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CLADISTICS ruined my life: intersections of fandom, internet memes, and public engagement with science

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Abstract

In an increasingly mediated culture, social institutions such as science, public health, and civic engagement exist within the same modes of discourse as popular media. As a human endeavor, science is also a cultural phenomenon, and there are webs of multidirectional and layered communication that occur between formal science communication, pop science, and, indeed, popular media. For public participants, engagement with science and entertainment may be one in the same. This essay draws from research of transformative works, fan studies, and memetics to examine how the public engages with science and popular media within digital cultures.

Keywords

Public engagement with science and technology; Science and media; Visual communication

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Introduction

Science communication, public engagement with science, fan studies, and memetics are multidisciplinary fields of study and practice, and in many respects are deeply intertwined with one another. In 1995, Bruce Lewenstein described the web model of science communication in studying the complex flow of information among and between scientists, mass media, and other agents [Lewenstein, 1995]. With the disruptions afforded by widespread access to the Internet, the cultural narratives reflecting and informing scientific understanding, and the possibilities for transformative works, remixes and critique have allowed for even more connections and information flows. Scholarly study of fan works and Internet memes are both emerging fields. Both fields have much in common: fan works and memes are often dismissed as trivial artifacts of popular culture, but both have been described as a kind of modern (or postmodern) folklore, and as such, a reflection of social and cultural structures and values [Coppa, 2017; Shifman, 2014]. In this essay, I hope to bring together elements of cultural studies in science communication with the study of transformative works which are endemic to online communities and digital cultures, particularly fan works and Internet

memes in order to highlight new and increasingly complex modes of culturally informed engagement with science.

Examining exchanges and informational flows through Internet memes, fan works, and other types of public engagement with science, including the scientists' engagement with digital cultures, drawing clear lines between disciplinary domains of fan studies, media and cultural studies, and science studies becomes challenging. Such challenges are similarly expressed by Tumblr user harmalite, who declared "CLADISTICS ruined my life" as shown in Figure 1. Cladistics, a taxonomic system applied to the study of evolutionary relationships, can be a point of frustration for students, a site for heated debate among scientists, and more recently, meme inspiration for science fans.

In an increasingly mediated culture, it should be no surprise that many people engage with societal institutions, such as politics, technology, and science, in much the same way that they approach their favorite TV show, movies, games, or sports teams. Astronauts now Tweet from space and participate in Reddit AMAs (Ask Me Anything). The Katmai National Park and Preserve in Alaska has had great success in the annual celebration of "Fat Bear Week," inviting audiences to vote in a tournament bracket as the bears residing in the preserve gain weight in preparation for winter. Similarly, the New Zealand conservation organization Forest & Bird allows international voters to determine the New Zealand Bird of the Year. Iconic New Zealand birds such as the kiwi, kea, and kākāpō have been named Bird of the Year in the past, but the 2021 was a controversial winner: the pekapeka or New Zealand long-tailed bat. Celebrity scientists and science celebrities further blur lines between science communication and entertainment. As individual scientists, science communicators, and medical professionals reach new levels of celebrity, their authority may be assumed regardless of their individual area of expertise, level of training, or even actual credibility and commitment to professional ethics.

In recent years, there has been increasing interest in the role of social media in science communication [Brossard, 2013; Hargittai, Füchslin & Schäfer, 2018; Huber, Barnidge, Gil de Zúñiga & Liu, 2019; Mueller-Herbst, Xenos, Scheufele & Brossard, 2020], as well as the role of humor in science communication [Anderson & Becker, 2018; Pinto, Marçal & Vaz, 2015; Riesch, 2015; Su et al., 2021; Yeo, Cacciatore, Su, McKasy & O'Neill, 2021], and the use of comics in science communication [Collver & Weitkamp, 2018; Farinella, 2018; Jonsson & Grafström, 2021]. In the last two years, there has been emerging interest in Internet memes in the construction of science on social media [Zeng, Schäfer & Allgaier, 2021], health communication [Kostygina et al., 2020], and the COVID-19 pandemic [Butler, Farzin & Fuchs, 2021; de Saint Laurent, Glăveanu & Literat, 2021; Pulos, 2020; Vicari & Murru, 2020].

Building upon this research, there are more opportunities for strengthening science communication research and practice through media and cultural studies. Indeed, a recent article in this journal approached science communication through the framework of cultural studies [Davies, Halpern, Horst, A. Kirby & Bruce Lewenstein, 2019]. Davies and colleagues argue for an approach to science communication that recognizes communication as experiential and emotional and that mean-making is frequently both a form of storytelling and a collective experience. Similarly, Nisbet and Scheufele [2009] have argued that public perceptions and understandings of science are informed by contextual frames, or

Figure 1. Tumblr user harmalite expresses frustration with cladistics in a remix of the "Galaxy Brain" meme [harmalite, 2019, Retrieved 8 February 2022].

interpretive storylines and common points of reference which are culturally informed. In an earlier study, Schell [1997] found that news articles, popular science books, and science fiction are "mutually, minutely entangled" [98].

A 2015 Medium essay by writer Ben Thomas [2015], "A Disease of Scienceyness" lamented the role of online "science fandom" in spreading misinformation by sharing "sciencey" sounding headlines, although some scientists and researchers pushed back against Thomas's harsh critique of laypeople and argued that "scienceyness" can be useful in promoting public engagement [Zastrow, 2015]. The Fanlore wiki, a project of the Organization for Transformative Works, defines "fan"

simply as "a person who displays a degree of enthusiasm about a person, media text, genre, or activity" [Fanlore, n.d.]. While science fans and fandom likely overlaps with more general public interest in science or those highly engaged "sciencephiles" [Schäfer, Füchslin, Metag, Kristiansen & Rauchfleisch, 2018], fandom is a distinct phenomenon that is worth consideration as a form of engagement. Writing on interdisciplinarity in fan studies, Tisha Turk argued that "not all fans are or have been media fans" [Turk, 2018, p. 546. Emphasis in the original]. In their editorial for the "Fandom and Politics" special issue of Transformative Works and Cultures, Ashley Hinck and Amber Davisson [2020] introduce the intersections of fan activism and political engagement and the development of fan communities with and around political spheres and individual political figures. Articles featured in the special issue explore fandom and politics through election campaigns, activist resistance, voter registration, and charity work. Similarly, in recent years, special attention has been given to Internet memes as political expression and engagement [see: Shifman, 2014; Wiggins, 2019].

We may similarly build new understanding through exploring the intersections of public understanding of science through cultural frames and the expression of scientific understanding through fandom activities and transformative works. Importantly, fan works and Internet memes are shared and a kind of collective meaning-making. If we approach science as part of culture, audiences may remix and negotiate meaning in both mass media texts and in understandings and engagement with science.

Dinosaurs and paleontology are ubiquitous both in popular culture and science outreach, and as such, the discipline of paleontology and the associated "dinosaur fandom" provide an abundance of online engagement, remixes, memes, and transformative works to begin to explore. The associated fan communities also highlight both the overlap and conflict between fans of dinosaur media and fans of paleontology, biology, and related sciences. For this essay, I will delve into a collection of case studies of public engagement with science, particularly paleontology and dinosaurs, in online communities through transformative and fan works, and the sharing, adaptation and remixing of Internet memes.

Science fans and *Jurassic Park*

Both fan works and Internet memes can be viewed as transformative and elements of what Henry Jenkins [2006] has called participatory culture, a concept which sought to contrast with notions of passive media spectatorship. Jenkins [2018] describes participatory culture as being characterized by low barriers for participation and engagement, strong support for creating and sharing content, and social connections with others within the community. Jenkins [2018] has further described fan works as "creative transformations and ideological negotiations with mass media texts, and imagining ways they speak back to texts, producers, and fellow fans, asserting their own agenda" [p. 14]. Similarly, Bradley Wiggins defines the Internet meme as "as a remixed, iterated message that can be rapidly diffused by members of participatory digital culture for the purpose of satire, parody, critique, or other discursive activity" [Wiggins, 2019, p. 11].

Wiggins [2019] introduces the term digital culture as a variation of Jenkins's participatory culture. For Wiggins, digital culture acknowledges a movement away from more traditional broadcast media to personalized and user-generated content.

Digital culture brings together the digital, which is programmed, and culture, which is lived. Culture requires human agents engaging with one another and responding to expressions. Through the digital, communication is enhanced on the one hand, but also constrained to specific modes of discourse [Wiggins, 2019]. One such mode of discourse is that of Internet memes, another is fan works. The human agents engaged in digital culture draw from a tremendous variety of media, expressions, and experiences, including cinema, scientific discoveries, and lived experiences.

The image shown in Figure 2 is an example of what Wiggins may label an emergent meme, that is, a piece of spreadable media (in this case the movie Jurassic Park, or more specifically, this particular film still) that has been altered and shared [Wiggins, 2019]. In this case, the creator superimposed a photo of a pet parrotlet over the Tyrannosaurus rex in the famous scene in Jurassic Park. The image, which was posted to Tumblr by user Viergacht and captioned simply “Jurassic Park remastered.” Of course, the crux of the joke here is the evolutionary connection between theropod dinosaurs and modern birds; by labeling the image “Jurassic Park remastered,” the suggestion is that a visually improved version of the Jurassic Park film would feature more bird-like dinosaurs. Through the truncated genre of the Internet meme, “Jurassic Park remastered” points to a gap between popular media and scientific representations that comes to fruition through fan engagement in digital cultures.

Figure 2. Tumblr user Viergacht reimagines "Jurassic Park remastered" [Viergacht, 2017, Retrieved 8 February 2022].

The "Jurassic Park remastered” emergent meme earned 36,598 notes (“notes” is the platform-specific term for user interactions, including shares and likes) on Tumblr and was especially popular on bird blogs. Bird enthusiasts recognize the outsized aggression of the small parrot as an appropriate stand-in for the T. rex. By swapping out the carnivorous reptilian Tyrannosaurus with a colorful parrot, the meme also challenges the role of Sam Neill’s character Alan Grant as the masculine scientist-adventurer. This emergent meme has qualities of a Jurassic Park fan work and of a meme. Notably, fan works and memes have significant overlap: both are

transformative in some way and inherently intertextual, both are meant to be shared, and both are situated within a community or cultural context [Coppa, 2017; H. Jenkins in Harmon, 1997; Shifman, 2014]. Fan works and memes are also best understood not as individual works, but as a collection of texts [Coppa, 2017; Shifman, 2014].

"Jurassic Park remastered" is in part a playful remix of a beloved film, but can also be viewed as part of a broader collection of fan works which transform the narrative of the Jurassic Park film through the creators' understanding of science and remixing the narrative through posing "What if" scenarios. "Early Triassic Park" is a simple, two-panel comic which was posted to Tumblr by strange-buffoon (Figure 3). The comic shows a zookeeper keeping watch over a variety of cartoonish reptiles and amphibians, in the second panel, the zookeeper comments, "This is manageable." The comic was accompanied by the creator's comment, "I'm just saying that maybe it wouldn't have turned out quite as bad." While "Early Triassic Park" asks "What if Jurassic Park brought back animals from the early Triassic period instead of megafauna of the Cretaceous?" the fan work, "5 Times the Raptors Tried to Kill Miriam, and 1 Time They Didn't," a Jurassic Park fan fiction originally posted to Archive of Our Own by user JulisCaesar in 2015, seeks to answer the question, "What if Jurassic Park had employed trained professionals experienced in animal behavior and training?"

The fic is an example of the "Five Things" or "5+1" form, a popular fanfiction structure, and among other tags, the work is tagged as "Science" and "Like a lot of science" by the author. Although this work has been included in reader generated collections such as "Mary Sue Big Bang" and "Best of Self-Insert Fanfiction," the actual background, education or profession of the author is not provided. The main character of the story is Miriam Cohen, a 37-year-old animal behaviorist from San Francisco who accepts a job working for John Hammond on Isla Nublar before the opening of Jurassic Park. As promised, the author does, indeed, include "like a lot of science." From the opening lines, Miriam insists on calling her dinosaur hatchlings Deinonychus, and corrects others who call them Velociraptors. The reader learns that the Deinonychus hatchlings are the result of the third cloning attempt. The first attempt used frog DNA to fill in the gaps (as in the film), but "Frogs were anamniotes, and dinosaurs, whatever else they did, had laid amniotic eggs. That clutch had failed to form a hard eggshell, collapsing in its own yolk, a waste of millions of dollars" [JulisCaesar, 2015]. The second failed attempt used crocodile DNA, but the third, and successful attempt used bird, specifically bald eagle DNA. Miriam is strikingly distinct from scientists typically depicted in mass media: firstly, Miriam is an adult woman in her thirties. She is also Jewish and has ethical conversations with her rabbi over telephone. Miriam is also asexual, and bonds with other queer characters in the story through the shared loss of loved ones during the ongoing AIDS crisis of the early 1990s.

Drawing from the work of Stuart Hall, Henry Jenkins has framed fan works as a kind of negotiated reading in practice. Jenkins explains that fans are "responding to products that are mass-produced and distributed for commercial profit, and they intervene in those practices to generate forms of culture that more fully address their own fantasies, desires, and interests" [Jenkins, 2018, p. 22]. JulisCaesar's 23,000 word fan fiction (about the length of a novella), is much more than a self-insert fantasy, and while there does seem to be some enjoyment in injecting the popular science fiction story with more science, the story also represents issues and

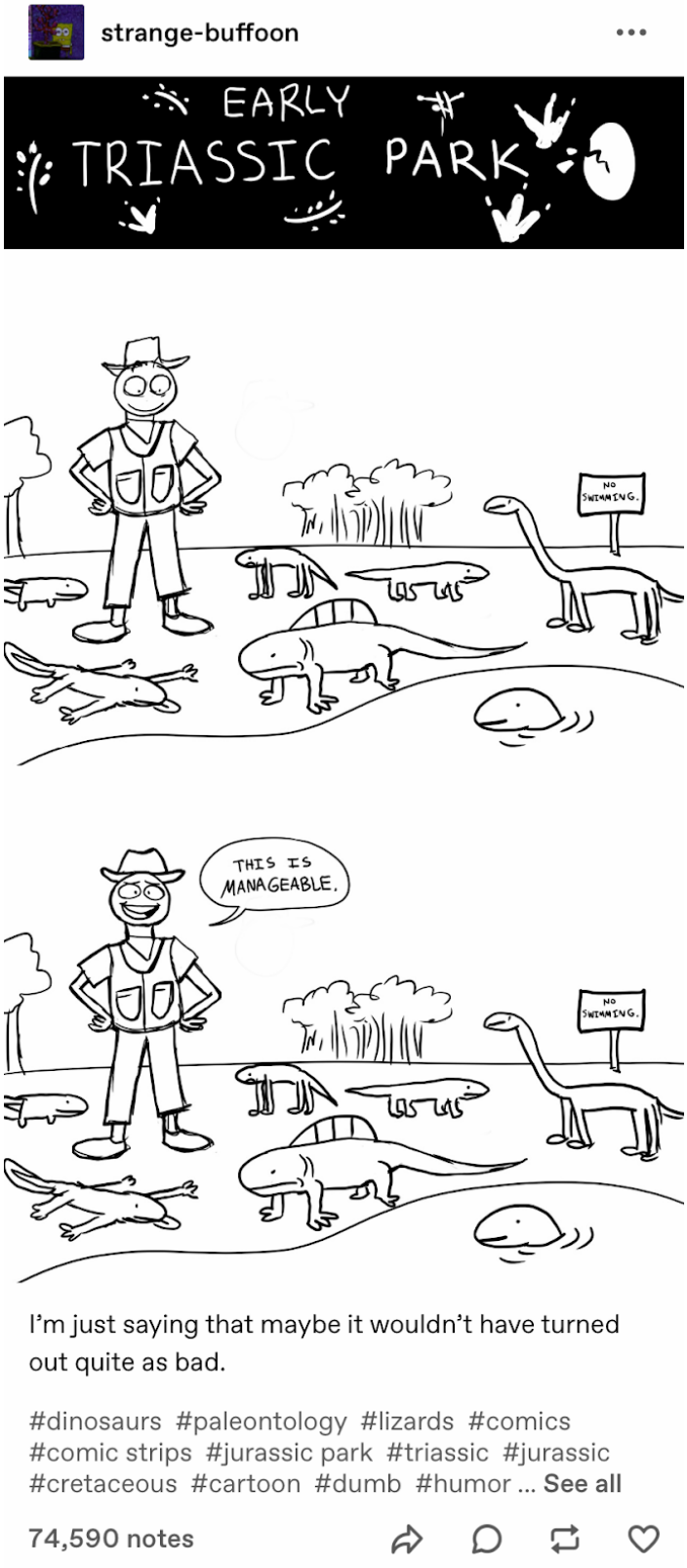

Figure 3. "Early Triassic Park" comic by Tumblr user strange-buffoon [strange-buffoon, 2021, Retrieved 8 February 2022].

identities that are often under or poorly represented in mass media: such as a Jewish woman in science or queer adults mourning those lost to AIDS.

Dinosaurs fans and digital cultures of science

Similar to fan works, Bradley Wiggins has argued that Internet memes "are a genre, not a medium, of online communication and are artifacts of participatory digital culture characterized specifically by an agency of consumption-production" [Wiggins, 2019, p. 44]. Further, just as fan works are "ideological negotiations," Internet memes are frequently deployed to make a comment or critique of some social, cultural, political, economic, or related phenomena [Wiggins, 2019]. The meme shown in Figure 4 was posted to Tumblr by user rubysunstone in February 2021. This is an intermemetic meme, a combination of two preexisting memes. The "Feel like pure shit just want her back x" meme which originated on Snapchat in 2014 as a photograph of a tearful teen boy with the text overlaid "Feel like pure shit just want her back x," has been remixed with the MakeSweet Heart Locket GIF which originally appeared online in 2008, but gained popularity on Tumblr in February 2021 [Know Your Meme, n.d.-b, n.d.-c].

Figure 4. Tumblr user rubysunstone mourns the loss of the T. rex Stan [rubysunstone, 2021, Retrieved 8 February 2022].

The Stan referred to in the meme is specimen BHI 3033, a Tyrannosaurus rex fossil discovered in the Hell Creek Formation of South Dakota in 1997. The specimen nicknamed "Stan" is considered one of the finest T. rex fossils ever discovered, but in October 2020, the specimen was sold to an unidentified private buyer for over US$31 million [Black, 2021; Greshko, 2020]. Through the Internet meme, as a "truncated genre of communication," the creator (and the others who shared and spread the image) succinctly expresses their dismay at the loss of this outstanding Tyrannosaurus specimen from the scientific community — and the public at large — to a wealthy private owner. Davies and colleagues argue that "Science is an achievement of our societies, and its representation within public communication should be understood as being as much about contemporary popular culture as contemporary science" [Davies et al., 2019, p. 3]. Articles about the sale in Smithsonian Magazine and National Geographic highlighted the concerns of professional paleontologists about the loss of the specimen from the scientific

community [Black, 2021; Greshko, 2020]. The "Just want Stan back" meme succinctly illustrates that the value and significance of specimens like BHI 3033 transcend the potential paleontological discoveries to become an achievement and discovery of value to the culture at large.

Wiggins argued that memes are often more a kind visual argument than a joke alone; Internet memes posit an idea, a point, an argument, or commentary which is catered to a specific audience and often also targets an institution, ideology, or specific or imagined individuals. In the meme referenced in Figure 1, the creator expresses frustration with cladistics, and further down the subsequent discussion thread user a-dinosaur-a-day elucidates the problem (see Figure 5).

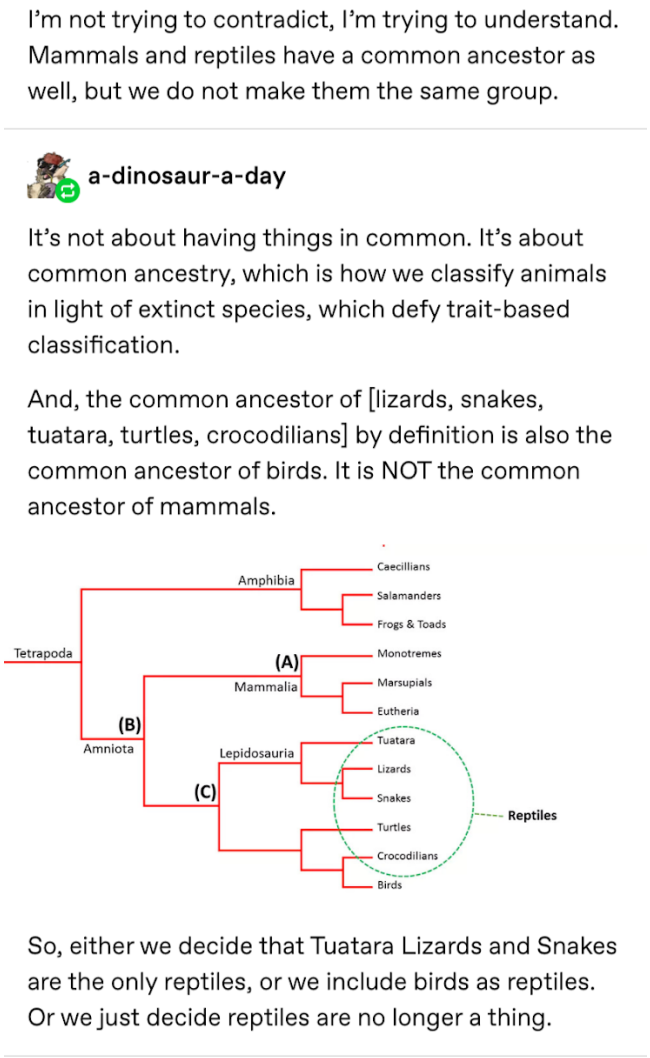

Figure 5. Tumblr user a-dinosaur-a-day responds to the "CLADISTICS ruined my life" meme thread by explaining where birds fall in relation to other reptiles [a-dinosaur-a-day, 2019, Retrieved 8 February 2022].

Perhaps in response to the "science ruined dinosaurs" discourse among dinosaur fans which emerged from new discoveries of feathered dinosaurs [Black, 2012b, 2012a], many science-minded dinosaur memes target those who would deny or remain ignorant of the genetic link between dinosaurs and modern birds. In October 2016, Tumblr user distinguishedbaloney posted the image and caption

shown in Figure 6 rather facetiously expressing grief over the loss of the dinosaurs. Shortly after, user grandenchanterfiona posted a photo of a Scaly-breasted lorikeet with a speech bubble saying, "Stop telling people I'm dead", a reference to the "Sometimes I can still hear his voice" meme which emerged from the 2003 animated film Brother Bear ["Sometimes I can still hear his voice [Wiki]", 2019].

Figure 6. Tumblr user grandenchanterfiona references the "Stop telling people I'm dead" meme to point out that extant birds are dinosaurs in biological terms [grandenchanterfiona, 2016, Retrieved 8 February 2022].

Nearly all the works I have referenced thus far are significantly anonymized, with the creators' status as lay fans of science, science students, or professional scientists is left vague or unclear (a notable exception is the A Dinosaur A Day blog, which is authored by Meig Dickson a PhD student in paleontology and paleobiology at New Mexico State University). This anonymity allows for a certain level of freedom in expressing opinions or critiques toward popular culture, the role of global capitalism in science, the practice of specific scientific disciplines, or the

perceived ignorance of lay people. When scientific institutions seek to engage the public through humor on social media and Internet memes, there are obvious risks associated with using a "dead" meme or misunderstanding the connotations of a given meme [Wiggins, 2019]. There are also the risks specific to science communication: the joke or meme always requires some background knowledge to be understood, audiences may feel alienated if they do not have the requisite knowledge to "get" the joke — either the scientific knowledge or the reference or context of the meme itself [Riesch, 2015; Wiggins, 2019; Yeo et al., 2021].

The Royal Tyrrell Museum, a paleontological museum in Alberta, Canada, posts memes to their social media (Facebook, Twitter, and Instagram) every Monday. The meme shared in July 2021 (Figure 7) is intermemetic meme, referencing both the "Bae come over" meme which originated on Twitter in 2014 and the "Free real estate" meme, a reference to a 2009 sketch from the Adult Swim series Tim and Eric Awesome Show Great Job! [Know Your Meme, n.d.-a, n.d.-d]. But in order to get the meme, the audience also must understand the role of the Tiktaalik in evolutionary history as the direct ancestor of all tetrapods, or four-limbed land-dwelling animals [Padian, n.d.]. In contrast, another meme shared in July 2021 is a simple "Expectation vs. Reality" meme, visually comparing the expectation of discovering a fully-articulated dinosaur fossil with the reality of finding an assortment of crushed fossils. While these two examples require different levels of contextual information to understand, neither of these memes from the Royal Tyrell Museum has a particular target. The short-lived "Red Flag" meme from October 2021 originally emerged on Twitter and used the red flag emoji to highlight warning signs or conversation deal-breakers in a variety of imagined settings [Mendoza, 2021]. The Tyrell Museum's timely entry, shown in Figure 8, to the trend playfully pokes fun at those museum-goers who would label any large theropod dinosaur a T. rex. There is a potential risk here as well: when science institutions or professionals highlight the apparent ignorance of lay people in an attempt at humor, they may actually end up alienating audiences and reinforcing negative stereotypes about scientists as aloof and superior [Riesch, 2015; Yeo et al., 2021]. On the other hand, as a natural history museum and research facility dedicated to the study of paleontology, the Royal Tyrrell Museum may feel confident in assuming that those who follow the museum on social media are themselves professional scientists, students of science, or lay people with a devoted interest in science and paleontology. In this regard, by sharing memes which require some degree of specialized knowledge or gently poking fun at those lacking such knowledge, the Tyrrell Museum can include the institution itself and lay science fans within the same in-group, potentially strengthening two-way engagement between the public and the museum.

Paleontology fans and Gregory S. Paul

In March 2022 Gregory Paul and colleagues published the article "The Tyrant Lizard King, Queen and Emperor: Multiple Lines of Morphological and Stratigraphic Evidence Support Subtle Evolution and Probable Speciation Within the North American Genus Tyrannosaurus," in Evolutionary Biology. The article proposes that the species Tyrannosaurus rex is actually three separate species: Tyrannosaurus rex, Tyrannosaurus imperator, and Tyrannosaurus regina [Paul, Persons & Raalte, 2022].

The provocative study received significant media attention from both general news

Figure 7. The Royal Tyrrell museum memes the rise of the Tiktaalik [Royal Tyrrell Museum of Palaeontology [@royaltyrell], 2021, Retrieved 8 February 2022].

media and science news sources. The study has not been well received within the paleontological community, and the research methods have been criticized for overlooking the wealth of data and T. rex specimens, and instead selecting only that data which supported the hypothesis [Barras, 2022; Elbein, 2022; Greshko, 2022]. While the aforementioned science reporting cited here (New Scientist, The New York Times Science section, and National Geographic, respectively) all highlighted the controversial nature of the study, many other general news and popular science sources downplayed or entirely omitted critiques of the research.

Pop science social media jumped to share the news of three Tyrannosaurus species. The YouTube series SciShow, which is hosted by author and social media personality Hank Green and has 7 million subscribers, posted "There's A New Tyrannosaurus in Town" to the channel on March 4 and at the time of writing, the video has received nearly 200,000 views just two weeks later [Complexly [SciShow], 2022]. The social media brand and science news aggregator, IFL Science, which has over 20 million followers on Facebook and over 200,000 followers on Twitter, posted "Say hello to Tyrannosaurus imperator (tyrant lizard emperor) and Tyrannosaurus regina (tyrant lizard queen)" to Facebook on 1 March 2022. The post garnered over 2,000 reactions, 113 comments, and 92 shares [IFLScience, 2022].

While many traditional and new media outlets shared "clickbait" style headlines

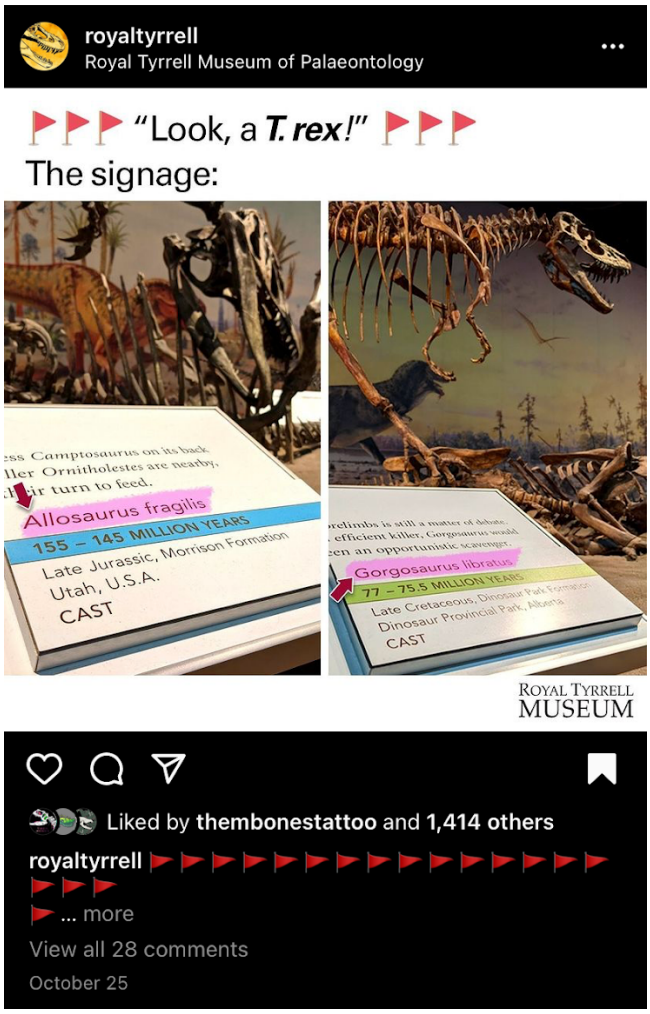

Figure 8. The Royal Tyrrell Museum adds to the February 2021 "Red Flags" meme [royaltyrell, 2021, Retrieved 8 February 2022].

intended more to attract attention than to report on scientific debates, other corners of the Internet delighted in the rapid creation and sharing of memes to critique a weak scientific hypothesis, debates over dinosaur classification more broadly, and even Gregory S. Paul himself. For example, several iterations of the "Spider-Man Pointing at Spider-Man" meme circulated on Reddit, including the redrawn version shown in Figure 9, originally posted to Instagram by Sergio Ibarra Mellado (@theaftenogaster) on March 1. This meme, based on an image from the 1960s Spider-Man cartoon, visually argues that the proposed three Tyrannosaurus species are in fact one in the same [Know Your Meme, n.d.-f].

A reference to a 2003 episode of Futurama shared in the Reddit community r/Dinosaurs argued "Your hypothesis is bad and you should feel bad" [see: Know Your Meme, n.d.-g] and another meme likened Gregory S. Paul to an overeager "Bro Explaining" to an uncomfortable young woman, a visual stand-in for "The rest of the paleo community" shown in Figure 10 [see: Know Your Meme, n.d.-e].

These and similar memes circulated in the days after the publication of "The Tyrant Lizard King, Queen and Emperor" study. In one sense, the memes allowed students, lay people and fans of paleontology, an immediate channel to "talk back"

Figure 9. Biology student and illustrator Sergio Ibarra Mellado contributes to the meme-ing of "The Tyrant Lizard King, Queen and Emperor" on Instragram on 1 March 2022 [theafenogaster, 2022, Retrieved 16 March 2022].

to the authors of the controversial study. Jenkins [2013] characterized fans and participatory culture more broadly as rejecting "proper" critical and aesthetic distance and calling into question institutional authority and expertise. In these examples, fans chose to forgo more measured and objective approaches in their responses to what they viewed as flawed scientific research. Importantly, while the authors of the study may be the target of these memes, they are not the intended audience. As a genre, memes are not just an easily accessible mode of communication, but also represent social motivations and cultural participation [Wiggins, 2019]. In other words, the creation and sharing of these memes show the active participation of paleontology fans within the communities within broader digital cultures.

Conclusion

Fan studies and memetics may offer new ways to conceptualize public engagement with science. Through this lens, science fans may be understood as active participants in digital cultures of science. Digital culture supports collective meaning-making and favors modes of expression that are sharable and often transformative. Science fans may share interests, negotiate meaning, remix popular culture through participation in shared digital cultures in much the same way that more typical media fans take part in their own "fandoms." The lack of critical distance characteristic of fandom does become problematic when empirical scientific understandings come into conflict with science fans' perceptions and

Figure 10. Figure 10: Reddit user Ancalago-123 compares author and illustrator Gregory S. Paul to an over-eager "Bro Explaining" in this Reddit meme from 1 March 2022 [Ancalago-123, 2022, Retrieved 7 March 2022].

identity, there may also be opportunities for fans and lay publics to "talk back" to individuals or institutions and challenges traditional methods of communication and institutional hierarchy.

Scholars and practitioners of science communication have previously described public understanding of science as being intricately and deeply entwined with popular media and cultural frames more broadly. The discursive power of transformative works such as fan works and memes equips publics with new modes of expressing and sharing negotiated readings and commentary. Put another way, lay publics, science enthusiasts, students of science, and professional scientists may inject pop culture into their science and science into their pop culture, disrupting both the traditional trajectory of mass-produced cultural artifacts and of traditional science communication. There are many avenues for further research, such as the success of institutions like the Monterey Bay Aquarium in creating a strong social media presence through memes, the adoption

of "scienceyness" as part of the identity work of social media, or the engagement of scientists as fans and creators in digital cultures. My hope here is to begin a deeper conversation and demonstrate the need for further attention and research into the dynamics and discourses between science and the public in digital cultures.

References

a-dinosaur-a-day (2019). It's not about having things in common [Blog comment]. *Tumblr blog*. Retrieved from https://a-dinosaur-a-day.com/post/188710291515/cladistics-ruined-my-life

Ancalago-123 (2022). hopping on this "Three rex" meme train [Reddit post]. *Reddit*. Retrieved from https://www.reddit.com/r/PrehistoricMemes/comments/t4lv5j/hopping_on_this_three_rex_meme_train/

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

Barras, C. (2022). Tyrannosaurus rex may actually be three separate species. *New Scientist*. Retrieved from https://www.newscientist.com/article/2308160-tyrannosaurus-rex-may-actually-be-three-separate-species/

Black, R. (2012a). Who Doesn't Love Fuzzy Dinosaurs? *Smithsonian Magazine*. Retrieved 22 November 2021, from Smithsonian Magazine website. Retrieved from https://www.smithsonianmag.com/science-nature/who-doesnt-love-fuzzy-dinosaurs-16982900/

Black, R. (2012b). Why Is It Cool To Hate On Dinosaur Discoveries? *Smithsonian Magazine*. Retrieved 22 November 2021, from Smithsonian Magazine website. Retrieved from https://www.smithsonianmag.com/science-nature/why-is-it-cool-to-hate-on-dinosaur-discoveries-76335199/

Black, R. (2021). A T. Rex Sold for $31.8 Million, and Paleontologists Are Worried. *Smithsonian Magazine*. Retrieved 8 December 2021, from Smithsonian Magazine website. Retrieved from https://www.smithsonianmag.com/science-nature/t-rex-sold-318-million-and-paleontologists-are-worried-180976071/

Brossard, D. (2013). New media landscapes and the science information consumer. *Proceedings of the National Academy of Sciences 110* (Supplement 3), 14096–14101. doi:10.1073/pnas.1212744110. PMID: 23940316

Butler, M., Farzin, S. & Fuchs, M. (2021). PandemIcons? The Medical Scientist as Iconic Figure in Times of Crisis. *Configurations 29* (4), 435–451. doi:10.1353/con.2021.0031

Collver, J. & Weitkamp, E. (2018). Alter egos: an exploration of the perspectives and identities of science comic creators. *JCOM 17* (01), A01. doi:10.22323/2.17010201

Complexly [SciShow] (2022). There's A New Tyrannosaurus in Town [Video]. *YouTube*. Retrieved from https://youtu.be/X5ECr0zgqi4

Coppa, F. (Ed.) (2017). *The Fanfiction Reader*. doi:10.3998/mpub.9479376

Davies, S. R., Halpern, M., Horst, M., A. Kirby, D. & Bruce Lewenstein (2019). Science stories as culture: experience, identity, narrative and emotion in public communication of science. *JCOM 18* (05), A01. doi:10.22323/2.18050201

de Saint Laurent, C., Glăveanu, V. P. & Literat, I. (2021). Internet Memes as Partial Stories: Identifying Political Narratives in Coronavirus Memes. *Social Media + Society 7* (1). doi:10.1177/2056305121988932

Elbein, A. (2022). They Want to Break T. Rex Into 3 Species. Other Paleontologists Aren't Pleased. *The New York Times*. Retrieved from https://www.nytimes.com/2022/02/28/science/tyrannosaurus-rex-species.html

Fanlore (n.d.). Fan [Wiki]. Retrieved from https://fanlore.org/wiki/Fan

Farinella, M. (2018). The potential of comics in science communication. *JCOM 17* (01), Y01. doi:10.22323/2.17010401

grandenchanterfiona (2016). [Photo of a green parrot with the text "Stop telling people I'm dead"] [Blog comment]. *Tumblr blog*. Retrieved from https://grandenchanterfiona.tumblr.com/post/151641913853

Greshko, M. (2020). 'Stan' the T. rex just sold for $31.8 million — and scientists are furious. *National Geographic*. Retrieved from https://www.nationalgeographic.com/science/article/stan-tyrannosaurus-rex-sold-at-auction-paleontologists-are-furious

Greshko, M. (2022). Should T. rex be 3 species? New study sparks fierce debate. *National Geographic*. Retrieved from https://www.nationalgeographic.com/science/article/call-to-split-tyrannosaurus-rex-into-3-species-sparks-fierce-debate

Hargittai, E., Füchslin, T. & Schäfer, M. S. (2018). How do young adults engage with science and research on social media? Some preliminary findings and an agenda for future research. *Social Media + Society 4* (3), 1–10. doi:10.1177/2056305118797720

harmalite (2019). CLADISTICS ruined my life [Tumblr post]. *Tumblr blog*. Retrieved from https://harmalite.tumblr.com/post/185086923564/cladistics-ruined-my-life

Harmon, A. (1997). In TV's Dull Summer Days, Plots Take Wing on the Net. *The New York Times*. Retrieved from https://www.nytimes.com/1997/08/18/business/in-tv-s-dull-summer-days-plots-take-wing-on-the-net.html

Hinck, A. & Davisson, A. (2020). Fandom and politics. *Transformative Works and Cultures 32*. doi:10.3983/twc.2020.1973

Huber, B., Barnidge, M., Gil de Zúñiga, H. & Liu, J. (2019). Fostering public trust in science: the role of social media. *Public Understanding of Science 28* (7), 759–777. doi:10.1177/0963662519869097

IFLScience (2022). Say hello to Tyrannosaurus imperator (tyrant lizard emperor) and Tyrannosaurus regina (tyrant lizard queen). *Facebook*.

Jenkins, H. (2006). *Convergence culture: where old and new media collide*. 1. publ. in paperback 2008, updated with a new afterword [Repr.] New York, U.S.A.: New York University Press. Retrieved from https://www.jstor.org/stable/j.ctt9qffwr

Jenkins, H. (2013). *Textual poachers: television fans and participatory culture*. Updated 20th anniversary ed. New York, U.S.A.: Routledge.

Jenkins, H. (2018). Fandom, Negotiation, and Participatory Culture. In P. Booth (Ed.), *A Companion to Media Fandom and Fan Studies* (pp. 11–26). doi:10.1002/9781119237211.ch1

Jonsson, A. & Grafström, M. (2021). Rethinking science communication: reflections on what happens when science meets comic art. *JCOM 20* (02), Y01. doi:10.22323/2.20020401

JulisCaesar (2015, November 12). 5 Times the Raptors Tried to Kill Miriam, and 1 Time They Didn't. Archive of Our Own.

Know Your Meme (n.d.-a). Bae Come Over [Know your meme website]. Retrieved from https://knowyourmeme.com/memes/bae-come-over

Know Your Meme (n.d.-b). Feel Like Pure Shit Just Want Her Back x [Know your meme website]. Retrieved from https://knowyourmeme.com/memes/feel-like-pure-shit-just-want-her-back-x

Know Your Meme (n.d.-c). Heart Locket GIF [Know your meme website]. Retrieved from https://knowyourmeme.com/memes/heart-locket-gif

Know Your Meme (n.d.-d). It's Free Real Estate [Know your meme website]. Retrieved from https://knowyourmeme.com/memes/its-free-real-estate

Know Your Meme (n.d.-e). John Silver Explaining to Anna Jay [Know your meme website]. Retrieved from https://knowyourmeme.com/memes/john-silver-explaining-to-anna-jay

Know Your Meme (n.d.-f). Spider-Man Pointing at Spider-Man [Know your meme website]. Retrieved from https://knowyourmeme.com/memes/spider-man-pointing-at-spider-man

Know Your Meme (n.d.-g). Your Music's Bad and You Should Feel Bad [Know your meme website]. Retrieved from https://knowyourmeme.com/memes/your-musics-bad-and-you-should-feel-bad

Kostygina, G., Tran, H., Binns, S., Szczypka, G., Emery, S., Vallone, D. & Hair, E. (2020). Boosting Health Campaign Reach and Engagement Through Use of Social Media Influencers and Memes. *Social Media + Society 6* (2), 205630512091247. doi:10.1177/2056305120912475

Lewenstein, B. V. (1995). From Fax to Facts: Communication in the Cold Fusion Saga. *Social Studies of Science 25* (3), 403–436. doi:10.1177/030631295025003001

Mendoza, J. (2021). Red flag meme: Here's why you're seeing [red flag emojis] all over your social media. *USA TODAY*. Retrieved from https://www.usatoday.com/story/tech/2021/10/13/red-flag-meme-takes-over-tik-tok-twitter-facebook-instagram/8437407002/

Mueller-Herbst, J. M., Xenos, M. A., Scheufele, D. A. & Brossard, D. (2020). Saw It on Facebook: The Role of Social Media in Facilitating Science Issue Awareness. *Social Media + Society 6* (2), 205630512093041. doi:10.1177/2056305120930412

Nisbet, M. C. & Scheufele, D. A. (2009). What's next for science communication? Promising directions and lingering distractions. *American Journal of Botany 96* (10), 1767–1778. doi:10.3732/ajb.0900041

Padian, K. (n.d.). Tiktaalik roseae | fossil vertebrate. *Encyclopedia Britannica*. Retrieved from https://www.britannica.com/animal/Tiktaalik-roseae

Paul, G. S., Persons, W. S. & Raalte, J. V. (2022). The Tyrant Lizard King, Queen and Emperor: Multiple Lines of Morphological and Stratigraphic Evidence Support Subtle Evolution and Probable Speciation Within the North American Genus Tyrannosaurus. *Evolutionary Biology 49* (2), 156–179. doi:10.1007/s11692-022-09561-5

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

Pulos, R. (2020). COVID-19 crisis memes, rhetorical arena theory and multimodality. *JCOM 19* (07), A01. doi:10.22323/2.19070201

Riesch, H. (2015). Why did the proton cross the road? Humour and science communication. *Public Understanding of Science 24* (7), 768–775. doi:10.1177/0963662514546299. PMID: 25138269

Royal Tyrrell Museum of Palaeontology [@royaltyrell] (2021). This #MemeMonday post features the 'fishapod' that started it all! #tiktaalik". *Twitter*. Retrieved from https://twitter.com/RoyalTyrrell/status/1414596705056591874

royaltyrell (2021). "Look, a T. rex!" [red flag emojis]. *Twitter*. Retrieved from https://twitter.com/RoyalTyrrell/status/1452644887632007172

rubysunstone (2021). [Animated heart locket with "feel like shit just want stan back" text] [Tumblr post]. *Tumblr blog*. Retrieved from https://rubysunstone.tumblr.com/post/643778520091328512

Schäfer, M. S., Füchslin, T., Metag, J., Kristiansen, S. & Rauchfleisch, A. (2018). The different audiences of science communication: a segmentation analysis of the Swiss population's perceptions of science and their information and media use patterns. *Public Understanding of Science 27* (7), 836–856. doi:10.1177/0963662517752886

Schell, H. (1997). Outburst! A Chilling True Story about Emerging-Virus Narratives and Pandemic Social Change. *Configurations 5* (1), 93–133. doi:10.1353/con.1997.0006

Shifman, L. (2014). *Memes in digital culture*. Cambridge, MA, U.S.A.: The MIT Press.

Sometimes I can still hear his voice [Wiki]. (2019). *Fanlore*. Retrieved from https://fanlore.org/wiki/Sometimes_I_can_still_hear_his_voice

strange-buffoon (2021). Early Triassic Park comic [Tumblr post]. *Tumblr blog*. Retrieved from https://strange-buffoon.tumblr.com/post/639983555590717440/im-just-saying-that-maybe-it-wouldnt-have-turned

Su, L. Y.-F., McKasy, M., Cacciatore, M. A., Yeo, S. K., DeGrauw, A. R. & Zhang, J. S. (2021). Generating Science Buzz: An Examination of Multidimensional Engagement With Humorous Scientific Messages on Twitter and Instagram. *Science Communication 44* (1), 30–59. doi:10.1177/10755470211063902

theafenogaster (2022). The Tyrant Lizard King, Queen and Emperor: Multiple Lines of Morphological and Stratigraphic Evidence Support Subtle Evolution and Probably Speciation Within the North American Genus Tyrannosaurus [Instagram post]. *Instagram*. Retrieved from https://www.instagram.com/p/Cak8JfKrQHB/

Thomas, B. (2015). A Disease of Scienceyness. *Medium*. Retrieved from https://writingben.medium.com/a-disease-of-scienceyness-7b5571a34953

Turk, T. (2018). Interdisciplinarity in Fan Studies. In P. Booth (Ed.), *A Companion to Media Fandom and Fan Studies* (pp. 539–551). doi:10.1002/9781119237211.ch34

Vicari, S. & Murru, M. F. (2020). One Platform, a Thousand Worlds: On Twitter Irony in the Early Response to the COVID-19 Pandemic in Italy. *Social Media + Society 6* (3), 205630512094825. doi:10.1177/2056305120948254

Viergacht (2017). Jurassic Park remastered [Tumblr post]. *Tumblr blog*. Retrieved from https://viergacht.tumblr.com/post/164711223287/jurassic-park-remastered

Wiggins, B. E. (2019). *The discursive power of memes in digital culture: ideology, semiotics, and intertextuality*. New York, U.S.A.: Routledge.

Yeo, S. K., Cacciatore, M. A., Su, L. Y.-F., McKasy, M. & O'Neill, L. (2021). Following science on social media: The effects of humor and source likability. *Public Understanding of Science*, 096366252098694. doi:10.1177/0963662520986942

Zastrow, M. (2015). A criticism of 'science fandom' prompts online reflection. *Nature 519* (7543), 265–265. doi:10.1038/519265f

Zeng, J., Schäfer, M. S. & Allgaier, J. (2021). Reposting "Till Albert Einstein Is TikTok Famous": The Memetic Construction of Science on TikTok. *International Journal of Communication 15*, pp. 3216–3247. Retrieved from https://ijoc.org/index.php/ijoc/article/view/14547/3497

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