boundary conditions under which they hold true.

Despite these limitations, our study contributes to the field of science communication by systematically examining the elements of TikTok videos that enhance scientific information reach and engagement. Our work expands the understanding of humor's role in science communication by extending its analysis from static formats (e.g., image macro memes and textual content in Tweets) to multimodal and dynamic formats like videos. Furthermore, our study contributes to the study of memetic communication and digital media. While previous research has studied memetic communication's effects (e.g., Akram & Drabble, 2022; Myrick et al., 2022), much of that work focused on image macros. By applying the definition of memes by Milner (2016) to videos, our study provides nuanced insights into the role of video-based memes in science communication. Moreover, our research advances the growing body of work on short video-based social media platforms as a new frontier for science communication. It offers evidence-based recommendations for science communicators considering TikTok to engage audiences, addressing the need for more research to guide scientists in effectively using this

platform (Rein, 2023). Consequently, this study also responds to the call for research in harnessing social media for positive outcomes (Dörr et al., 2025). By understanding the message elements that drive engagement online, our findings provide valuable insights for science communicators seeking visibility in online platforms, especially as they compete with other actors who influence audiences on science-related issues amidst the evolving modes of information distribution and consumption in the contemporary media landscape.

CHAPTER 3: MEMETIC COMMUNICATION, TRUST IN SCIENCE, AND RISK PERCEPTION

Science has historically been highly regarded compared to other institutions in the United States, yet recent data suggests that this trust is declining (Lupia et al., 2024; Tyson & Kennedy, 2024). Although the decline in trust is less pronounced than for other groups (such as journalists), it nevertheless indicates the public's changing views about science which has potential dire implications for issues like vaccine uptake (Jamieson et al., 2021), climate change beliefs (Hmielowski et al., 2014), and disaster mitigation (Su et al., 2017). Effective science communication is increasingly necessary, as the credibility of science depends on how it is communicated (Weingart & Guenther, 2016). Yet, less than half of U.S. adults perceive scientists as effective communicators (Tyson & Kennedy, 2024), and the evolving media landscape, where science is primarily encountered through social media (Saks & Tyson, 2022), has further complicated the practice of science communication, due to the changing patterns of information consumption afforded by algorithms and search engines, evolving challenges in online source evaluation, and emerging communication practices in digital media (Scheufele & Krause, 2019). Science communicators have thus encouraged experts to engage more on social media platforms to maximize their presence, expand opportunities for public engagement, build social capital to foster collaborations, and improve their ability to communicate information that builds trust (Insall, 2023; Mojarad, 2017; Neeley, 2013).

More recently, TikTok has emerged as a venue for science communication, where technical information is combined with entertaining elements, and authoritativeness typically used in institution-based communication is secondary to casualness and accessibility (Zeng et al., 2021). Content creators leverage TikTok's cultures of imitation and playfulness, and meme-based

elements are used to make information more engaging online and increase virality in digital media. As demonstrated in Study 1 of this dissertation, the use of memetic elements in science videos is associated with increased engagement on TikTok. However, while social media metrics such as likes and reactions may be indicative of affective evaluations, and comments may be reflective of user deliberation (Alhabash & McAlister, 2015), they do not specifically measure how this memetic communication influences public perceptions. If using novel communication strategies and emerging platforms to communicate science is the goal to reach wider audiences, make technical information more understandable and engaging, and build trust, then relying only on social media metrics is insufficient. Therefore, this study investigates how memetic communication in short science videos shapes perceptions of trust in scientists and downstream consequences on public perceptions of risks about scientific issues.

Trust in scientists

The stereotype content model (Fiske & Dupree, 2014), which conceptualizes social perceptions as based on dimensions of warmth and competence, provides a useful framework to understand how trust perceptions are built. Warmth refers to traits such as integrity and sincerity, while competence refers to skills and intelligence of the communicator (Cuddy et al., 2008). These dimensions constitute people's bases for trusting others, including scientists, where warmth judgments are used to infer scientists' motivation to be truthful, and competence judgments are used to evaluate if scientists are indeed experts and knowledgeable about their field (Fiske & Dupree, 2014).

While both are important, perceptions of warmth appear to influence trust-building more than competence (Cuddy et al., 2008), as warmth perceptions are often processed quickly than competence when forming impressions of others (Wojciszke et al., 1998). Yet prior work has

shown that scientists are often viewed as competent but cold (Fiske & Dupree, 2014), reflecting long-held stereotypes of scientists as isolated and socially inept. Such perceptions can be detrimental to efforts to promote public trust in science.

Improving perceptions of warmth (and trust more broadly) is crucial, because trust, in turn, serves as a heuristic; when communicators are trusted, audiences are more likely to believe the message (Fiske & Dupree, 2014; Siegrist, 2021). Audiences use their trust on the information source to decide what to do and how to feel about issues (Bearth & Siegrist, 2022), especially in contexts where they lack the necessary resources (interest, time, knowledge) to make informed decisions (Siegrist, 2021). Studies about trust in information sources and concern about global warming and climate change have supported this, where trust in scientific information sources was positively associated with concern about these issues, especially when the communicator indicated that these topics warrant concern (Malka et al., 2009; Mase et al., 2015). Therefore, we hypothesize that:

H1: Perceived warmth and competence of the scientist will be positively associated with increased risk perceptions.

Affect

In psychology, feelings and emotions are conceptualized as affect, or the specific quality of "goodness" or "badness" of a stimulus, experienced as a feeling state and demarcating its negative or positive qualities (Slovic & Peters, 2006). Affect serves as the "faint whisper of emotion" (Slovic & Peters, 2006) in judgment and decision-making, and it orients people's reactions towards new stimuli. The reliance on such information can facilitate intuitive and automatic judgments and quick decision-making, which is conceptualized as the affect heuristic (Slovic et al., 2004).

People tend to rely on the affect heuristic, especially in the face of uncertainty (Slovic, 2000). Research has consistently found that the affect heuristic plays a central role in information processing and judgment, where inducing positive affect is associated with increased trust and confidence in science (Fage-Butler et al., 2022; Nabi et al., 2024), evaluation of others (Clore et al., 1994), and acceptance of technologies (such as vaccines) (Chen, 2015). Inducing negative affect, whether through imagery, narratives, fear appeals, or presentation formats, tends to heighten audiences' evaluations of risk, as it provides them with informational cues on how to judge them (Loewenstein et al., 2001; Visschers et al., 2012).

When memes are employed in science communication, they can embed affect to scientific messages and alter their presentation, especially among younger audiences (Ayele et al., 2025; Hautea et al., 2021). This is because memes serve vehicles of affective meaning used not only to convey emotional reactions by online users, but also signal affiliation and belongingness to online cultures (Katz & Shifman, 2017). Reaction memes employing shock value may thus induce negative feelings and heighten risk perceptions; while remixing relatable images and trending elements (hashtags, music, scripts) may foster positive feelings that can elicit favorable social judgments. Drawing from the affect heuristic, we hypothesize that:

H2a: Affect will be significantly different across conditions, such that the shift towards negative affect will be greatest in the meme-heavy condition compared to the non-memetic and meme-lite conditions, on average.

H2b: Affect will have a direct linear association with perceptions of warmth and competence. As affect shifts from strongly negative to strongly positive, perceptions of warmth and competence will correspondingly increase.

H2c: Affect will have a direct negative association with risk perceptions. As affect shifts from strongly negative to strongly positive, risk perceptions will correspondingly decrease.

Humor

Memetic communication on TikTok is often characterized as funny and playful, where content creators use various elements to make fun of and play with "serious" matters such as politics and science (Matamoros-Fernández, 2023). This humorous quality contributes to memes' effectiveness and virality in digital media (Taecharungroj & Nueangjamnong, 2015). Moreover, research on humor in science communications has revealed its positive role in people's perceptions, including increasing perceived credibility and communicator effectiveness (Yeo, Anderson, et al., 2020), as well as source likability (Yeo et al., 2021). Mirth, or appreciation of stimuli designed to be funny or humorous, in particular, had consistently positive downstream effects on perceptions of scientists (Yeo et al., 2021, 2022). Beyond improving perceptions of the messenger, humor can also improve attention towards message itself, and its use can serve as an attention-grabbing strategy and facilitate better recall about risk topics (Meyer & Venette, 2017) and influence risk perceptions.

However, not all types of humor produce similar effects. For example, a scientist's humorous social media post based on feelings of superiority (where people find the misfortune of others funny or ridiculous) elicited fewer engagements and more negative attitudes towards vaccinations compared to a non-humorous post (Zhang & Lu, 2023). Excessive humor can also distract audiences from content and calls to action on health risks, as they become a matter of entertainment rather of information worth of serious consideration (Meyer & Venette, 2017). Similarly, the persuasive effects of messages can also diminish when they are not taken seriously

due to the presence of humor (Nabi et al., 2007). Therefore, careful consideration of humor style and magnitude is essential.

One humor style that produces positive effects is benign violation, where humor is generated through a breakage in expected patterns of non-threatening social behaviors or conventions (McGraw & Warren, 2010). Puns and wordplays are examples of benign violations, requiring audiences to know the rule or convention (the actual word), recognize the violation (the play on the word), and consider the violation as non-threatening or benign (McGraw & Warren, 2010). Memes often do this by drawing "attention to contradictions or absurdities in a situation" (Myrick et al., 2022, pp. 1–2) and juxtaposing popular culture references with "serious" evidence or information, creating moments of benign violation that elicit humorous responses (Knobel & Lankshear, 2007; Milner, 2016).

Studies on humor have found the use of benign violations in science communication, often through science puns or wordplays, as consistently effective in engaging audiences (Su et al., 2015; Yeo, et al., 2020). Much of this work has examined textual posts (e.g., tweets) or static images (e.g., image macros), and the effects of humor produced by multimodal content such as short videos and other forms of benign violations remain unexplored. Given the positive effects of humor and mirth on social judgements, and their role in heightening audience attention to risk messages, we hypothesize that:

H3a: Mirth will be significantly different across conditions, such that perceived mirth will be highest in the meme-heavy condition compared to in the non-memetic and meme-lite conditions, on average.

H3b: Induced mirth will be positively associated with increased perceptions of warmth and competence of scientists.

H3c: Induced mirth will be positively associated with risk perception.

Psychological distance

Individuals signal their knowledge of and inclusion in digital media trends and culture by engaging with memes. Through pop cultural references and participation in online trends, users create shared social identities and form membership within relevant social groups (Leiser, 2022). Thus, when science communicators employ memetic elements in their messages, they signal relatability to their audiences and create a sense of social proximity. This closeness has implications for trust in communicators and how audiences process information from them (Maglio, 2020).

Multiple elements of memetic communication on TikTok can potentially reduce perceived social distance from scientists. For one, memetic communication is often embodied, with the human body playing an important role in content. Content creators point to words in videos, occupy a large percentage of the screen while directly speaking to the camera, or perform skits and dances as they participate in challenges (Gerbaudo & Moreno, 2023). Prior research on visual content has found that the presence of human faces generates more audience engagement (Bakhshi et al., 2014). Moreover, scientists who post selfies are perceived as warmer and as competent as those who do not (Jarreau et al., 2019). Second, informality in memetic communication can also influence perceptions of distance. Research reveals that more polite messages increase perceptions of distance (Stephan et al., 2010), while informality creates feelings of closeness and benevolence (Schwabe et al., 2025).

Memes also create perceptions of familiarity by integrating elements resonant with audiences. Instead of speaking purely in jargon and technical language, scientists who participate in online trends and challenges, use trending hashtags and scripts, and employ memes speak the

language of social media (Riser et al., 2020) and immerse themselves in the same cultural moments as their viewers.

Unlike news articles or formal presentations, scientists in memetic videos can appear closer to audiences, both physically and psychologically. Prior work on psychological distance in communication has employed the linguistic category model (Seih et al., 2017) to examine how messages influence perceptions of closeness based on construal levels, or the level of abstraction of an issue. However, the relationship between message abstraction and perceived closeness remains unclear. Zwickle & Wilson (2013) suggest that psychological distances can be reduced by crafting messages that are construed as concrete. Alternatively, distances may also be transcended by encouraging audiences to think in more abstract ways (Zwickle & Wilson, 2013). It is uncertain, however, whether memetic communication works through the former or the latter mechanism due to a lack of empirical work linking memes, construal levels, and these perceptions. Thus, we pose the following questions:

RQ1: How does exposure to meme-based videos shape construal levels?

RQ2: How are construal levels associated with perceptions of warmth and competence of scientists?

RQ3: How are construal levels associated with risk perception?

Conceptual framework

We consolidate the study's hypotheses and research questions into a conceptual framework (Figure 1) that examines how memetic communication directly and indirectly relates to measures of trust and risk perceptions. We investigate how affect, humor, and level of abstraction shape audience perception of trust in scientists, measured through warmth and competence (Fiske et al., 2002) and risk perceptions.

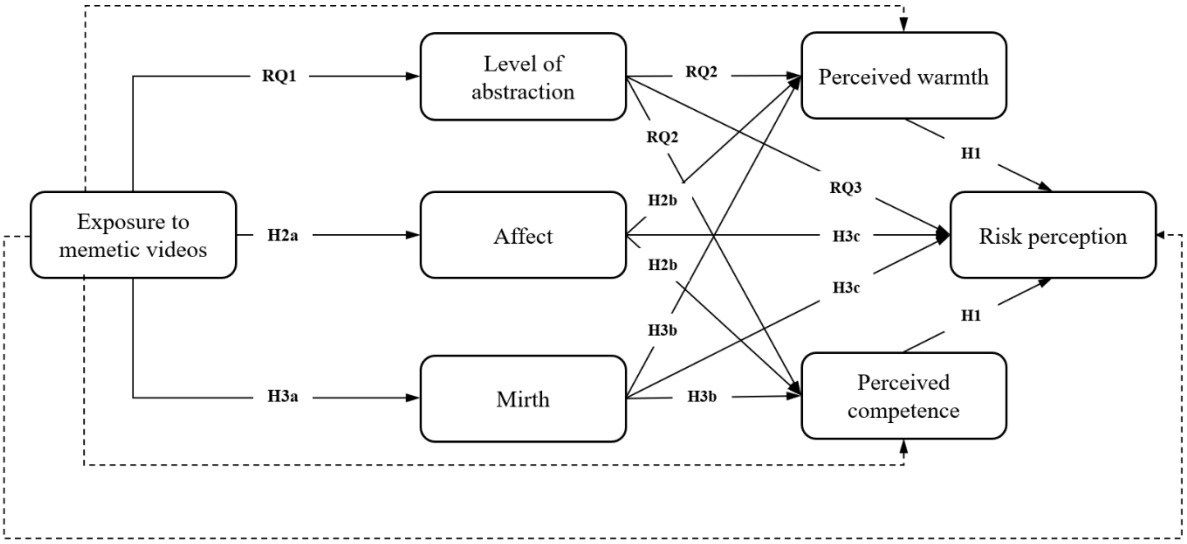


Figure 1. Study conceptual framework

Methods

To answer the research questions and test hypotheses, we employed a between-subjects online experiment design, in which participants were exposed to one of three conditions that presented videos varying in their level of "memetic-ness." Prior to data collection, a pilot test was carried out to assess study feasibility and to refine experiment procedures. A small sample (N = 60) of United States residents aged 18 to 25 was recruited via CloudResearch on February 3, 2025, to participate in the pilot, ensuring that all instructions, items, and conditions were clear and effective. Feedback and preliminary data analysis based on the pilot test were also considered to inform study design adjustments, optimizing survey structure, and re-wording potentially confusing test items. An institutional review board deemed the study exempt from review.

Study participants

636 United States residents aged 18 to 25 were recruited via CloudResearch from February 6 to 17, 2025. We set participant quotas based on gender (50% Man, 50% Woman), age (100% 18-25 years old), ethnicity (85.2% Not Hispanic, Latino, or Spanish origin), and race

(80.5% White, 13.1% Black or African American), aligned with the demographic distributions of the United States population to ensure representativeness in the study's findings, and those who participated in the pilot study were excluded from recruitment. Median survey completion time was 8 minutes and 22 seconds. Participants who spent less than five minutes, or less than the 90th percentile of the total number of participants on the survey were removed (n = 21). Participants who failed the attention check question, "What kind of allergy did the video just talk about?" were also removed (n = 5). We also checked for variation in responses to Likert scales, and found that all participants varied in their answers. The final sample size was 610 participants, which meets the required sample size for adequate statistical power at 80% to detect small to moderate effect sizes (Cohen's d ≈ 0.02–0.5) among three groups with an error probability of 0.05.

Participants were randomly assigned to one of three video conditions: the "non-memetic" condition (n = 207), the "meme-lite" condition (n = 204), and the "meme-heavy" condition (n = 199). Across conditions, 50.1% of participants were women and 68.4% were White or of European ethnicity. Regarding education, the largest group of participants (41.9%) self-reported having some college (but no degree) or associates/technical degree. There was a median annual income of $50,000 to $74,999 (Table 5) and had a self-reported median age of 23.

Randomization checks indicate no significant difference and associations among groups in terms of age ($F(2, 603) = 0.865$, $p = .42$), gender ($\chi^2(6, 610) = 2.65$, $p = .85$), income ($\chi^2(12, 610) = 12.07$, $p = .61$), education ($\chi^2(12, 610) = 7.23$, $p = .84$), race and ethnicity ($\chi^2(14, 610) = 8.17$, $p = .88$), nor political ideology ($\chi^2(8, 610) = 2.31$, $p = .97$)

Table 5

Sample Characteristics

Socio-demographic characteristics	Condition			Total
	Non-memetic	Meme-lite	Meme-heavy	
Gender				
Man	49.0	49.5	48.7	49.1
Woman	50.5	50.0	49.7	50.1
Non-binary	0.5	0.5	1.0	0.7
Prefer not to say	0.0	0.0	0.5	0.2
Education				
High school diploma, GED, or less	17.4	13.9	18.8	16.7
Some college but no degree, or associates or technical degree	43.5	42.1	40.1	41.9
Bachelor's degree or more	39.1	44.1	40.6	41.3
Prefer not to say	0.0	0.0	0.0	0.0
Race and Ethnicity				
White or European	67.1	68.3	69.9	68.4
Hispanic or Latino	10.6	9.9	10.7	10.4
Black or African American	14.5	13.9	10.2	12.9
American Indian/Native American or Alaska Native	0.5	0.0	0.5	0.3
Arab, Middle Eastern, and North African	1.0	1.0	1.0	1.0
Asian or Asian American	4.8	6.4	5.6	5.6
Native Hawaiian or Pacific Islander	0.0	0.0	0.0	0.0
Other race, ethnicity or origin	1.4	0.0	1.0	0.8
Prefer not to say	0.0	0.5	1.0	0.5
Income				
Less than $25,000	23.2	15.3	18.8	19.1
$25,000 to $49,999	19.3	18.3	19.3	19.0
$50,000 to $74,999	20.3	19.8	17.8	19.3
$75,000 to $99,999	13.5	16.3	13.7	14.5
$100,000 to $149,999	12.1	16.8	12.2	13.7
$150,000 or more	8.7	9.4	13.2	10.4
Prefer not to say	2.9	4.0	5.1	4.0

Procedures

After providing informed consent, participants were asked first asked the following questions: “how much do you know about penicillin allergies”, “how interesting are penicillin

allergies", "how important is it to know about penicillin allergies to you, personally?", and "how important is it to know about penicillin allergies to society?". Responses are each collected on a five-point Likert scale. Participants were then informed that they would be watching a video by Dr. Zachary Rubin, an immunologist and allergist on TikTok. They were also asked to ensure their audio was functional and adjusted to a comfortable level, and to consider using headphones if they were in a noisy environment.

Once participants were ready, they were randomly assigned to one of three video conditions that varied in "memetic-ness": the non-meme condition, the meme-lite condition, and the meme-heavy condition (Table 6). The non-meme condition presented information about medical allergies through stock videos and voice-over, edited to mimic informative and educational videos typically produced by news and other media outlets. The meme-lite condition featured the scientist visible via green screen, with the same stock footage and information, similar to informative videos produced by content creators on TikTok. Finally, the meme-heavy condition incorporated trending background music on TikTok, sound effects, meme GIFs, reaction clips, and on-screen hashtags, embodying full memetic integration, while presenting the same information as the non-meme and meme-lite conditions. The videos were developed by the first author, who used to work as a social media content developer, using existing public TikTok videos (Rubin, 2023a, 2023b) to enhance external validity. Memetic elements were used in the message treatments to enhance external validity. Moreover, videos were edited (or "remixed") using CapCut (ByteDance, 2024), an editing application often used alongside TikTok in video creation. The videos were 52 to 54 seconds long, and all contained the same script (Appendix 4).

Table 6

Video elements per experimental condition

Condition	Non-memetic	Meme-lite	Meme-heavy
Video elements	Issue background Risk message Research attribution Subtitles Stock videos Scientist as voice-over	Issue background Risk message Research attribution Subtitles Stock videos Scientist in video Green screen effect	Issue background Risk message Research attribution Subtitles Stock videos Scientist in video Green screen effect Meme GIF inserts Meme sound effects Background music Hashtag on screen

Participants were then asked if they had seen the video before, as well as other videos by the scientist. Following this, we measured construal level by asking participants to describe, in one to two sentences, the video they had just watched (Seih et al., 2017).

We then measured participants' level of knowledge by asking them to respond either "true" or "false" to three statements, based on the information shared in the video.

Next, we measured participants' affective responses to the video by asking, "What kind of feelings did watching the video evoke for you?" Responses to this single item were collected on a 7-point Likert scale ranging from "very negative" to "very positive." Participants were then asked to provide a brief explanation for their answers in an open-ended question. Risk perceptions were measured using a modified risk perception measure by asking, "How risky does it feel to have penicillin allergies in your medical record?" (Pollatsek & Tversky, 1970). The question was modified to refer explicitly to the topic of the video. Responses to this question were collected on a 5-point Likert scale ranging from "not at all" to "extremely risky." We supplemented this measure by asking participants how concerned they were about the risks of

penicillin allergies in the following scenarios: having it in their own record, affecting people they know, becoming increasingly dangerous over time, and continuing to affect future generations. Responses to these questions were collected on a 5-point Likert scale ranging from "not concerned at all" to "extremely concerned." These 5 questions created the risk perception measure (Cronbach's $\alpha = .85$).

We then asked participants about their impression of the video using the perceived humor and mirth scale (Yeo, Anderson, et al., 2020), a five-point semantic differential scale comprised of the following items: humorous, funny, playful, amusing, and entertaining (Cronbach's $\alpha = .81$). We then measured participants' trust in the scientist in the video by asking them their impression of Dr. Rubin using the competence and warmth scales (Fiske et al., 2002). Perceived competence was measured using a five-point semantic differential scale comprised of the following items: competent, competitive, independent, intelligent, and confident (Cronbach's $\alpha = .64$). Likewise, perceived warmth was measured based on the following items: warm, tolerant, good-natured, and sincere (Cronbach's $\alpha = .79$).

In the last section of the questionnaire, we asked participants about their average weekday usage of short-form video-based platforms such as TikTok, Instagram Reels, Facebook Reels, and YouTube Shorts, following a modified version of the media use scale by Coromina & Saris (2009). We also measured their numeracy using the 1-NUM measure (Silverstein et al., 2023). Personal experience with medical allergies was also assessed, specifically whether they had a known penicillin allergy or knew someone with a penicillin allergy. The study questionnaire is available in Appendix 5.

Data processing and analysis

We used part-of-speech taggers built using the NLTK package in Python (Bird et al., 2009) to automatically classify words in the open-ended responses and count the presence of nouns and adjectives in sentences. The results were then combined with the LIWC-22 (Pennebaker et al., 2022) linguistic category model package to calculate the level of abstraction score, which places sentences on a continuum of abstraction (1 = concrete, 5 = abstract) based on the weighted number of direct action verbs, interpretive action words, interpretive action verbs, state verbs, adjectives, and nouns within a sentence (Seih et al., 2017).

Composite measures for mirth, perceived warmth and competence, and risk perception were calculated by averaging the scores of responses across scale items.

We performed one-way analyses of variance (ANOVA) to directly compare differences in affect, mirth, level of abstraction, perceived warmth, perceived competence, and risk perception across conditions, and performed post-hoc comparisons using Tukey's HSD. We then conducted path analysis using the lavaan package in R (Rosseel, 2012) to examine the direct and indirect relationships among memetic communication, affect, mirth, level of abstraction, perceived warmth and competence, and perceived risk (Figure 1).

Results

Descriptive statistics

Descriptive statistics are shown for level of abstraction, affect, mirth, perceived warmth and competence, and risk perception in Table 7. We also show the correlations among the composite measures of these variables as a matrix in Table 8.

Table 7

Descriptive statistics for level of abstraction, affect, mirth, competence, warmth, and risk

	Mean	SD	Min	Median	Max
Level of abstraction	3.0	0.3	2.1	3.0	4.8
Affect	4.2	1.2	1.0	4.0	7.0
Mirth 1: Humorous	1.7	1.0	1.0	1.0	5.0
Mirth 2: Funny	1.6	0.9	1.0	1.0	5.0
Mirth 3: Playful	2.0	1.1	1.0	2.0	5.0
Mirth 4: Amusing	2.4	1.2	1.0	2.0	5.0
Mirth 5: Entertaining	3.2	1.2	1.0	3.0	5.0
Competence 1: Competent	4.2	0.9	1.0	4.0	5.0
Competence 2: Competitive	2.6	1.1	1.0	3.0	5.0
Competence 3: Independent	3.8	0.9	1.0	4.0	5.0
Competence 4: Intelligent	4.3	0.8	1.0	4.0	5.0
Competence 5: Confident	4.3	0.8	1.0	4.0	5.0
Warmth 1: Warm	3.6	0.9	1.0	4.0	5.0
Warmth 2: Tolerant	3.7	0.9	1.0	4.0	5.0
Warmth 3: Good-natured	4.1	0.8	1.0	4.0	5.0
Warmth 4: Sincere	4.1	0.9	1.0	4.0	5.0
Risk 1: Risk feeling	3.0	0.9	1.0	3.0	5.0
Risk 2: Concern for personal safety	2.2	1.2	1.0	2.0	5.0
Risk 3: Concern for people they know	2.4	1.1	1.0	2.0	5.0
Risk 4: Concern for danger over time	2.6	1.1	1.0	3.0	5.0
Risk 5: Concern for future generations	2.6	1.1	1.0	2.0	5.0

Table 8

Correlation matrix for level of abstraction, affect, mirth, competence, warmth, and risk

	Risk	Competence	Warmth	Mirth	Affect
Level of abstraction	.07	.09	.09	-.01	-.09
Affect	.05	.19***	.28***	.20***	
Mirth	.16***	.16***	.16***		
Warmth	.21***	.65***			
Competence	.26***				

*** $p < .001$

Bivariate analysis

We examined the main effects of memetic communication on abstraction, affect, mirth, warmth, competence, and risk perception (Table 9). Our findings revealed a significant main effect of memetic communication on affect ($F(2, 16) = 6.039$, $p = .002$). Post-hoc analyses indicated that participants in the meme-heavy condition reported significantly lower affect scores than those in the non-memetic ($p = .03$) and meme-lite ($p = .003$) conditions, suggesting a more negative affective response. Thus, H1a is supported; on average, participants experienced more negative than positive affect in the meme-heavy condition. Memetic communication also had a significant main effect on mirth ($F(2, 603) = 35.8$, $p < .001$), with participants in the meme-heavy condition reporting significantly higher mirth scores than those in the meme-lite ($p < .001$) and non-memetic conditions ($p < .001$). These findings provide support for H2a. Meanwhile, to answer RQ1, respondents between conditions did not significantly differ in level of abstraction ($F(2, 603) = 2.882$, $p = 0.06$).

Table 9

Mean scores and standard deviations of mirth, affect, and level of abstraction across experimental conditions

Variables	Non-memetic (NM) (n = 207)		Meme-lite (ML) (n = 204)		Meme-heavy (MH) (n = 199)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Level of Abstraction	3.0	0.3	3.0	0.3	3.1	0.3
Affect**	4.3	1.2	4.4	1.2	4.0 [a, b]	1.1
Mirth***	2.0	0.7	2.0	0.7	2.6 [a, b]	0.9
Perceived warmth	3.9	0.7	3. 9	0.7	3.8	0.7
Perceived competence	3.9	0.5	3.8	0.5	3.8	0.6
Risk perception	2.5	0.9	2.6	0.9	2.6	0.8

*** $p < .01$; *** $p < .001$; [a] $NM \neq MH$, [b] $ML \neq MH$*

Path analysis

Figure 2 summarizes the standardized direct path estimates of the conceptual model. Here, we compared exposure to the meme-heavy condition (condition = 1) with the meme-lite and non-memetic conditions collapsed into one group (condition = 0), following the results of the ANOVA tests in which the meme-heavy condition appeared to have produced significantly different effects compared to the meme-lite and non-memetic condition. Table 10 presents the path coefficients for both direct and indirect paths. Based on the R-squared values, the model accounted for 10% of the variance in risk perception, 12% in perceived warmth, 9% in perceived affect, 7% in level of abstraction, 12% in mirth, and 2% in affect. The model demonstrated good fit (CFI = .85, RMSEA = .06, TLI = .76) and excellent alignment with the study's conceptual model.

Memetic Communication. The meme-heavy condition was positively associated with the level of abstraction (β = 0.07, 95% CI [0.01, 0.13], $p < .05$), suggesting that exposure to content containing multiple memetic elements may promote abstract thinking (RQ1). Like the bivariate analyses, the meme-heavy condition had a significantly negative association with affect (β = -0.34, 95% CI [-0.53, -0.15], $p < .001$), indicating that the participants exposed to meme-heavy communication experienced more negative emotional responses, on average. H2a is, therefore, supported. Meanwhile, exposure to the meme-heavy condition was significantly positively associated with mirth (β = 0.57, 95% CI [0.43, 0.71], $p < .001$), lending support to H3a.

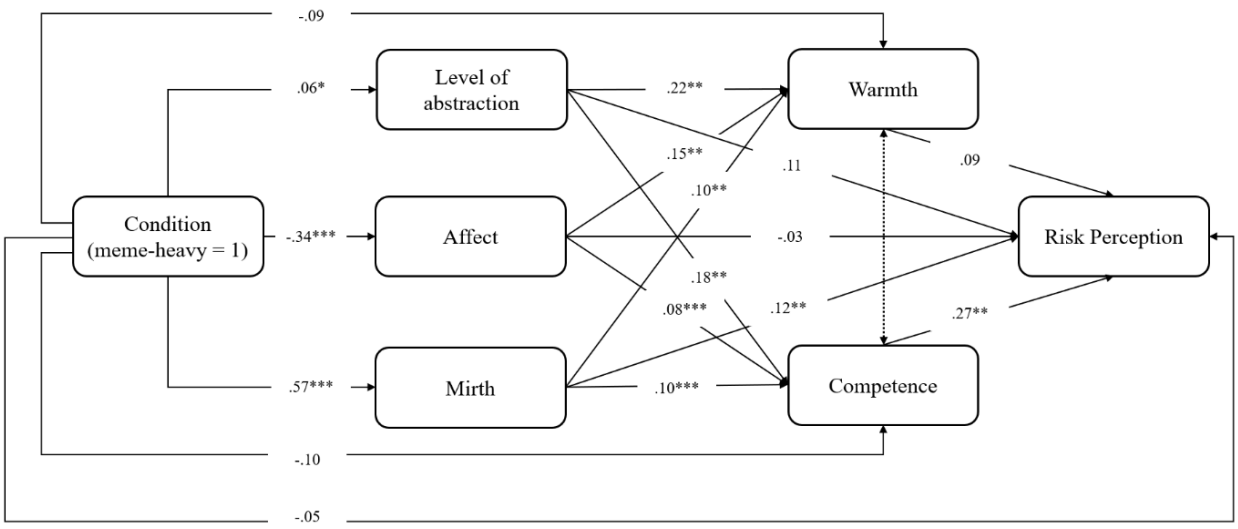
Level of Abstraction. Level of abstraction was positively associated with both perceived warmth (β = 0.22, 95% CI [0.05, 0.37], $p < .01$) and perceived competence (β = 0.18, 95% CI

[0.04, 0.30], $p < .01$), (RQ2). Meanwhile, in response to RQ3, we found no significant direct associations between level of abstraction and risk perception.

Affect. Affect was positively associated with warmth ($\beta = 0.15$, 95% CI [0.10, 0.20], $p < .01$) and competence ($\beta = 0.07$, 95% CI [0.03, 0.11], $p < .01$), supporting H2b, which posited that a more positive affective state is positively associated with measures of trust. However, affect was not directly associated with risk perception. Thus, H2c (which hypothesized that affect would have an inverse relationship with risk perception) was not supported.

Mirth. Mirth was significantly positively associated with risk perception ($\beta = 0.12$, 95% CI [0.03, 0.20], $p < .01$), warmth ($\beta = 0.10$, 95% CI [0.03, 0.17], $p < .01$), and competence ($\beta = 0.10$, 95% CI [0.04, 0.16], $p < .001$), suggesting that humor plays a positive role in shaping social judgments while also heightening perceived risks. This finding supports H2b and H2c, which proposed that mirth would be significantly positively associated with perceived warmth and competence, as well as risk perception.

Perceived competence and warmth. Perceived competence was significantly positively associated with risk perception ($\beta = 0.27$, 95% CI [0.11, 0.42], $p < .01$), while perceived warmth was not significantly associated with risk perception ($\beta = 0.09$, 95% CI [-0.04, 0.22], $p = .16$), suggesting that participants' perception of the scientists' skill and expertise, rather than perceptions of likability of the source, had a positive role in shaping risk judgments about penicillin allergies. These findings partially support H1.



Note: Standardized path coefficients are shown. Model was estimated using structural equation modeling with 5000 bootstrap samples. The following variables were controlled at each path: awareness, interest, knowledge, platform use, numeracy, personal experience with penicillin allergies, knowing someone with penicillin allergies, education, and income. Dotted lines indicate covariance.

Figure 2. Path estimations of the conceptual model with standardized coefficients of direct effects

Finally, mediation analysis revealed that the meme-heavy condition was indirectly associated with increased perceived competence through affect (β = 0.04, 95% CI [0.02, 0.07], p < .05) and heightened risk perception through affect and competence (β = 0.02, 95% CI [0.00, 0.03], p < .05), providing more nuanced findings for H2b and H2c. Specifically, positive affect generated by the meme-heavy condition served as a mechanism for increasing favorable competence perceptions (H2b), which subsequently contributed to heightened risk perceptions (part of H2c). Meanwhile, the meme-heavy condition negatively associated with perceived competence (β = -0.04, 95% CI [-0.07, -0.01], p < .05) and risk perception (β = -0.04, 95% CI [-0.08, -0.01], p < .05) indirectly through mirth, suggesting that humor in memetic communication may attenuate credibility-related judgments and perceptions of risk—thus refining the findings of H2b and H2c.

Table 10

Standardized direct and indirect effects

Paths	β	Confidence Intervals	
		Lower	Upper
Direct effects			
Condition -> Risk	-.05	-.19	.10
Condition -> Perceived warmth	-.09	-.21	.04
Condition -> Perceived competence	-.10	-.21	.00
Condition -> Level of abstraction	.07*	.01	.13
Condition -> Affect	-.34***	-.53	-.15
Condition -> Mirth	.57***	.43	.71
Level of abstraction -> Risk	.11	-.11	.32
Level of abstraction -> Perceived warmth	.22**	.05	.37
Level of abstraction -> Perceived competence	.18**	.04	.30
Affect -> Risk	-.03	-.10	.04
Affect -> Perceived warmth	.15**	.10	.20
Affect -> Perceived competence	.07**	.03	.11
Mirth -> Risk	.12**	.03	.20
Mirth -> Perceived warmth	.10**	.03	.17
Mirth -> Perceived competence	.10***	.04	.16
Perceived warmth -> Risk	.09	-.04	.22
Perceived competence -> Risk	.27**	.11	.42
Indirect paths			
Condition -> Level of abstraction -> Warmth -> Risk	.00	.00	.00
Condition -> Affect -> Warmth -> Risk	.01	.00	.02
Condition -> Mirth -> Warmth -> Risk	.00	-.01	.00
Condition -> Level of abstraction -> Competence -> Risk	.00	.00	.01
Condition -> Affect -> Competence -> Risk	.02*	.00	.03
Condition -> Mirth -> Competence -> Risk	-.01*	-.03	.00
Condition -> Level of abstraction -> Warmth	.01	.00	.03
Condition -> Affect -> Warmth	.09*	.05	.12
Condition -> Mirth -> Warmth	-.03*	-.07	-.01
Condition -> Level of abstraction -> Competence	.01	.00	.03
Condition -> Affect -> Competence	.04*	.02	.07
Condition -> Mirth -> Competence	-.04*	-.07	-.01
Condition -> Level of abstraction -> Risk	.01	-.01	.03
Condition -> Affect -> Risk	-.01	-.06	.03
Condition -> Mirth -> Risk	-.04*	-.08	-.01

** p < .05; ** p < .01; *** p < .001*

Discussion

Declining confidence in institutions (Lupia et al., 2024) and the prevalence of social media (Saks & Tyson, 2022; Weingart & Guenther, 2016) presents significant challenges for effective (science) communication. Given the saturation of online spaces with memetic, short-video content (Boffone, 2022), this study investigates its potential as a novel strategy for science communication, despite its departure from traditional authoritative approaches (Zeng et al., 2021).

Overall, our findings reveal that memetic communication can shape warmth and competence perceptions, as well as risk perceptions through cognitive and affective responses elicited by memetic elements in short science videos. We find that abstraction, affect, and mirth were all associated with exposure to the meme-heavy condition. While all three variables had significant direct associations with perceptions of warmth and competence of the scientist in the video, only mirth had significant direct associations with risk perception. The direct associations provide empirical support for the hypothesized relationships of affect, mirth, warmth, competence, and risk perception, but indirect associations provide nuance to these findings, suggesting that their hypothesized relationships with measures of trust and risk perceptions are not as direct as initially anticipated. Our findings show that exposure to memetic videos had indirect associations with perceptions of scientist warmth and competence through affect and mirth, and perceptions of risk through mirth, and we discuss each of these complexities in detail below.

First, the significant associations revealed among memetic communication, affect, and trust emphasize the role of memes as vehicles for affective meaning (Katz & Shifman, 2017). Their use in communications can provide informational cues that signal to their audiences how to

evaluate communicators (Clore et al., 1994). We also found that memes can heighten risk perceptions, revealing that memes may be useful in affect-inducing risk communication (Loewenstein et al., 2001; Visschers et al., 2012). The indirect associations of memetic communication on warmth and competence through affect reveal an inconsistent mediation effect. While the meme-heavy condition induced negative affect, it appears to have simultaneously increased feelings of warmth and competence. Negative feelings induced through memetic communication may have heightened feelings of dread towards the risk issue, consistent with the function of affect as information (Clore et al., 1994; Slovic et al., 2004), yet also invoke a sense of trust with the communicator in the video (based on warmth and competence perceptions) due to their use of memetic elements. These findings also indicate how trust and affect shape each other (Visschers & Siegrist, 2008) and the role of the trust heuristic (Bearth & Siegrist, 2022). While our study has shown the direct associations between affect and trust, it is also possible that trust generated through memetic communication served as a cue for audiences on how to feel about the risk issue. More research is thus warranted, given the complex effects of memetic elements that appear to perform multiple communicative functions, influencing both message perception and source evaluations when deployed in multimodal messages.

Second, our findings emphasize humor's role in memetic communication and its direct and significant associations with measures of trust (warmth and competence) and risk perceptions. Our findings support prior work on the direct effects of humor (Meyer & Venette, 2017; Yeo, Anderson, et al., 2020; Yeo et al., 2022), however, the indirect effects of exposure to meme-heavy content through mirth appear to be associated with lower perceptions of warmth and competence, and risk, even though exposure to the meme-heavy condition is significantly

associated with higher mirth. It is possible that the inclusion of humorous elements may have led to messages and their communicators not being taken seriously. When humor in communication overpowers its actual messages, they can be interpreted more as entertainment rather than serious informative messages (Meyer & Venette, 2017). It is also possible that the effects of humor on measures of trust and risk perceptions generated through memetic communication may be delayed or built through continued exposure, rather than a single exposure to a message (Meyer & Venette, 2017). Indeed, research on humor has provided evidence of its sleeper or delayed effects, where messages discounted at the onset of exposure had observable persuasive effects later on, due to an increase in recall generated by humorous elements (Nabi et al., 2007). Nonetheless, these findings indicate the need to exercise caution when using humor in communication, as not all forms of humor work for the audiences of science (Zhang & Lu, 2022). Additional research is also necessary to reveal the delayed effects of humor in memetic communication.

Finally, our findings show how memetic communication is associated with an abstract, rather than concrete, construal of messages. Mentally representing messages in abstract terms appeared to be associated with perceived warmth and competence of the communicator, where the scientist was viewed more favorably as a source of information, suggesting that audiences transcend psychological distances by focusing on broader patterns and styles of communication employed by the source, rather than specific (concrete) details (Zwickle & Wilson, 2013). In the case of memetic communication, it may be possible that speaking the language of social media did not make the scientists “closer” to their audience but instead enabled them to connect with the message content, see the broader implications of the issue, and facilitate a more favorable view of the scientist. Memetic elements such as hashtags, trending music, reaction GIFs and

references to popular culture signal affinity to and awareness of digital cultures (Katz & Shifman, 2017), and employing them in communications may have developed a sense of familiarity among audiences and enable them to see past (cold and distant) stereotypes commonly associated with scientists (Fiske et al., 2002) and perceive them not only as competent, but also relatable figures.

Limitations & Conclusions

While we have highlighted certain limitations and future research directions in our discussion above, it is important to reiterate the need to conduct more research on the role of memetic communication. First, this study specifically focused on participants 18-25 years of age, as they serve as the primary user base of short-video social media platforms like TikTok (We Are Social & Meltwater, 2023), and U.S. residents. Thus, the observed effects may only be applicable to this demographic group. Future work can thus examine the effects of memetic communication when considering generational and geographic differences.

Second, this study is cross-sectional in design and given the dearth of experimental research on short video-based communication, its goal is to provide an initial examination of the effects of memes and surface the underlying cognitive and affective mechanisms that explain them. But, as discussed above, more work is necessary to further delineate these pathways, considering the multiple communicative functions memes appear to serve. Future studies can thus perform a focused examination on meme effects on source and channel appraisals. Research specifically focused on messages can also explore the variation in effects of various memetic elements and formats and how they influence perceptions, including specific emotional responses induced by memes and their effects.

Third, our study used penicillin allergies as a test case to examine meme effects, as there was no widespread public debate related to this issue at the time of data collection, compared to other polarizing topics such as climate change. This is also evident in the low awareness (m = 1.97, sd = 0.89) and interest (m = 2.45, sd = 0.93) about penicillin allergies among participants, making it a good test case to examine meme effects. However, this also means that its effects may be specific to topics of this nature, especially considering the complexities of other issues. Therefore, the findings of this research may not be applicable to issues where other factors (such as political beliefs) may play a greater role in trust and risk perceptions. It also stimulates further inquiry into examining how humor, affect, and psychological distance in memes interact with other factors and the effects they produce, especially in other, more controversial scientific topics. Understanding the boundary conditions in which the effects of memes manifest is vital, in light of their prevalent use in short video-based platforms and their dominance as a genre of content in digital media.

Notwithstanding these limitations, this study contributes to the field of science and risk communication by revealing the complexities of using memes in short videos, demonstrating their impact not only in how risk messages are processed and interpreted, but also on how science communicators are judged and evaluated. Specifically, these findings demonstrate the role of memes in trust-building and affect-inducing communication in digital media. Our work also responds to the call of Shifman to take memetic communication seriously (Shifman, 2013) by conducting systematic research based on established theories of humor, affect heuristic, and psychological distance in science and risk communication. In doing so, we advance the study of digital communications more broadly by elucidating the psychological pathways that make social media-native formats more persuasive and online sources more trustworthy. These

findings also provide practical insights for scientists and science communicators who aim to employ short videos to reach audiences. By using the language of social media, memes can make sources and their messages more funny, felt, and familiar, bridging the gaps between scientists and their audiences.

CHAPTER 4: SUMMARY AND CONCLUSION

Over a decade has passed since Shifman called for a more serious examination of the seemingly humorous and unserious content of memes (Shifman, 2013), yet her assertion remains pertinent. Not only have memes become prominent in digital spaces, but platforms like TikTok that promote memetic communication (Zulli & Zulli, 2022) have also emerged and become a dominant venue for online communication, crystallizing the use of memes as integral to digitally mediated communicative practice. As science and risk communicators and institutions adopt memetic communication styles, we echo Shifman's call to take memes more seriously. This scholarly undertaking also becomes pressing in light of the growing complexities of the science communication landscape (Scheufele & Krause, 2019) and the role of social media as the top information source for scientific information (Saks & Tyson, 2022). This dissertation thus conducted a systematic examination of memetic communication, examining its use and associations with engagement in digital media, and the effects of exposure to meme-style science communication on trust and risk perceptions.

Summary

In Study 1, we conducted a content analysis of public videos posted on TikTok from January 1 to October 10, 2024, and found that not all scientists regularly engage in memetic communication, despite the memetic cultures of TikTok and its platform design that promotes the use of memes (Hautea et al., 2021; Zulli & Zulli, 2022). Many videos do not consistently engage TikTok's platform vernaculars, but those that do tend to have higher engagement—more views, likes, shares, and comments—than videos not containing these memetic elements. Specifically, we found that memetic characteristics of resonance through humorous content and referencing non-scientific media, as well as collectivism through imitation of social media storytelling styles

and templates, were significantly associated with daily engagement on the platform. These findings offer a glimpse into the changing ways science is communicated in digital media, where casualness and playfulness appear to be dominant communication styles, as opposed to the direct and authoritative stance typically employed in conventional science communication. We then conducted another study to further understand the effects of memetic communication, testing the implications of informal and playful science communication on the critical roles played by science communicators in shaping trust and risk perceptions.

In Study 2, we conducted a between-subjects experiment on 610 online participants aged 18-25 years old. Here, we tested how short science videos about penicillin allergies, edited and "remixed" with varying levels of "memetic-ness," elicited affective responses, evoked humorous reactions, and shaped mental construals, and their varying effects on participants' trust in the scientist and risk perceptions. Overall, we found that meme-heavy videos elicited negative affective responses, more humorous reactions, and more abstract mental construal compared to the other conditions. We also found that trust was directly associated with (positive) affect, humor, and level of abstraction, and that only humor had direct effects on risk perception. Mediation analysis also revealed that meme-heavy videos had indirect positive effects on trust through affect and had indirect negative effects on risk perception through humor. These results support prior work on the positive roles of humor in communicator effectiveness (Yeo et al., 2022) and risk messaging (Meyer & Venette, 2017). They also reveal the complex role played by memetic communication, which appears to be associated with both source evaluations and risk perceptions. Our findings also suggest the need to consider the kind and magnitude of humorous elements present in videos to maximize the effectiveness of humor. Finally, the direct effects of abstraction on trust perceptions suggest that memes can make audiences transcend distances

typically associated with scientists, making them appear closer and therefore generate favorable judgments of warmth and competence.

Conclusion

The two studies we conducted sought to answer two broad questions, namely: what does memetic communication accomplish for science communication, and what are the socio-psychological mechanisms that can explain its outcomes? The findings collectively paint a picture of memetic communication as a double-edged sword for science. While Study 1 highlights its potential to help scientists garner greater visibility and engagement on platforms like TikTok by aligning with prevalent online communication styles, Study 2 reveals the nuanced psychological impacts of this approach. It appears that the very elements that drive engagement – the negative affect and the increased humor perceptions elicited by the meme-heavy content – have complex and sometimes contrasting effects on how audiences perceive scientists and the risks they communicate. Specifically, the positive association between humor and trust, and the indirect negative effect of meme-heavy videos on risk perception through humor, underscores the delicate balance communicators must strike, ensuring that humorous elements aimed to generate perceptions of warmth do not distract audiences from the key risk messages they communicate in videos. Furthermore, the finding that abstraction fostered greater trust suggests that memetic communication might bridge perceived distances, yet the overall impact on risk perception appears less straightforward.

CHAPTER 5: RESEARCH IMPLICATIONS AND DIRECTIONS

Theoretical Implications

From a theoretical standpoint, our findings emphasize that effective science communication in social media goes beyond communicating factual and correct information (Neeley, 2013). It requires an integrated approach that considers platform logics and vernaculars, source characteristics, and the dynamic interplay between them.

Our findings also highlight the utility of the Stereotype Content Model as a framework to understand trust, emphasizing that trust formation is not a monolithic construct and that its components (warmth and competence) can be influenced by different factors (e.g., affect, mental construal, and humor, as demonstrated here). This suggests that a more granular approach might be necessary when theorizing trust in mediated science communication and how communication can improve warmth perceptions, where scientists tend to score relatively lower compared to other groups (Fiske et al., 2002).

Our work also contributes to theories on informal science communication, by providing empirical evidence for its benefits (engagement, bridging distances) and drawbacks (complex effects on trust and risk perceptions), pushing for more theoretical frameworks that can explain the mechanisms and boundary conditions of such informal styles.

Finally, this dissertation highlights the role of memes as educative and affective tools that convey scientific information and generate emotional responses that shape social judgments and perceptions. This opens avenues for further theoretical explorations on the cognitive and affective functions of memes in science communication, especially with their widespread use in digital media.

Methodological Implications

From a methodological standpoint, this research highlights the need to move beyond engagement metrics. While they may serve as initial indicators, they should not be treated as definitive measures of communicators effectiveness. This dissertation thus emphasizes the necessity to employ methods that can directly assess intended outcomes of digital communications, such as surveys and experiments.

Relatedly, studying communication on social media requires methodological agility, given that the communication styles and platform norms of digital media are constantly changing, as are the complex interactions among its elements (e.g., algorithms, online practices, online actors). Researchers studying social media must thus keep abreast of these dynamics and incorporate data collection approaches and analysis relevant to digital environments. We demonstrated this by employing multi-level modeling in study 1, where we accounted for the characteristics of our units (videos) as nested within another layer (content creators), as well as conducting a content analysis that considered the multimodality of TikTok content. We encourage future works to consider digital-native factors in the design and analysis of their research.

Practical Implications

Finally, from a practical perspective, this research offers practical guidance for scientists and science communicators strategically leveraging memetic communication or considering the use of short video-based platforms like TikTok to gain wider visibility, particularly for younger audiences. It also highlights how memetic communication can serve as a strategy to induce affect and to draw attention to key information. As with prior work, science communicators should carefully identify goals and employ strategies that can meet them (Peters, 2017). Memetic

communication can add to the arsenal of (social media) strategies available for science communicators, given its potential to improve engagement in science videos online and effects on trust and risk perceptions.

However, our results also reveal the need to balance the use of these elements and consider their unintended consequences (such as risk amplification). These findings thus caution communicators from employing them as a blanket strategy for online communication. As demonstrated in this work, when used to induce negative affect and emphasize risk, memetic communication can be used in risk amplification. This highlights the ethical responsibility for science communicators to be mindful of how their messages can distort risk perceptions through their use of memes. At the same time, it must be recognized that the same elements enabling the spread of science communication online (as we found in study 1) can be used for nefarious reasons (e.g., spread of misinformation and conspiracy theories). These findings thus have implications for media literacy and education, and the development of strategies and interventions to identify and counter harmful content employing memetic communication.

Research Directions

This dissertation identified the message and psychological characteristics that shape the outcomes of memetic communication. As mentioned in chapters 2 and 3, additional studies are required to replicate its findings and address limitations we identified. Aside from extending this research to examine the boundary conditions of the effectiveness of memes, and its different effects when considering generational and geographic differences, we also propose two studies that the findings of the current dissertation have touched upon, using the lens of risk communication theory.

Memetic communication and risk information-seeking behaviors

Communication channels repackage and disseminate information from sources such as government agencies and research institutions. More recently, studying channels over sources has become more prevalent given people's reliance on social media, where users face an overwhelming number of information channels. During the COVID-19 pandemic, social media emerged as the preferred channel, offering useful, timely, and easily understandable information (Gupta et al., 2021). Decision-making research has also revealed that audiences often prioritize channels (i.e., those who repackage information) over their original sources, aligning with the idea that humans use mental shortcuts in decision-making (Dunwoody & Griffin, 2014). Audiences make decisions about channel selection based on assessments on information usefulness and (perceived) costs of access (Chaffee, 1986, as cited in Dunwoody & Griffin). Most people "satisfice" when it comes to channels, opting for easily accessible options that provide adequate information (Dunwoody & Griffin, 2014).

Online influencers, who repackage scientific information, function as cost-effective online channels, mediating information from various entities to influence audience decisions. These channels frequently employ memetic communication—leveraging video templates, trending music, and pop culture references (Zeng et al., 2021), consistent with Study 1 findings. From the perspective of risk information-seeking and processing (RISP) model (Griffin et al., 1999), Study 2 suggests memetic communication shapes channel beliefs by influencing perceptions of science content creators' warmth and competence, potentially making them preferred over direct sources. While memetic communication appears to be related to risk perceptions, its role on information-seeking motivations and behaviors remains largely unexplored.

RISP offers a framework for future research, positing that information-seeking results from beliefs about communication channels, people's perceived capacity to gather hazard information, and their motivation, which is shaped by subjective norms and existing risk knowledge. Perceived hazard characteristics and affective responses also influence information-seeking (Yang et al., 2014).

Following RISP, our work provides initial insights into memetic communication's effects on channel beliefs and hazard characteristics. However, memetic communication can also influence perceived information-gathering capacity and motivation, as supported by research on memes in education showing increased student interest and engagement (Riser et al., 2020). The economy-driven logic of memetic communication (Shifman, 2012) also relates to this – when employed on science and risk topics, the typically lengthy, technical, scientific information is condensed into short, memetic formats that online audiences can easily understand. These formats fit within the current patterns of information consumption in digital media and enable individuals to learn information within shorter periods. The emotional responses evoked by memes, through their use of trendy elements, humor, and connective language, can influence information behaviors, as RISP also underscores the influence of affective responses in these outcomes.

As our understanding of communication channels of science and risk evolves, the impact of memes on audience engagement becomes increasingly significant. Investigating how memetic communication shapes information behaviors will help us understand how individuals prioritize channels in environments with unlimited options and what communicative factors motivate them to seek risk-related content in contemporary media.

Memetic communication and risk amplification

Study 1 demonstrated memes' effectiveness for information dissemination. Coupled with the social media's networked architecture and its features that facilitate instantaneous information sharing, their humor and relatability enable rapid spread in digital spaces, making memetic communication an attractive strategy to reach online audiences (e.g., the case of the Baltimore City Health Department). However, this strategy can also be used for nefarious objectives – advancing anti-science agendas (Harvey et al., 2019), conspiracy theories, and misinformation (Basch et al., 2021; Prasad, 2022).

Memetic communication's ability to exaggerate or downplay risks necessitates further examination, exploring how it amplifies or attenuates them and its interaction with other amplification stations also present in digital spaces, like the media and governments. The social amplification of risk framework (SARF) offers conceptual guidance. SARF defines attenuation as serious expert-judged hazards receiving less societal attention, while amplification as low-risk events receiving more attention (Kasperson et al., 2022). Risk amplification information transfer and social responses via amplification stations (e.g., news media or interpersonal communication), leading to behavioral outcomes (Kasperson et al., 2022).

Research using SARF has explored the many ways social media amplifies risk. Due to its networked and interactive design, online media can communicate risks to a larger public, enabling them to participate in the construction of risks. Digital media research has uncovered how risks are amplified through the active participation of the public in digital media and their interaction with mass media as an amplification station (Chung, 2011). The dynamics of amplification have also become more complex in digital media as users themselves act as individual amplification stations. Online users are provided with a venue to communicate their

own experiences before a larger audience, and the communication of varying experiences of risk related to the COVID-19 pandemic has led to diverging risk perceptions as an outcome of the simultaneous amplification and attenuation of risks (Hopfer et al., 2021).

Applying SARF to memetic risk communication, our findings indicate that using memes to convey affective information and build communicator trust can amplify perceived risks. Future research can explore how different memes facilitate other risk communication outcomes, like attenuation. SARF-informed network research can identify amplification stations strategically using memetic communication to spread harmful information and conversely, identify strategic actors for disseminating accurate information to underserved online audiences.

Being emotionally charged and easy to understand, memes can heighten risk perceptions or spread misconceptions. Therefore, it is vital to understand the dynamics and implications of amplification or attenuation due to memetic communication and develop message and channel strategies to use memes effectively for public understanding of science.

APPENDIX 1: STUDY 1 CODING SCHEME AND RELIABILITY

Variable	Measure	Code	Krippendorf's Alpha
Video length	Number of seconds	Video length in MM:SS format 88 if content not video	1
Moving body	Presence of moving body/body part: Video has the creator within the video (the main speaker, narrator, explainer, dancer in a challenge, lip syncer, etc)	1 = Yes 0 = No 88 = content not moving	1
Multimodality	Moving image: Integrates a video or moving image	1 = Yes 0 = No	undefined*
	Still image: Integrates still images in the video	1 = Yes 0 = No	0.867
	Music: Integrates music in main video (not from stitched content)	1 = Yes 0 = No	1
	Non-music audio: Integrates non-melodic sounds in their video (e.g., line spoken by a character in a show or movie; exclude those from stitched content)	1 = Yes 0 = No	1
	Text: video shows textual content (could be subtitles, could be snippet of a document containing only plain text (nothing else)	1 = Yes 0 = No	undefined*
Reappropriation	Pop culture reference: References pop culture elements anywhere in their content as part of their script, video, text, etc. (e.g., popular celebrities, characters from TV shows, trending music)	1 = Yes 0 = No	1

	Use of slang: Uses slang words or coded language (e.g., “it’s giving”, “flex”, “slay”)	1 = Yes 0 = No	1
	Use of visual or aural media from non-scientific content: (1) still or GIF images from television shows, movies, etc.; (2) music that is not science related but is not considered an “online” challenge; (3) recorded audio, such as lines from tv shows, movies, or other content that is used in the video; (4) videos clips from other content.	1 = Yes 0 = No	1
Resonance	Humor: Uses humor or jokes in their content; uses word play, puns, etc	1 = Yes 0 = No	0.785
	Conversational/Plain language: text and script in the video is understandable by non-specialist, young audiences of TikTok(18 to 30) without having to re-watch or re-read the content; refer to at least two of these: (1) uses conversational or informal language in their content; (2) when jargons are used, content creator explains most of them, or uses other communicative techniques to make them understandable (e.g., visuals); (3) when numbers are used, content creator explains what they mean or makes them understandable	1 = Yes 0 = No	0.716
	Emotional: any of these: (1) presence of narrative – not just laying out facts, but tells a story and uses imagery; (2) uses emotional language – adjectives and figures of speech; (3) uses emotional tone (e.g., excited, sad, sarcastic) in the message; (4) uses dramatic music (symphonic, melodic, suspense-building, etc.); (5) uses photographic or illustrative images; (6) evokes an emotional reaction (e.g., smiling)	1 = Yes 0 = No	0.913

Collectivism	Imitation: uses social media storytelling scripts and formats (e.g., #grwm [get ready with me], unboxing videos, ASMR, #storytime, day in a life, #watchmy, #thatgirl, mukbang, reaction videos, make-up tutorials), minecraft videos, subway surfing, parkour, video inserts; scripts such as "very demure, very mindful"; use of tiktok content creation tools/features such as duet and stitch.	1 = Yes 0 = No	0.931
	Specific style used	Indicate specific style used	
	Participation: Video is part of an online challenge or game. NOTE: Video explicitly states that it is a challenge (verbally mentioned, use of hashtag in description, part of the video text)	1 = Yes 0 = No	undefined*
	Invitation: Video invites other users to share their thoughts, comments, or create their own similar content; uses comments as part of their content	1 = Yes 0 = No	0.78
Calibrated amateurism	Amateurism: Video editing is unpolished, with some parts having low video quality	1 = Yes 0 = No	0.785
Topic	Science Field: Science field mainly covered in the video.	1 = Physical sciences (physics, chemistry, engineering, astronomy, geology, earth science, geography, climate science, meteorology) 2 = Life sciences (biology, agriculture, environment and nature, biotechnology,	0.857

		biochemistry, genetics, food science) 3 = Social and behavioral sciences (education, psychology, anthropology, sociology, philosophy, economics) 4 = Computer science (artificial intelligence, computing, mathematics, coding) 5 = Health and medicine (medical and health-related content, neuroscience, surgery) 6 = Science in general (no specific discipline mentioned)	
Form	Form: Type of presentation of scientific ideas/information. You may select more than one.	1 = Demonstration: recording a procedure 2 = Plain speaking: speaking and explaining a concept, process, discovery, paper, etc. 3 = Performing: person is dancing, lip synching, acting, etc. 4 = Duet: content is made	0.779

		using the duet function of TikTok 5 = Stitch: content is made using the stitch function of TikTok 6 = Other: content is made using other ways not listed here

* lacks variance in last round of reliability testing, therefore reliability scores are unable to be calculated

APPENDIX 2: USERNAMES OF SCIENCE CONTENT CREATORS

a_biology_teacher
aplantbiologist
askaneuroscientist
astro_alexandra
astroathens
astrokirsten
astrokobi
austinchiangmd
benswolfson
billnye
blitzphd
brainsurgerydropout
cannabichem
chem.thug
chemicalkim
chemis.te
chemteacherphil
climatehuman
colethesciencedude
coolchemistryguy
cunningham.kaylee
distilledscience
doctorshepard_md
dr.benaduce_explains
dr.brein
dr.eric.b
dr.noc
dr_asherwilliams
dr_idz
dr_inna
drdre4000
drglaucomflecken
drmohammedalo
drterrysimpson
ellahubber
entomologyabby
epidemiologistkat
erinwinick
evanthorizon
evelyn_vollmer
evibacarter
fascinatedbyfungi
foodsciencebabe
fractal_inc_official
groovygeologist
hankgreen1
histology_yolly
icy_pete
impossiblescience
jadroppingscience
jbrennerfisics
jc.dombrowski
jenlovesfood
joelbervell
katvoltage
kelliegerardi
kindlefromthelab
kurz_gesagt
lab_shenanigans
ladyspinedoc
lauren.rolerat
lenaunderwater
lifeofadoctor
liloceanpaige
lindsaynikole
maklelan.0
malikandmiles
marenmicrobe
mattgreen.jgm
miniminuteman
miniminuteman.12
modernday_eratosthenes
mrs.b.tv
mrslukeslab
neildegrassetyson
nickuhas
notyourcellbioprof
nuclearsciencelover
oddpride
oliviapura
particleclara
philsustainability
popculturescientist
professorcasey
queerbrownvegan
qwscience
renegadescienceteacher
rickyrick.phd
rubin_allergy
sciencebysaana
scishow
scitimewithtracy
sibleyaqua
simonegiertz
simplebiologist
sofishtication
spaceaccordingtoskylar
starstrickensf
stemcellchristian
tedtoks
the_brain_scientist
thegalacticgal
thegarbagequeen
thehybridprofessor
thespacegal
thestomachdoc
tilscience
tofology
tofumcneil
veritasium
wolf_science
yourfemaleengineer
zekedarwinscience
bloodflower

APPENDIX 3: LINEAR MIXED MODELS

Linear mixed model predicting log-transformed views per day

	Estimate	Std. Error	df	t value	p	
(Intercept)	3.23	1.49	861.59	2.17	0.03	*
Author video count	-0.10	0.22	68.45	-0.46	0.65	
Author follower count	0.66	0.19	95.03	3.50	0.00	***
Author following count	-0.19	0.16	76.06	-1.24	0.22	
Author likes count	0.11	0.27	69.95	0.42	0.68	
Video length (in seconds)	-0.14	0.16	892.64	-0.84	0.40	
LIWC word count	0.11	0.16	888.47	0.66	0.51	
LIWC big words	-0.05	0.05	853.59	-1.04	0.30	
LIWC emotionality	-0.04	0.05	856.17	-0.83	0.41	
% of slang words	-0.02	0.04	887.48	-0.40	0.69	
Contains video	0.89	0.72	826.76	1.23	0.22	
Contains still image	0.04	0.11	875.62	0.32	0.75	
Contains music	-0.08	0.12	903.61	-0.64	0.52	
Contains other audio	0.13	0.18	865.61	0.72	0.47	
Reappropriation of non-science media	-0.43	0.15	853.19	-2.83	0.00	**
Uses humor	0.14	0.13	872.19	1.08	0.28	
Imitates social media storytelling style/templates	0.41	0.12	883.64	3.46	0.00	***
Invites users to engage	0.02	0.11	854.97	0.18	0.86	
Calibrated amateurism	0.04	0.19	908.98	0.22	0.83	
Topic: physical science	1.55	1.27	831.34	1.22	0.22	
Topic: life science	1.02	1.28	834.30	0.80	0.42	
Topic: social and behavioral science	0.68	1.28	833.22	0.54	0.59	
Topic: computer science and mathematics	1.16	1.30	835.52	0.89	0.37	
Topic: health and medicine	0.73	1.27	834.50	0.58	0.56	
Topic: science in general	0.68	1.28	833.42	0.53	0.60	
Topic: not science related	0.95	1.27	831.24	0.75	0.45	
Form: demonstration	0.09	0.26	851.33	0.35	0.73	

Form: plain speaking	0.26	0.27	847.93	0.94	0.35	
Form: stitching	0.18	0.19	862.21	0.93	0.35	
Form: performance	-0.24	0.35	863.92	-0.68	0.50	
Form: others	0.08	0.33	842.17	0.24	0.81	
Difference score	-0.38	0.04	858.15	-9.05	0.00	***

Random Intercepts

n	91
σ2	1.776
SD	1.333

Model Scores

Total number of observations	941
Conditional R2	0.66
Marginal R2	0.25

Linear mixed model predicting log-transformed likes per day

	Estimate	Std. Error	df	t value	p	
(Intercept)	0.89	1.39	860.38	0.64	0.52	
Author video count	-0.23	0.21	66.76	-1.09	0.28	
Author follower count	0.56	0.18	92.69	3.19	0.00	**
Author following count	-0.10	0.15	74.18	-0.70	0.49	
Author likes count	0.20	0.25	68.22	0.81	0.42	
Video length (in seconds)	-0.02	0.15	892.08	-0.10	0.92	
LIWC word count	0.01	0.15	887.80	0.04	0.97	
LIWC big words	-0.04	0.04	852.07	-0.92	0.36	
LIWC emotionality	-0.02	0.04	854.72	-0.53	0.59	
% of slang words	-0.02	0.04	886.80	-0.45	0.65	
Contains video	0.96	0.68	824.67	1.41	0.16	
Contains still image	0.00	0.11	874.63	0.00	1.00	
Contains music	-0.04	0.12	903.38	-0.37	0.71	
Contains other audio	0.08	0.17	864.39	0.48	0.63	
Reappropriation of non-science media	-0.27	0.14	851.68	-1.93	0.05	.
Uses humor	0.24	0.12	871.12	2.05	0.04	*
Imitates social media storytelling style/templates	0.36	0.11	882.85	3.22	0.00	**
Invites users to engage	-0.11	0.11	853.49	-1.07	0.28	
Calibrated amateurism	-0.05	0.18	908.97	-0.26	0.80	
Topic: physical science	1.32	1.19	829.34	1.11	0.27	
Topic: life science	0.96	1.20	832.36	0.80	0.42	
Topic: social and behavioral science	0.67	1.20	831.25	0.56	0.58	
Topic: computer science and mathematics	0.68	1.21	833.60	0.56	0.58	
Topic: health and medicine	0.55	1.19	832.56	0.46	0.64	
Topic: science in general	0.60	1.20	831.46	0.50	0.62	
Topic: not science related	0.78	1.19	829.23	0.66	0.51	
Form: demonstration	-0.17	0.25	849.76	-0.69	0.49	
Form: plain speaking	0.24	0.26	846.30	0.95	0.34	
Form: stitching	0.14	0.18	860.91	0.76	0.45	

Form: performance	-0.23	0.33	862.64	-0.68	0.49	
Form: others	-0.23	0.31	840.41	-0.77	0.44	
Difference score	-0.35	0.04	856.74	-8.72	0.00	***

Random Intercepts

n	91
σ2	1.564
SD	1.251

Model Scores

Total number of observations	941
Conditional R2	0.68
Marginal R2	0.28

Linear mixed model predicting log-transformed shares per day

	Estimate	Std. Error	df	t value	p	
(Intercept)	-1.07	1.13	865.47	-0.95	0.34	
Author video count	-0.13	0.10	53.07	-1.33	0.19	
Author follower count	0.37	0.10	114.70	3.81	0.00	***
Author following count	-0.01	0.07	66.65	-0.18	0.86	
Author likes count	-0.06	0.12	61.79	-0.50	0.62	
Video length (in seconds)	-0.01	0.12	891.75	-0.06	0.95	
LIWC word count	0.07	0.12	900.08	0.55	0.58	
LIWC big words	-0.01	0.04	890.48	-0.20	0.84	
LIWC emotionality	-0.07	0.03	889.54	-1.88	0.06	.
% of slang words	0.02	0.03	908.90	0.61	0.55	
Contains video	0.49	0.56	841.03	0.88	0.38	
Contains still image	0.05	0.09	908.04	0.54	0.59	
Contains music	0.12	0.09	842.86	1.28	0.20	
Contains other audio	-0.04	0.13	895.09	-0.27	0.79	
Reappropriation of non-science media	-0.18	0.11	875.03	-1.56	0.12	
Uses humor	0.28	0.10	906.04	2.94	0.00	**
Imitates social media storytelling style/templates	0.22	0.09	908.35	2.53	0.01	*
Invites users to engage	-0.04	0.09	886.52	-0.41	0.68	
Calibrated amateurism	0.05	0.14	754.99	0.38	0.70	
Topic: physical science	1.28	0.97	854.90	1.32	0.19	
Topic: life science	1.24	0.98	861.02	1.27	0.20	
Topic: social and behavioral science	1.11	0.98	859.68	1.13	0.26	
Topic: computer science and mathematics	1.00	0.99	864.69	1.01	0.31	
Topic: health and medicine	1.15	0.98	860.85	1.18	0.24	
Topic: science in general	1.00	0.98	858.23	1.02	0.31	
Topic: not science related	1.04	0.97	854.32	1.07	0.29	
Form: demonstration	-0.21	0.20	884.31	-1.05	0.30	
Form: plain speaking	0.06	0.21	868.11	0.27	0.78	
Form: stitching	-0.11	0.15	889.58	-0.77	0.44	

Form: performance	-0.19	0.27	900.59	-0.70	0.48	
Form: others	-0.20	0.25	868.76	-0.82	0.41	
Difference score	-0.23	0.03	888.16	-7.02	0.00	***

Random Intercepts

n	91
σ2	0.3011
SD	0.5487

Model Scores

Total number of observations	943
Conditional R2	0.40
Marginal R2	0.19

Linear mixed model predicting log-transformed shares per day

	Estimate	Std. Error	df	t value	p	
(Intercept)	-0.17	0.76	845.96	-0.23	0.82	
Author video count	-0.07	0.08	62.15	-0.84	0.40	
Author follower count	0.19	0.07	109.81	2.50	0.01	*
Author following count	-0.02	0.06	76.41	-0.31	0.76	
Author likes count	0.05	0.10	67.29	0.52	0.60	
Video length (in seconds)	0.08	0.08	893.61	0.94	0.35	
LIWC word count	-0.03	0.08	893.97	-0.39	0.70	
LIWC big words	-0.01	0.02	861.86	-0.57	0.57	
LIWC emotionality	-0.04	0.02	863.17	-1.67	0.10	.
% of slang words	0.01	0.02	890.90	0.49	0.62	
Contains video	0.41	0.37	822.14	1.09	0.28	
Contains still image	-0.03	0.06	884.33	-0.57	0.57	
Contains music	0.01	0.06	881.20	0.20	0.84	
Contains other audio	0.05	0.09	871.43	0.55	0.58	
Reappropriation of non-science media	-0.17	0.08	853.38	-2.22	0.03	*
Uses humor	0.19	0.07	881.92	2.96	0.00	**
Imitates social media storytelling style/templates	0.22	0.06	891.20	3.65	0.00	***
Invites users to engage	0.01	0.06	862.27	0.09	0.93	
Calibrated amateurism	0.04	0.09	846.73	0.38	0.70	
Topic: physical science	0.47	0.65	831.21	0.71	0.48	
Topic: life science	0.31	0.66	836.11	0.48	0.63	
Topic: social and behavioral science	0.29	0.66	834.73	0.44	0.66	
Topic: computer science and mathematics	0.14	0.67	838.46	0.21	0.83	
Topic: health and medicine	0.27	0.66	836.19	0.41	0.68	
Topic: science in general	0.18	0.66	834.11	0.27	0.78	
Topic: not science related	0.39	0.66	830.94	0.60	0.55	
Form: demonstration	-0.28	0.14	858.78	-2.09	0.04	*
Form: plain speaking	0.07	0.14	847.80	0.47	0.64	

Form: stitching	0.00	0.10	864.60	0.03	0.98	
Form: performance	-0.36	0.18	875.64	-1.97	0.05	*
Form: others	-0.21	0.17	846.28	-1.26	0.21	
Difference score	-0.16	0.02	864.42	-7.30	0.00	***

Random Intercepts

n	91
σ2	0.2158
SD	0.4646

Model Scores

Total number of observations	926
Conditional R2	0.49
Marginal R2	0.20

APPENDIX 4: SCRIPT AND AUDIO-VISUAL ELEMENTS PER VIDEO

Script	Audio-Visual Elements		
	Non-memetic	**Meme-lite**	**Meme-heavy**
Millions of people in the United States and around the world think that they're allergic to penicillin when they actually are not.	**Video clip**: white tablets (depicting penicillin) **Video overlay**: none	**Video clip**: white tablets (depicting penicillin) **Video overlay**: Scientist speaking (green screen effect)	**Video clip**: white tablets (depicting penicillin) Video overlay: Scientist speaking (green screen effect) **Text overlay**: #60SecondScience **Image overlay**: Cat reaction meme GIF **Background music**: trendy lo-fi music
Approximately 10% of people in the united states report a penicillin allergy but when you test these people out, it's estimated that 90% of them are actually not allergic.	**Video clip**: people walking **Video overlay**: none	**Video clip**: people walking **Video overlay**: Scientist speaking (green screen effect)	**Video clip**: people walking **Video overlay**: Scientist speaking (green screen effect) **Image overlay**: Deadpool reaction meme GIF **Background music**: trendy lo-fi music
And even those who are truly allergic to penicillin, roughly 80% of them may outgrow their penicillin allergy.	**Video clip**: scientist speaking **Video overlay**: none	**Video clip**: scientist speaking **Video overlay**: none	**Video clip**: scientist speaking **Video overlay**: none **Video insert**: Minions reaction video **Background music**: trendy lo-fi music
Having a penicillin allergy label on your medical record can have all sorts of health implications. As an example, one of my colleagues published this paper fairly recently which reported	**Video clip**: screenshot of research paper	**Video clip**: screenshot of research paper **Video overlay**: Scientist speaking (green screen effect)	**Video clip**: screenshot of research paper **Video overlay**: Scientist speaking (green screen effect) **Image overlay**: circle arrows GIF pointing to title

that people with a penicillin allergy have a higher risk of developing MRSA or C-Diff bacterial infections which can be rather severe.			**Background music**: trendy lo-fi music
Other examples include the fact that people with penicillin allergies are being put on a broad spectrum of antibiotics that are more expensive, have more side effects, and can increase the risk of developing drug resistant germs.	**Video clip**: doctor writing prescription, hand sorting medicines, germs under microscope	**Video clip**: doctor writing prescription, hand sorting medicines, germs under microscope **Video overlay**: Scientist speaking (green screen effect)	**Video clip**: doctor writing prescription, hand sorting medicines, germs under microscope **Video overlay**: Scientist speaking (green screen effect) **Sound overlay**: Vine boom sound meme

APPENDIX 5: QUESTIONNAIRE

Part 1: Informed Consent

Part 2: Pre-test (no. of items: 4)

Topic familiarity (Fujita et al., 2006)

1. How much do you know about penicillin allergies? *(1 = None at all; 5 = A lot)*
2. How interesting are penicillin allergies? *(1 = None at all; 5 = A lot)*
3. How important is it to know about penicillin allergies to you, personally? *(1 = None at all; 5 = A lot)*
4. How important is it to know about penicillin allergies to society? *(1 = None at all; 5 = A lot)*

Part 3: Video exposure

Part 4: Post-test (no. of items: 36)

Attention check

1. What kind of allergy did the video just talk about? *(Randomized Order - Pollen Allergy/Penicillin Allergy /Food Allergy /Pet Allergy)*

Prior exposure

2. Have you seen this video before? *(1 = Yes, 0 = No)*
3. Have you seen other videos by Dr. Rubin before? *(1 = Yes, 0 = No)*

Construal levels (Seih et al., 2017; Semin & Fiedler, 1988)

4. In one to two sentences, describe the video that you just watched (open-ended response)

Knowledge (True or False) **[**Randomized order]

Based on the video you just watched, please indicate if the following statements are TRUE or FALSE.

5. 90% of Americans who think they are allergic to penicillin are actually not allergic. (TRUE)
6. People with a penicillin allergy on their medical record have a higher risk of developing MRSA or C. diff bacterial infections. (TRUE)
7. People with a penicillin allergy on their medical record are often prescribed antibiotics that are cheaper and have fewer side effects. (FALSE)

Affect

8. What kind of feelings did watching the video evoke for you? *(1: Very negative; 7: Very positive)*
9. Please provide a brief explanation for your response to the previous question.

Mirth (Yeo et al., 2020)

Please indicate your impression of the video by choosing the appropriate number between the pairs of adjectives below. [Order will be randomized] (1 = Not at all, 5 = Extremely)

(Semantic differential scale) [Randomized Order]

1. Not Humorous 1 2 3 4 5 Humorous
2. Not Funny 1 2 3 4 5 Funny
3. Not Playful 1 2 3 4 5 Playful
4. Not Amusing 1 2 3 4 5 Amusing
5. Not Entertaining 1 2 3 4 5 Entertaining
6. Informal 1 2 3 4 5 Formal

Risk perception (Pollatsek & Tversky, 1970)

7. How risky does it feel to have penicillin allergies in your medical record? *(1: Not at all risky, 2: Slightly risky, 3: Moderately risky, 4: Highly risky, 5: Extremely risky)*

8. How concerned are you (if at all) about the risks of having penicillin allergies in your medical record? *(1: Not at all concerned, 2: Slightly concerned, 3: Moderately concerned, 4: Highly concerned, 5: Extremely concerned)*
9. How concerned are you (if at all) that the risk of having penicillin allergies in one's medical record will affect people you know? *(1: Not at all concerned, 2: Slightly concerned, 3: Moderately concerned, 4: Highly concerned, 5: Extremely concerned)*
10. How concerned are you (if at all) that the risk of having penicillin allergies in one's medical record will become increasingly dangerous over time? *(1: Not at all concerned, 2: Slightly concerned, 3: Moderately concerned, 4: Highly concerned, 5: Extremely concerned)*
11. How concerned are you (if at all) that the risk of having penicillin allergies in one's medical record will continue to affect future generations? *(1: Not at all concerned, 2: Slightly concerned, 3: Moderately concerned, 4: Highly concerned, 5: Extremely concerned)*

Trust (Fiske et al., 2022)

Please indicate your impression of Dr. Rubin, the scientist in the video, by choosing the appropriate number between the pairs of adjectives below. [Order will be randomized] *(1 = Not at all, 5 = Extremely)*

(Competence)

12. Not Competent 1 2 3 4 5 Competent
13. Not Competitive 1 2 3 4 5 Competitive
14. Not Independent 1 2 3 4 5 Independent
15. Not Intelligent 1 2 3 4 5 Intelligent

16. Not Confident 1 2 3 4 5 Confident

(Warmth)

17. Not Warm 1 2 3 4 5 Warm
18. Not Tolerant 1 2 3 4 5 Tolerant
19. Not Good-natured 1 2 3 4 5 Good-natured
20. Not Sincere 1 2 3 4 5 Sincere

Topic familiarity

After watching the video, please tell us:

21. How much do you know about penicillin allergies? *(1 = None at all; 5 = A lot)*
22. How interesting are penicillin allergies? *(1 = None at all; 5 = A lot)*
23. How important is it to know about penicillin allergies to you, personally? *(1 = None at all; 5 = A lot)*
24. How important is it to know about penicillin allergies to society? *(1 = None at all; 5 = A lot)*

Controls (no. of items: 10)

Video-based platform use (modified scale from Coromina and Saris, 2009)

1. On an average weekday, how much time do you generally spend using short-form video-based platforms such as TikTok, Instagram, Facebook reels, and YouTube shorts? *(1: No time at all, 2: Less than ½ hour, 3: ½ up to 1 hour, 4: 1 hour up to 2 hours, 5: More than 2 hours)*

Numeracy - 1-NUM measure (Silverstein et al., 2023)

2. Imagine that you have a 5-sided die (the sides of which show 1, 2, 3, 4, and 5), and we throw it 150 times. On average, out of these 150 throws how many times would this 5-sided die show an odd number (1, 3, and 5)? ___ out of 150 throws

Personal experience

3. Do you have a known allergy to penicillin (i.e., diagnosed by a healthcare provider)? *(1 = Yes, 2 = No, 3 = Not Sure/Don't Know, 4 = Prefer to not disclose)*
4. Do you know anyone who has a known allergy to penicillin? *(1 = Yes, 2 = No, 3 = Not Sure/Don't Know, 4 = Prefer to not disclose)*

Socio-demographic characteristics

5. What is your age? Please answer in years, only using numbers.
6. What is the highest level of education you have completed? *(1: Some high school or less, 2: High school diploma or GED, 3: Some college but no degree, 4: Associates or technical degree, 5: Bachelor's degree, 6: Graduate or professional degree (MA, MS, MBA, PhD, JD, MD, DDS, etc.,), 7: Prefer not to say)*
7. How do you describe your gender? *(1: Man, 2: Woman, 3: Non-binary, 4: Prefer to self-describe, 5: Prefer not to say)*
8. What was your total household income before taxes during the past 12 months? *(1: Less than $25,000, 2: $25,000 - $49,999, 3: $50,000 – $74,999, 4: $75,000 - $99,999, 5: $100,000 - $149,000, 6: $150,000 or more, 7: Prefer not to say)*
9. Choose one or more races that you consider yourself to be: *(1: White or Caucasian, 2: Black or African American, 3: American Indian/Native American or Alaska Native, 4:*

Middle Eastern and North African, 6: Asian, 7: Native Hawaiian or Other Pacific Islander, 8: Other, 9: Prefer not to say)

10. In terms of political opinions, do you consider yourself as: *(1: Very liberal, 2: Somewhat liberal, 3: Centrist, 4: Somewhat conservative, 5: Very conservative)*

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