A SCIENTIST AND A COMEDIAN WALK INTO A BAR:
HUMOUR'S ROLE IN SCIENCE COMMUNICATION

by

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Abstract

The art of communicating science to non-scientists (e.g., policy makers, lay-audiences) is the challenge faced by science communicators. Not only is it vital that scientific information leave the realm of academia to be put into action, but the goals of science communication increasingly include public engagement with science. Traditional tactics for public engagement have faced roadblocks in terms of being accessible and actually engaging to a broad audience.

Communicators have thus identified that non-traditional techniques, such as adding humour, may make scientific information more accessible. In this MRP, I investigate the use of humour as a creative communication tool to engage the public with science in informal settings. I analyze 34 episodes of a funny science podcast, *The Infinite Monkey Cage*, to identify how humour is used, and by whom (e.g., scientists, non-scientists). I identify potential roles of common humour types and humour usage styles, as well as the role of each author type. These findings may serve to aid future humorous science communication endeavors, as well as to guide future research.

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Contents

Author's Declaration.....	ii
Abstract	iii
Acknowledgements.....	iv
List of Tables	vi
List of Figures	vii
Introduction.....	1
Research Questions.....	4
Literature Review.....	6
Role of Humour in Science Communication	6
Pitfalls of Humour in Science Communication.....	8
Types of Media Studied	9
Types of Humour Studied	10
Methods.....	11
Sample.....	11
Data Collection.....	13
Analysis.....	17
Findings.....	18
Discussion.....	24
Limitations	40
Conclusion	42
Contributions to Humorous Science Communication Research	42
Suggestions for Future Research.....	44
References.....	46

List of Tables

Table 1: Humour types and definitions used to code sample	14
Table 2: Humour types sorted by usage rate in sample	18

List of Figures

Figure 1: Central vs. tangential use of each humour type	21
Figure 2: Humour type usage by each author type	23
Figure 3: Central vs. tangential usage by each author type	24

Introduction

From freshly-added stand-up comedy specials on streaming services, to a seemingly endless supply of funny podcasts, and every cat meme in between, humour is a ubiquitous source of entertainment. For those of us who tend not to take life too seriously, humour can feel like welcome relief from the mundane – what better way is there to cope with the boredom of a dentist’s waiting room than to scroll through videos of people falling off treadmills? To take it a step further, humour, and laughter (the best medicine), are sure-fire ways to pull many of us out a funk. But why stop there? If humour can do things like relieve boredom and improve our mood, maybe it can play a role in things like learning and engagement with some, well, more boring topics (we all have that uncle that drones on and on about politics, would it hurt to throw a knock-knock joke or two in the mix?) Boring is subjective of course, and in this MRP, I chose to look to humour as a way to engage people with science, which I personally find (mostly) fascinating, but others may not.

Take this example, for instance. After a thorough discussion about the marvels of space exploration on the science-comedy podcast, *The Infinite Monkey Cage*, comedian Mark Steel is asked his opinion on what would be an amazing next step for space travel. His response discusses the human aspect of travelling to Mars as the most captivating next step for the layperson:

“...I think the human side of experimentation is probably what’s most fascinating rather than, I’m sure, you know, when we finally get there well find some rocks and muck about with them. But the amazing things, the physical thing of a human being, that’s why it’s so much more captivating than some little clanky metal thing that we’ve sent up to various places and people who say, yeah, yeah, yeah, clanky metal things, one on Saturn probably, I don’t know...”

Brian Cox, co-host and physicist, interjects: “That’s a gas planet,” implying the improbability of landing a rover on Saturn.

And later, astronaut Helen Sharman attempts to relay the science and importance behind rovers: “In defense of these clanky metal things, I mean they can do absolutely tremendous things...” and she goes on to describe those tremendous things (Cox & Ince, 2019e).

What started as a question of opinion turned into a conversation between comedian and scientists about a complex scientific topic. Steele attempts to describe what about space travel would be the most engaging for a lay public, while the scientists attempt to ensure that he’s not misrepresenting the science. This dichotomy is not unusual for this podcast, as it is designed to facilitate these kinds of (hilarious) conversations. And they were funny – as difficult as it is to relay conversational humour through text, Steele’s irreverence and Cox’s outwitting indeed garnered laughter from the audience. But is using humour in this way a useful method to engage audiences with science?

This MRP investigates the use of humour as a communication tool to engage the public with science in informal settings. Scientists and research organizations are, indeed, increasingly interested in finding useful tools for public engagement to translate new research to an audience outside of the scientific community, as traditional paths for this type of communication have faced roadblocks. For example, communicators are increasingly aware that the public have a diverse range of personal experiences and contexts which may affect how they engage with traditional science communication (Kappel & Holmen, 2019). To overcome roadblocks such as these (among many others), some science communicators are moving away from traditional written formats, and towards creative engagement techniques (Kappel & Holmen, 2019), such as humour.

I myself have difficulty engaging with certain science topics that I think could use a little pizzazz, such as anything to do with physics – I just cannot get into physics. What a coincidence, then, that the medium I chose to analyze for this MRP is a science-comedy podcast co-hosted by Brian Cox, a physicist. What follows in this paper is a tale of my journey to listen to this podcast,

The Infinite Monkey Cage, and see if I can actually understand all the physics episodes (just kidding, I do more than that, but now you have the subtext to understand my many references to the complexity of physics). This podcast features many other types of science, however, and it's their goal to add that humorous pizzazz to each episode.

Scientists and communicators have not commonly used such creative techniques as humour in traditional science communication, likely because of how science has been traditionally viewed. Some refer to this divide as deference vs. irreverence, where science is classically viewed with power and authority (deference), and where using humour to discuss science (irreverence) challenges the implied need for respect of that authority (Bell, 2011). However, as the goals of science communication change to include public engagement, rather than simply conveying facts to stakeholders, communicators have identified that non-traditional techniques, such as adding humour, may make scientific information more accessible (as the comedians on this podcast would likely attest). This suggests the need for research to investigate the potential *utility* of irreverence in science communication. *The Infinite Monkey Cage*, in fact, is described as a “witty, irreverent look at the world through scientists' eyes” (Cox & Ince, 2009–present).

Accordingly, using humour to communicate science isn't restricted to science communicators, as comedians like Ricky Gervais or Robin Ince (co-host of *The Infinite Monkey Cage*) have used their comedic platforms to discuss scientific topics (Pinto & Reisch, 2017). The notion that using humour may lead to misinterpretation or misrepresentation of the science being communicated, however, is a major focus of research that investigates these techniques.

In many of the articles studying this topic, researchers note that humour is often recommended as a good tool for science communication, but that this claim generally lacks empirical evidence (e.g., Yeo et al., 2020b). As this body of research is young, with most research

from 2015-present, the literature review is exploratory in nature to identify findings or major gaps in several relevant areas including: the role and potential pitfalls of humour for audience engagement with science, and the types of media and humour that have been studied. The research questions presented in the following section will thus address some of the gaps in the literature.

Research Questions

The following research questions explore how humour is used in science communication. This MRP uses a funny science podcast, *The Infinite Monkey Cage*, to investigate these questions. Podcasts are an increasingly popular form of media, including for scientific topics (MacKenzie, 2019), but podcasts have not been studied in relation to humorous science communication until the current research.

Firstly, few studies have examined different types of humour, but there is some evidence for differential effects or considerations based on the type (e.g. Yeo et al., 2020b; Feldman, 2017). Identifying the types of humour used most in science communication is necessary to set the stage for further research on the role of humour in science communication on audience engagement (whether positive or negative). Of the few studies examining humour types in science communication, Yeo et al. (2020b) conducted a preliminary study to identify most common types of humour in scientific social media posts. These researchers coded humour types using categories developed by Buijzen and Valkenburg (2004) from television commercials, and Long and Graesser (1988) from television talk shows, as well as inductively (Yeo et al., 2020b). The first research question will thus use Buijzen and Valkenburg's (2004) and Long and Graesser's (1988) categories of humour to identify the types of humour used in a sample of podcasts discussing science:

RQ1: What types of humour are used most when communicating science in a sample of podcasts?

Secondly, it is important to consider how humour types are used to discuss science – humour may be central to the scientific content by incorporating the scientific content itself into a joke or witty comment, or may be tangential to the scientific content by using humour only slightly connected to the main scientific content. Considerations regarding potential pitfalls of using humour to communicate science (e.g., misunderstanding of humour, misinterpretation of concepts) may be most salient for central humour, which incorporates science itself into the humour. The second research question will categorize the type of humour in this way:

RQ2: Is the humour that is used central or tangential to the scientific content?

A final consideration regarding humour use in science communication includes the author of the humour (i.e., who made the witty comment or joke). As noted, either scientists and/or comedians can be authors of the humour (Pinto & Reisch, 2017). It is likely that scientists, rather than comedians (or other non-scientists), have a more in-depth understanding of the science involved in their humour, especially if the humour relates to their own research. It is thus possible that their humour may represent the science more accurately than other author types' humour would. As a secondary consideration for this research question, it is also likely that scientists and comedians use different types of humour and at different rates when discussing science, and evidence of this could prove useful for future humorous science communication efforts. The third research question will thus identify the author of the humour:

RQ3: Who is the author of the humour, and who is the author of the research being discussed? If the authors are different, what does this mean?

These research questions are the basis for this MRP, and were developed based on gaps in the literature as presented in the next section.

Literature Review

This section reviews the current state of literature regarding the theoretical roles and pitfalls of humour in science communication, as well as the types of humour and media that have been studied thus far in humorous science communication research.

Role of Humour in Science Communication

Many authors in this body of literature note a theoretically beneficial role of humour in science communication, but also note the lack of evidence to support this claim. This section examines the major themes from those studies that do examine humour's role.

Learning

Learning science is a main objective of informal science communication (Pinto & Riesch, 2017). Whether humour can actually aid this learning, however, has mixed reviews. In Kaltenbacher and Drews' (2020) review of humour in climate communications, 6 studies investigated learning effects, 4 of which found positive learning effects of humour, and 2 which did not. Additionally, Pinto, Maçral and Vaz's (2015) study that had scientists perform science comedy routines found that attendees had mostly positive, but also mixed reviews as to whether they felt they learned anything about the topic (approximately 70% felt they did, but 29% did not). This area of research may benefit from additional research to determine whether humour influences scientific learning in informal settings.

Mirth and Positive Affect as a Mediator

Overall, there is general support from the literature that mirth (or amusement) and positive affect may contribute to humour's effect of making science communication more engaging

(Kaltenbacher & Drews, 2020) likely as a mediator (Yeo et al., 2020b). Yeo et al. (2020b) exposed participants to science-related Twitter posts with one of three types of humour, or a non-humorous post, and found that higher levels of mirth (in the humorous conditions) led to a higher intent to like, share, or repost. Additionally, Yeo et al. (2020a) found that participants who perceived more mirth in a science comedy video (through the addition of audience laughter) rated comedy as a more valid source of science. Finally, Osnes, Boykoff and Chandler (2019) found that creating good-natured comedy about climate science helped students process negative emotions about the subject. Other studies have also noted that lightening the mood of the classically doom and gloom frame of climate science can increase engagement with this topic (Boykoff & Osnes, 2019; Kaltenbacher & Drews, 2020). Given the apparent benefits of mirth on engagement, future studies should expand these findings to examine whether several different types of humour or media elicit more mirth than others.

Gateway Effect

A few studies suggest that humorous science communication can act as a gateway, introducing the audience to a topic they would then be inclined to pay attention to in the future. This theory stems from findings in humorous political communication research (e.g., Baek & Wojcieszak, 2009). In a review of science communication in satirical comedy shows (e.g., The Daily Show, The Colbert Report), Feldman (2017) states support for this theory, noting that these entertaining soft news shows draw an audience that may not otherwise pay attention to scientific topics on traditional news platforms. The entertaining frame, Feldman (2017) notes, may be cognitively easier to engage with. There is limited empirical support for this theory, however, as it may require a longer-term study to examine if audience members actually engage more on their

own to a significant extent, which studies are currently absent from the body of literature (Kaltenbacher & Drews, 2020; Vraga, Kim & Cook, 2019).

Pitfalls of Humour in Science Communication

Despite the potential role of humour to increase learning and engagement with science, researchers do ponder whether the potential risks outweigh the rewards due to the general lack of evidence. The following is a summary of potential pitfalls communicators or comedians may face, according to researchers.

Audience Characteristics

Researchers in this field are commonly concerned with humour's dependence on certain audience characteristics (Kaltenbacher & Drews, 2020).

Need for Humour. Yeo et al. (2020b), in their study of mirth and humour in science, noted that an audience trait, “need for humour”, moderated the effects of mirth on intentions to engage, such that individuals who seek out more humour in their lives were more likely to engage with humorous social media posts.

Science Background. Additionally, some researchers note that comedy or jokes about science often require the audience to have some background information on the topic to understand the joke (Cain, 2019; Riesch, 2015). This may lead to problems when trying to engage a lay audience, and could create an alienating divide between in-groups (who have that science background and get the joke) and out-groups (who do not) (Cain, 2019; Riesch, 2015).

Misinterpretation. On a related note, many researchers theorize that audiences who do not understand a particular science joke may misinterpret the intended meaning of the joke (Cain,

2019; Pinto, Maçral & Vaz, 2015; Pinto & Riesch, 2017; Simis-Wilkinson et al., 2018), especially in the case of complex humour like irony where the joke may be taken literally, rather than ironically as intended (Feldman, 2017). Additional concerns are that a joke may inadvertently downplay the severity of the issue (Feldman, 2017; Skurka et al., 2018), or the mere presence of humour may make the science being communicated seem less credible (Pinto & Riesch, 2017)¹.

Political Beliefs. Researchers have also identified the political beliefs of the audience as a potential area of concern. Political beliefs were particularly relevant in climate communication studies, where Feldman (2017) notes that satirical comedy often criticises conservative views. Feldman (2017) suggests that this tactic is potentially polarizing because of the aggressive nature of the critiques.

A number of researchers have noted that communicators should tread carefully and consider audience effects when taking a humorous approach, though there was often not empirical research investigating these characteristics specifically in this field.

Types of Media Studied

Studies about humour in science communication have focused on a variety of media. These include: satirical news sources (Becker & Anderson, 2019; Feldman, 2017), sketch comedy, improv (Boykoff & Osnes, 2019), stand-up comedy (Pinto, Maçral & Vaz, 2015), popular science articles (Pinto & Riesch, 2017), Twitter (Simis-Wilkinson et al., 2018; Vraga, Kim & Cook, 2019; Yeo et al., 2020b), and videos (Skurka et al., 2018).

¹ This finding is in contrast with that of Yeo et al. (2020a), who found that participants who perceived more mirth in a science comedy video rated comedy as a more valid source of science.

Additionally, Kaltenbacher and Drews' (2020) review of the use of humour in climate communication notes that the media focus of these studies fall most heavily into moving images, followed by text, visuals, and direct communication.

Though research has covered a wide range of media, not all media are covered, or covered exhaustively. For example, science podcasts (i.e., audio-only) have become increasingly popular, with 952 English-language science podcasts in 2018 (MacKenzie, 2019). MacKenzie (2019) and Kwok (2019) suggest comedy as a good tool for science podcasters, but there is no literature regarding podcast-specific usage or effects.

Types of Humour Studied

Few articles focused specifically on the effects or usage rates of different types of humour used for science communication. Of those that did, Feldman (2017) focussed on satire and irony, and Becker and Anderson (2019) examined one-sided versus two-sided satire. Additionally, Yeo et al. (2020b) conducted a preliminary content analysis of types of humour used in scientific Twitter and Instagram posts. To code the types of humour, Yeo et al. (2020b) relied on previous classifications of humour developed by Buijzen and Valkenburg (2004) (slapstick, surprise, irony, clownish humour, satire, misunderstanding, parody) and Long and Graesser (1988)² (irony, satire, sarcasm, over and understatement, self-deprecation, teasing, replies to rhetorical questions, clever replies to serious statements, double entendre, transformations of well-known sayings, puns). Yeo et al. (2020b) identified slapstick, anthropomorphism (a subtype of clownish humour), clownish humour, wordplay (mostly puns), satire/sarcasm, and parody as the main categories of humour in

² Yeo et al. (2020b) cite Martin (2007) who defines these 11 categories, and notes they were developed by Long and Graesser (1988).

scientific Twitter and Instagram posts. Yeo et al. (2020b) focused their study on two of the most popular types – anthropomorphism and wordplay, and both combined.

Additionally, many studies supported the idea that positive humour (rather than negative, critical humour) is likely the most effective (and least risky) for a variety of science communication goals (Gross, 2015; Osnes, Boykoff & Chandler, 2019; Pinto & Riesch, 2017), but none explicitly investigated positive versus negative humour’s effects or usage rates.

Future research should investigate whether different types of humour have different effects or usage rates.

Along with aiding the development of the research questions and methodology of this MRP, the literature presented in this section also provides a basis for the analysis of this MRP’s findings in the “Discussion” section.

Methods

This section discusses how data was collected and analyzed in order to answer this MRP’s research questions. First, I outline how I chose a podcast and a sample of episodes for this research, then I describe how the data was collected, and finally I describe how the data were analyzed in terms of each research question.

Sample

This MRP analyzed a sample of podcast episodes from the BBC podcast, *The Infinite Monkey Cage*, hosted by Brian Cox (a physicist) and Robin Ince (a comedian). The criteria for the podcast selection included that it use humour, and discuss any science topic. I found this podcast through a simple Google search for “funny science podcast”. *The Infinite Monkey Cage*

was one of few podcasts that appeared in many of the search results. I listened to an episode and decided it was genuinely funny (to a science nerd like me, at least³), and could see from its list of episodes that it discussed a wide variety of science topics. The wide range of science topics covered indicated the sample may be representative of humour use across several scientific disciplines. For each episode, the podcast brings in a variety of scientists and non-scientists (usually comedians, but occasionally others involved in science-engagement activities) as a panel to discuss various scientific topics using humour. Choosing a podcast that includes numerous scientists and non-scientists may also lead to a more representative sample of humour use rather than a podcast that features, for example, one individual. It may also allow comparisons of humour use across author types.

At the time of sampling (May 2021) and according to the BBC Radio 4 website, this podcast had 152 total episodes available that spanned from 2009-2021. For the scope of this MRP, I analyzed a sample of 34 episodes released from January 2019 to April 2021. The included episodes span from the start of “Series 19” to “Series 23” (up to the most recent, 152nd episode). This sample also excludes the following episodes listed within the sampling timeframe: “Lucy Beaumont’s Close Encounters” (irregular format – it features Beaumont, a comedian who is sent out as a correspondent), “Astronaut Special” (a repeat of a 2017 episode), and “Introducing the Curious Cases of Rutherford and Fry” (solely presents highlights from another podcast). This sample should provide the most timely and relevant information about how humour is used in this podcast. Additionally, the episodes in this sample consist of a variety of

³ Fun fact: this could be classified as self-deprecation, which was a very common type of humour in the sample. (After categorizing humour types in my sample for a few days I started categorizing every joke I or my friends made, to their sheer delight (irony).)

scientific disciplines, so it should provide a broad picture of humour usage independent of the type of science.

Data Collection

To collect data from this podcast, I listened to each episode in the sample and coded each instance of humour⁴ that related to a scientific topic in terms of 3 categories that address each research question. As outlined in “Coding”, below, I coded humour deductively from the categories that I established prior to coding. The following section describes each of the three categories which I coded for this sample.

Coding

I created an Excel document listing each episode along with the coded categories below for each instance of humour within that episode. For each category, humour that was entirely unrelated to a scientific topic was excluded⁵. I coded each instance of humour that related to a scientific topic as follows:

1. I first identified the type of humour used. The codes I used to classify humour are based on the types of humour categorized by Buijzen and Valkenburg (2004) and Long and Graesser (1988). Buijzen and Valkenburg (2004) grouped 35 subtypes of humour into 7 general categories. In order to code humour types most accurately, I opted to code humour in terms of the 35 subtypes as they are distinct from each other (Yeo et al. (2020b) also coded humour using these subtypes). Long and Graesser’s (1988) 11 types of wit or conversational humour

⁴ The terms “instance of humour” or “humour” are used because as Long and Graesser (1988) point out, there is a difference between “jokes” and “wit”, but humour encompasses both.

⁵ In the “Science of Laughter” episode (Cox & Ince, 2020a), I also excluded instances of humour that were used as examples to discuss the topic, as they were not being used to communicate science, but rather were the basis for scientific investigation.

were all included in the code list. There were three overlapping types of humour between these authors, resulting in 43 total types of humour. Table 1 lists and defines the 43 types of humour I used to code this sample.

Table 1

Humour types and definitions used to code sample

Humour type	Definition
Slapstick ^a	“Physical pie-in-the-face humor often involving degradation of someone's status” ^a
Peculiar face ^a	“Making a funny face, grimace” ^a
Peculiar voice ^a	“Funny, unusual voice” ^a
Coincidence ^a	“A coincidental and unexpected occurrence” ^a
Clumsiness ^a	“Lacking dexterity or grace” ^a
Stereotype ^a	“Stereotyped or generalized way of depicting members of a certain nation, gender, or other group” ^a
Ridicule ^a	“Making a fool of someone, verbally or nonverbally” ^a
Malicious pleasure ^a	“Taking pleasure in other people's misfortune; victim humor” ^a
Repartee ^a	“Verbal banter, usually in a witty dialogue” ^a
Conceptual surprise ^a	“Misleading the audience by means of a sudden unexpected change of concept” ^a
Visual surprise ^a	“A sudden unexpected visual/physical change” ^a
Transformation ^a	“Someone or something takes on another form or undergoes a metamorphosis; before/after” ^a
Exaggeration ^a	“Making an exaggeration or overstatement; reacting in an exaggerated way; exaggerating the qualities of a person or product” ^a
Irony ^{ab}	“Saying one thing and meaning something else or exactly the opposite of what you're saying” ^a
Sarcasm ^{ab}	“Biting remark made with a hostile tone; sarcasm is always a verbal put-down” ^a

Humour type	Definition
	Targets an individual with the intent to chastise ^b
Embarrassment ^a	“An awkward situation in which someone gets a sense of discomfort, uneasiness, or shame” ^a
Puns ^a	“Playing with the meaning of words” ^a
	“Humorous use of a word that evokes a dual meaning, or the use of words that have the same sound but different meanings” ^b
Scale ^a	“Very large or small sizes of objects that surpass people's logical expectations” ^a
Clownish behaviour ^a	“Making vigorous arm and leg movements or demonstrating exaggerated irregular physical behavior” ^a
Anthropomorphism ^a	“Objects or animals with human features” ^a
Speed ^a	“Talking or moving in very fast or slow motion” ^a
Chase ^a	“A pursuit or chase of someone or something” ^a
Satire ^{ab}	“Making a fool of or poking fun at well-known things, situations, or public figures” ^a
	Intends to critique social institutions or social policy ^b
Irreverent behavior ^a	“Lacking proper respect for authority or the prevailing standards” ^a
Outwitting ^a	“Outsmarting someone or the establishment by retort, response, or comeback” ^a
Peculiar music ^a	“Funny, unusual music” ^a
Misunderstanding ^a	“Misinterpreting a situation” ^a
Ignorance ^a	“Someone acts or behaves in a foolish, naive, gullible, or childish manner” ^a
Disappointment ^a	“A situation that leads to (minor) disappointment” ^a
Peculiar sound ^a	“Funny sound, unexpected sound, as in cartoons” ^a
Parody ^a	“Imitating a style or a genre of literature or other media” ^a
Bombast ^a	“Talking in a high-flown, grandiloquent, or rhetorical manner” ^a

Humour type	Definition
Rigidity ^a	“Someone who thinks along straight lines, who is conservative and inflexible” ^a
Absurdity ^a	“Nonsense, a situation that goes against all logical rules” ^a
Infantilism ^a	“Playing with the sound of words” ^a
Over and understatement ^b	Repeating something that someone says with a different emphasis, changing the meaning ^b
Self-deprecation ^b	Targeting oneself – can show modesty, put listener at ease, etc. ^b
Teasing ^b	Non-aggressive; targeting another person’s personal appearance or foibles ^b
Replies to rhetorical questions ^b	Replies to rhetorical questions; violates expectations ^b
Clever replies to serious statements ^b	“Clever, incongruous or nonsensical replies to serious statements or questions” which are deliberately misconstrued ^b
Double entendre ^b	“A statement or word deliberately misperceived or misconstrued so as to entertain a dual meaning”; often sexual ^b
Transformations of well-known sayings ^{bc}	Transforming these well-known sayings into novel statements ^b

Note. Humour types are arranged with Buijzen and Valkenburg’s (2004) categories first in the order that groups subtypes from the same general category together, as was helpful when coding. Long and Graesser’s types follow in the order presented in their Taxonomy of Wit, with repeats excluded.

^a Humour type as defined by Buijzen and Valkenburg (2004).

^b Humour type as defined by Long and Graesser (1988).

^c This type of humour was called “transformations of frozen expressions” by Long and Graesser (1988), but “transformations of well-known sayings” by Martin (2007), which was the version used by Yeo et al. (2020b), and thus herein as well.

2. Next, I identified whether the instance of humour was central or tangential to the science being discussed by indicating either “central” or “tangential” in the Excel document. For this

MRP, humour was “central” if it incorporated the scientific content itself into the humour, and “tangential” if it was simply related to the scientific content (see “Discussion” section for examples of each from this sample).

3. Finally, I identified who authored the humour. I first identified whether the person authoring the humour (i.e., making the joke, witty comment, etc.) was a scientist (denoted with “yes” or “no” in the Excel document). (Authors that were not scientists are herein referred to as “non-scientists”, since they included both comedians and other science-engagement professionals). I finally identified whether that person was also the author of the scientific content that involved the humour (i.e., did they also author the science involved in their joke/witty comment?) denoted with a “yes” or “no”.

Analysis

In the “Discussion” section, I conduct a descriptive, quantitative content analysis of this sample of podcast episodes in terms of frequencies found in each category listed above. I then describe trends based on this quantitative data, and make inferences about the findings based on the “Literature Review”. I also use general observations I made while listening to the podcast to elaborate on the quantitative findings, where applicable.

Findings

This section discusses the findings in terms of each research question. I recorded a total of 557 instances of humour in the sample of 34 podcasts. The findings that are presented as percentages represent a proportion relative to the entire sample ($n = 557$).

RQ1: What types of humour are used most when communicating science in a sample of podcasts?

To determine the relative frequencies of each of the 43 types of humour, I determined the count total and proportion of each type in the sample, as outlined in Table 2. Overall, satire had the most usage ($n=74$; 13.29%), followed by teasing ($n=66$; 11.85%), absurdity ($n=50$; 8.98%), clever replies to serious statements ($n=49$; 8.80%), self-deprecation ($n=35$; 6.28%), and outwitting ($n=31$; 5.57%). Several types of humour were not used at all, including: scale, clownish behavior, chase, peculiar music/sound, parody, bombast, infantilism, and replies to rhetorical questions. The other types were used at various frequencies in between, as outlined in Table 2.

Table 2

Humour types sorted by usage rate in sample

Humour type	Number of uses (total = 557)	% of total uses
Satire	74	13.29
Teasing	66	11.85
Absurdity	50	8.98
Clever Replies to Serious Statements	49	8.80
Self-deprecation	35	6.28
Outwitting	31	5.57
Irreverent Behavior	29	5.21
Ignorance	23	4.13
Exaggeration	21	3.77

Humour type	Number of uses (total = 557)	% of total uses
Irony	20	3.59
Sarcasm	20	3.59
Ridicule	18	3.23
Anthropomorphism	17	3.05
Over and Understatement	17	3.05
Puns	13	2.33
Misunderstanding	11	1.97
Double Entendre	10	1.80
Stereotype	9	1.62
Rigidity	7	1.26
Slapstick	5	0.90
Peculiar Voice	5	0.90
Malicious Pleasure	5	0.90
Repartee	4	0.72
Transformations of well-known sayings	4	0.72
Conceptual Surprise	3	0.54
Disappointment	3	0.54
Speed	2	0.36
Peculiar Face	1	0.18
Coincidence	1	0.18
Clumsiness	1	0.18
Visual Surprise	1	0.18
Transformation	1	0.18
Embarrassment	1	0.18
Scale	0	0.00
Clownish Behaviour	0	0.00
Chase	0	0.00
Peculiar Music	0	0.00
Peculiar Sound	0	0.00
Parody	0	0.00
Bombast	0	0.00
Infantilism	0	0.00

Humour type	Number of uses (total = 557)	% of total uses
Replies to Rhetorical Questions	0	0.00

The section discussing RQ3's findings will also discuss how the rate of these humour types differed depending on the author type.

RQ2: Is the humour that is used central or tangential to the scientific content?

Of humour that related to scientific topics, 51.71% ($n=288$) was central to the scientific content, and 48.29% ($n=269$) was tangential. Additionally, different types of humour were used centrally or tangentially at different rates (see Figure 1 for total central vs. tangential use of each humour type). For example, the most common type of humour, satire, was central most often, in 7.90% ($n=44$) of the sample, compared to 5.39% ($n=30$) that was tangential. Conversely, the second most common type of humour, teasing, was tangential most often, in 8.44% ($n=47$) of the sample, and central in 3.41% ($n=19$) of the sample.

The next section will also discuss differences in central and tangential humour rates depending on the author type.

Figure 1

Central vs. tangential use of each humour type

RQ3: Who is the author of the humour, and who is the author of the research being discussed? If the authors are different, what does this mean?

Scientists authored 37.16% ($n=207$) of the humour⁶, and non-scientists authored 62.84% ($n=350$) of the humour. Additionally, 4.31% ($n=24$) of all humour was authored by a scientist and related to their own research. Therefore, the author of the humour and the author of the science involved in the humour differed for 95.69% ($n=533$) of the humour.

Figure 2 depicts the usage rates of each type of humour by each author type. The two most common types of humour authored by scientists and related to their own research were teasing ($n=4$) and absurdity ($n=3$). The two most common types of humour authored by scientists but did not relate to their own research were absurdity ($n=20$) and outwitting ($n=20$), with teasing as a close third ($n=19$). The two most common types of humour authored by non-scientists were satire ($n=57$) and teasing ($n=43$).

Figure 3 depicts the rate of central and tangential humour use over all three author types. The humour authored by scientists that related to their own research was most often central to the content ($n=15$) rather than tangential ($n=9$), a trend that is also seen in humour made by scientists but did not relate to their own research (central, $n=115$; tangential, $n=68$). Conversely, humour authored by non-scientists was most often tangential to the scientific content ($n=192$) compared to central ($n=158$).

⁶ One of the hosts, Brian Cox, is a physicist and he often added humour to the episodes, which would account for some of the >37% of humour authored by scientists.

Figure 2

Humour type usage by each author type

Figure 3

Central vs. tangential usage by each author type

The next section presents an analysis of these findings.

Discussion

This section analyzes this MRP's findings in terms of each research question and identifies its limitations.

RQ1: What types of humour are used most when communicating science in a sample of podcasts?

In general, this sample of podcast episodes contained multiple types of humour at varying rates, leading to a subset that were used most frequently. This general trend follows Yeo et al.'s (2020b) finding of six main types and two most popular types used in scientific Twitter and Instagram posts. The most popular types in this MRP (satire and teasing), however, differ widely

from Yeo et al.'s (2020b) two most popular (anthropomorphism and wordplay). This difference is not surprising, as social media posts are typically visual and/or text-based, compared to the audio-only and conversational format of podcasts. Because of this fundamental difference in format, it makes sense that humour types would differ even if the general topic (science) is the same.

The following two sections discuss my observations and implications about the use of the most and least common types of humour in this sample.

Most Common Humour Types

I identified the top six types of humour in this sample to be, in order of frequency: satire, teasing, absurdity, clever replies to serious statements, self-deprecation, and outwitting. Below I discuss each in terms of their possible role in communicating science. I will also discuss any potential pitfalls identified in the literature, where applicable.

Satire. Satire was the most common type of humour overall and among non-scientists. It was also the fourth most common among scientists. Satire's role is to make fun of or critique social institutions or policy (Long & Graesser, 1998), or other well-known situations (Buijzen & Valkenburg, 2004). In its use to discuss science in this podcast, I suggest that satire may work to relate the science to well-known societal issues or situations. Making comparisons between a scientific topic and say, a well-known politician's antics may help the audience to conceptualize a scientific concept in terms of what they already know about society (and add some fun to it).

An example of satire comes from the "The Future of Humanity" episode – comedian, actor and director Chris Addison introduces himself, and on his thoughts about the end of humanity, states: "My most optimistic thought about the end of humanity is: at least we won't have to hear about Brexit anymore" (Cox & Ince, 2019a).

Additionally, a few of the episodes' topics were likely more well-known and thus well-suited to societal discussions (and thus satire) to begin with than others (e.g., the "Coral Reefs" episode delved into climate change issues (Cox & Ince, 2020b), and "Conspiracy Theories" involved social and political issues (Cox & Ince, 2020c)). These types of scientific discussions thus had an established relation to society. However, satire wasn't restricted to these more social/political episodes. First, satire was most the most common type of humour overall, and from the raw data (in which humour is listed alongside its episode name and topic), episodes with a less obvious social/political connection (e.g., "Clever Creatures", about animal intelligence) also contained instances of satire. This may suggest that satire could play a role in creating these societal connections to scientific topics that have less obvious social or political implications.

Along with this potential role of satire comes the potential for theoretical pitfalls. As Feldman (2017) discusses, satire is used heavily in late-night comedy shows, including in discussions of science. The pitfall Feldman (2017) outlines involves the aggression of such humour leading to polarization on related social or political issues. The lens of this podcast is clearly pro-science, along with any political beliefs that may come with that stance. As this is a science podcast, the audience of this podcast are likely also pro-science but very possibly have varying political views. In this case, polarization may be a valid concern because of the relatively heavy use of satire. However, if I compare this podcast to late-night comedy shows, the satire is far less aggressive overall, as the podcast aims to take a lighthearted tone. Additionally, although satire is the most common type of humour in the sample, it only accounts for less than 15% of the total humour use, so it does not take up the entire podcast as it might in a late-night comedy show. Because of the style of this podcast, I would suggest the potential for polarization on social or

political issues due to the use of satire may still be present, but possibly less-so than in late-night comedy shows.

Teasing. Teasing was used second-most in the sample overall and among non-scientists, and tied for first among scientists. Teasing’s role is to make fun of someone else, but in a non-hostile way and without intending to seriously offend that person (Long & Graesser, 1988). This type of humour is well suited to this type of conversational, podcast setting, and may not be as common in other media that discuss science (e.g., static social media posts, late-night comedy shows). This type of humour was usually directed to hosts or the panelists (i.e., scientists or comedians on that episode).

An example of teasing comes from the “Origin of Numbers” episode. In a short discussion, neuroscientist Brian Butterworth alludes to certain mathematicians who can’t count well, and a horrible experiment involving ants, but in both cases states he won’t discuss specifics on the show. Co-host Robin Ince interrupts to say, “You really know how to flirt with people, don’t you? I *may* tell you the names of those mathematicians, and there’s something I know about ants but I won’t tell you *now*” (Cox & Ince, 2019b).

In this podcast, the lighthearted nature of frequent teasing may work to add to the mirth of the episode overall. As suggested by Boykoff and Osnes (2019), Kaltenbacher and Drews (2020) and Yeo et al. (2020b), mirth in general is likely to increase engagement with science. Thus, whether or not teasing helps with understanding of scientific material, it likely helps to keep the audience engaged with the podcast.

Teasing may also have a similar role to the also common self-deprecation, in which the person makes fun of themselves. Self-deprecation is said to put a listener or audience at ease, or show

modesty (Long and Graesser, 1988). As teasing is similar in nature (just directed to someone else), teasing may also work to reduce any perceived superiority or even force modesty upon the object of the teasing (see “Self-deprecation” (below) for a discussion of why modesty may be useful in science communication).

Absurdity. Absurdity was the second-most common type of humour used by scientists discussing their own research, tied for most common among scientists altogether, and fourth-most common among non-scientists. Absurdity refers to a nonsensical or illogical situation (Buijzen & Valkenburg, 2004). The unexpected or surprising nature of absurdity leads to its perceived humour (Buijzen & Valkenburg, 2004).

An example of absurdity comes again from the “Origin of Numbers” episode. The panellists are discussing the fact that humans can use mathematics for complex, abstract reasoning – co-host Robin Ince then imagines an absurd scenario about this in action, “oh my God, the buffalos are charging, quick, work out Fermat’s last theorem!” (Cox & Ince, 2019b).

When used by scientists, this type of humour was often related to the awe of the absurdity of a scientific finding or phenomena, or to the wonder that the scientists felt about their field and the research they get to perform. Either way it was used, absurdity as a form of humour may work to relay this wonder about science as well as showcase scientists’ passion and excitement for their work in a light and engaging way.

Non-scientists at times also used absurdity in a similar way in response to scientific concepts, etc. Often, however, non-scientists would also make up some sort of absurd or unlikely scenario based off of a scientific concept (as in the example provided). Using absurdity to discuss science in these ways may work to make light of what could be perceived as a dull concept. Picking out

the funny parts of what a lay audience may picture as mundane (e.g., the scientific method or the process of research), or even turning concepts into goofy scenarios may offer a new (enjoyable) perspective on the science. This potential function of absurdity could play a key role in creating engaging discussions about science.

Clever Replies to Serious Statements. This type of humour was used third-most commonly by non-scientists, but less so by scientists. Clever replies also refer to incongruous or nonsensical replies that purposely misconstrue the meaning of a serious statement, or reply to something other than the intended (serious) meaning of the statement (Long & Graesser, 1988).

An example of a clever reply to a serious statement comes from the “Science of Laughter” episode. After Professor Richard Wiseman had finished telling a few jokes from his humour research, co-host Brian Cox begins a new topic by saying, “...there’s a lot of a joke that’s in the delivery rather than the structure...” Wiseman pipes in to reply, “exactly what are you saying there, Brian?” as if Cox was implying that he delivered his jokes poorly (which was not the intent) (Cox & Ince, 2020a).

In this podcast, there were naturally many serious statements made (mostly by scientists) about science, thus lots of opportunity for e.g., a comedian to make this sort of clever and funny quip in response. This type of humour may reflect how stand-up comedians often interact with their audiences, for example, to facilitate engagement. This type of humour then, may play a role in simply lightening up a serious or potentially complex conversation with silly remarks that may help add mirth and maintain audience engagement with the topic or the podcast in general.

Self-deprecation. Both scientists and non-scientists commonly used self-deprecation. This type of humour is aimed at the person themselves. As Long and Graesser (1988) point out, self-deprecating remarks may show modesty, put at ease, or ingratiate themselves to an audience.

An example of self-deprecation comes from the “Science of Laughter” episode. Comedian Frank Skinner states, “...often when I’m writing material, I will laugh at the joke I’ve just written. Sometimes I’m the only person that ever laughs” (Cox & Ince, 2020a).

In this sample, self-deprecation was often used in relation to that person’s lack of knowledge on a scientific topic. When used by non-scientists in this way, in addition to showing modesty, etc., self-deprecation may work to indicate that they represent a lay audience. I at times noted that statements made and questions asked about science by non-scientists often mirrored what I myself (and thus, a lay audience) was also thinking about the topic. Thus, self-deprecation may work to establish this lay-lens in order to relate to how the audience may also feel while listening to discussions of scientific topics with which they may be unfamiliar. This sort of mutual effort by the non-scientists and the audience to absorb the scientific information may be more engaging than, as an audience member, thinking you’re the only one struggling to understand what could possibly be going on inside a black hole, and why we care.

When used by scientists, self-deprecation may work to make themselves seem more accessible and relatable, even if not quite at the lay-audience level. This role of self-deprecation could be quite useful for science communication efforts, considering modern attempts to breakdown traditional views of scientists as, for example, highly intelligent but low in warmth or kindness (e.g., Pietri, Johnshon & Majid, 2021), as they admit fallibility, laugh at themselves, and potentially ingratiate themselves to their audience.

Outwitting. Outwitting was the third-most common type of humour used by scientists. Non-scientists used outwitting less frequently than scientists, and far less frequently than other types of humour. Outwitting involves making a comment that outsmarts someone or something (Buijzen & Valkenburg, 2004).

An example of outwitting comes from the “Dinosaurs” episode. Comedian Rufus Hound makes reference to the story that comic artist Gary Larson came up with the name “Thagomizer” for the spiky end of dinosaur tails, and paleontologists didn’t have a name for it so they decided to adopt that name. In response, paleontologist Susannah Maidment says, “...the idea that we didn’t have a name for spikes is not the case because we had the name, ‘spike’” (Cox & Ince, 2019c).

In this sample, outwitting was commonly used to correct a panelist or host if they made a comment or a joke that was factually incorrect. Occasionally, scientists would outwit each other in a kind of lighthearted debate. This kind of outwitting, which does on paper sound fun-ruining, seemed funny as the audience would laugh at the incorrectness of the joke or the jokester (Buijzen & Valkenburg, 2004). It is possible that this podcasts’ humorous environment often made “correction” seem like “outwitting” due to either a humorous tone taken by the corrector, or the general atmosphere of respect and openness to science. (At times correction by scientists in this way was not particularly funny, but sometimes led to teasing of the scientist for being a wet blanket – this would be classified as teasing.)

That outwitting was used so frequently was likely facilitated by the presence of a panel on each episode. If someone made a joke or comment that could misrepresent the science (even a scientist at times), another scientist would usually jump in to correct them, and it rarely seemed harsh. This may be in contrast to platforms where fewer individuals discuss science, and leave little room for

this type of correction. Thus, the panel may act as a type of safeguard for the potential pitfall of humour misrepresenting scientific concepts.

This type of humour, then, may play an interesting role in correcting misinformation, a common task for science communicators. Outwitting, or as it was used in this podcast, correcting with humour may be a useful tactic to correcting misinformation compared to taking an aggressive tone. More aggressive types of humour may be detrimental to fostering interest and engagement with more politicized scientific concepts, particularly because of their potential to polarize audiences on those related political issues (Feldman, 2017; Osnes, Boykoff & Chandler, 2019; Bode, Vraga & Tully, 2020). Although tone in this sense may not alter the effectiveness of correcting misinformation in all cases, an uncivilized (i.e., insulting) tone may alter perceptions around certain topics in general (Bode, Vraga & Tully, 2020), which indicates the potential utility of lighthearted humour (e.g., outwitting) for this task.

Least Common and Unused Humour Types

As previously described, humour types fell into a range of usage rates, with some used most frequently, some with moderate or little usage, and some with very little to no usage in the sample. Examining the least frequently used types may provide insight into why certain types of humour were more or less suited to the podcast medium or science as a topic.

Buijzen and Valkenburg's (2004) general category clownish humour was one of the least frequently used, save for its subtype, anthropomorphism, which was used 17 times (and which Yeo et al. (2020b) also found to be a popular category in funny scientific social media posts). The other subtypes, speed (fast talking or movement), clownish behaviour (exaggerated physical movements), and chase (of someone/something), were used little or not at all. Because of the

physical nature of these types of humour, it is likely that they would require a visual medium, rather than the audio-only format of a podcast. Buijzen and Valkenburg's (2004) types were in fact developed from television commercials, so it is indeed likely that they play out better on visual media.

Other humour types may also require this visual medium, explaining their similarly low usage rates. For example, peculiar face, which was used once, is a clearly visual humour type. In this instance, I only knew to record it because host Robin Ince mentioned that one of the panelists was making a peculiar face in response to a comment, to explain the audience's laughter. Other types in this category could be scale (exaggerated sizes of objects (Buijzen & Valkenburg, 2004)), and visual surprise (and unexpected visual change (Buijzen & Valkenburg, 2004)).

It is also possible that some of the more frequently used types of humour are also more suited to discussions of science than others, based on their high usage rates in this sample and their potential roles as discussed previously. However, as the most frequent types vary from Yeo et al.'s (2020b) findings regarding scientific social media posts, it is likely that, as discussed, the medium plays an important role in determining the most suitable types of humour used to communicate science.

Finally, it is also possible that the panellists' perception of their audience's culture and preferences (e.g., based on level of education, etc.) may have influenced the type of humour used, however demographic data of the audience of this podcast was not readily accessible online.

RQ2: Is the humour that is used central or tangential to the scientific content?

In general, central and tangential humour were used fairly equally across the sample (51.71% central; 48.29% tangential).

Central

Humour that is central to the scientific content may work as a tool to make the content itself more accessible, which is a main goal of the podcast. Thus, it is unsurprising that much of the humour was central to the content.

Below is an example of self-deprecation that was used centrally to add humour to a discussion about dinosaurs having feathers from the “Dinosaurs” episode:

Steve Brusatte, palaeontologist states, “...these little feathers that looked like hair, that’s how feathers started out, that’s what most dinosaurs had. And you can’t fly with hair! None of us can fly with hair – I certainly can’t fly with what’s ever left of my hair” (Cox & Ince, 2019c).

This instance of humour was categorized as central because it was directly related to the scientific concept being discussed (i.e., hair not allowing flight).

Addressing Potential Pitfalls. Examining central humour usage is important as many of the pitfalls identified in the literature review (e.g., misinterpretation of science, need for science background), may arise more so if someone is using humour to discuss central aspects of the science.

The design of the podcast, however, may mitigate some of these potential pitfalls. For example, as discussed, each episode hosts a panel of both scientists and non-scientists, and as is frequently joked about, they are quick to correct any sort of joke or comment that misrepresents the science (see previous section, “Outwitting”). In this environment, then, using humour to discuss central aspects of scientific concepts may be innocuous as correcting an incorrect joke is common, and if presented as outwitting, would add even more humour to the episode while maintaining accuracy.

The need for a science background is also a concern when humour incorporates scientific concepts, and in this podcast it is also addressed by also hosting non-scientists/comedians. This potential pitfall may occur when a joke is made about a scientific concept, but the audience doesn't understand the joke because they don't understand the scientific concept (Cain, 2019; Riesch, 2015). As discussed, the non-scientists on the show seem to act as the lay audience – if they don't understand something (either a comment or humour), they ask for clarification. Since most of the humour was authored by non-scientists who base it on the exact science that the audience also hears from the scientists, that “lay audience” has the same background on the concepts as the actual audience does. The hosts are also very quick to take part of an explanation that may be too complex and break it down so a lay audience would understand it (a crucial part for me in the many physics episodes). If the non-scientists and hosts were not present to ensure the clarity of concepts and complex humour, the need for a science background may be more necessary.

An additional safeguard in this podcast against misinterpretation, etc., of a joke may be the presence of a studio audience. Throughout most of the podcast episodes, an audience (not just me at home) could be heard laughing along to comments and jokes made by the panelists. It is possible that the presence of laughter had two roles. First, as Yeo et al. (2020a) found, participants in their study who watched a science comedy video with audience laughter added perceived more mirth and rated comedy as a more valid source of science than without the laughter. It is possible that simply hearing the laughter throughout could itself add mirth and a perception of validity. Second, while I was coding, the presence of the audience's laughter actually helped me to notice instances of humour more easily. It could be possible that audience laughter could similarly help listeners identify when a comment was meant to be humorous, rather than serious. This in turn could work

to mitigate the risk of misinterpreting complex humour as serious statements, a concern raised by Feldman (2017).

Despite the high amount of central humour (about half of all humour), which in its effort to increase accessibility of science could be most prone to pitfalls, this podcast's design seems to mitigate the risk of those pitfalls. In turn, evidence of a high rate of central humour in humorous science communication may indicate that safeguards such as those described could be useful to consider in similar science communication endeavours.

Tangential

The equally high rate of humour that is tangential to the scientific content (i.e., not central, but still in some way related to the science) is also unsurprising. Non-scientists, in particular, were quick to chime in with different (funny) perspectives to the science that at times diverged from the scientific topic being discussed. The role of tangential humour in science communication was initially less obvious compared to central humour, but examining its usage may clarify its importance in creating general mirth and facilitating engagement with scientific discussions.

Below is an example of a pun that was used tangentially during a discussion about a song about the periodic table of elements from the “Anniversary of the Periodic Table” episode:

Professor Polly Arnold is telling a story of how her mother used to sing the periodic table song to her as a child, and mentioned that her mother thought they were bonding during this activity.

Co-host Brian Cox later quips: “And I love the fact that you thought you were bonding,” making reference to chemical bonds as Arnold had discussed previously⁷ (Cox & Ince, 2019d).

⁷ As Long and Graesser (1998) note, it is difficult to relay some types of more situational humour (e.g., this pun) in text and out of context – but this definitely got the eye roll-type of audience laughter you'd expect from such a magnificent pun.

This instance of humor was classified as tangential because it did not relate directly to the scientific concept being discussed (i.e., the arrangement of elements on the periodic table), but related more distantly to one aspect, chemical bonds. It did not relate to the science of chemical bonds either (which may have moved it to a central classification), but simply to the word itself.

Tangential humour seemed to come about naturally as panelists related the science to their own experiences or to society in general. Compared to central humour, which worked to lighten potentially dry scientific content and make it more accessible, tangential humour may work similarly, but with more of an effect on general mirth and engagement rather than accessibility/understanding of the scientific information itself. This can be seen through the heavily tangential use of teasing, which in itself likely does not contribute much to the understanding of the content, since it's directed at individuals (e.g., much friendly shade was thrown to Brian Cox and his nerdiness about physics). This can also be seen through satire, which, although used centrally more often, tangentially it may still work more to relate the science to society in some way or simply add mirth, rather than facilitate understanding of a concept, directly.

Additionally, some instances of tangential humour arose from a scientist making a funny (either central or tangential) comment about the point they were discussing. Often, a comedian would pick up on the more subtle humour made by the scientist and roll it over into consecutive jokes. These would often become tangential (or even off topic completely) even if the first instance of humour was central to the content.

This trend brings up the important note that this podcast contained humour that was neither centrally nor tangentially related to the scientific content. This type of humour often came naturally out of what started as science-related humour, but then as conversations do, it would get quite off topic. Our hosts, Ince and Cox then had the job of redirecting the conversation back to the science.

This happened quite a bit, but I personally found it to add to the engagement with the show itself, if not with the science, per se. The spontaneity of those unrelated conversations felt natural and was enjoyable to listen to.

Addressing Potential Pitfalls. Because tangential humour does not incorporate scientific concepts directly into jokes or witty comments as central humour does, this type of humour may not be as prone to pitfalls such as misinterpretation or need for a science background. However, the risk of reducing severity of an issue may still be present as the concern involves merely pairing humour with scientific discussion.

Feldman (2017) and Skurka et al. (2018) raised the concern that the presence of comedy when discussing a scientific issue may downplay the severity of the issue. This concern is valid if a goal of the science communication is to increase awareness of a severe issue like climate change, for example, particularly in such a lighthearted podcast.

In this podcast, though it is difficult to definitively say based on the small sample size, discussions of some more societally relevant topics (e.g., coral bleaching/climate change) endured a rare long period without a comedic break – indicating that the comedians/hosts understood the gravity of the issue. It may be that using comedy to discuss the issue itself could be seen to downplay its severity, but I might suggest that a long period without jokes in a comedic podcast would be a stark contrast that may even imply severity or gravity of an issue.

Overall, the near-equal amount of central and tangential humour in this sample indicate that both forms of humour may play important and potentially distinct roles in science communication. Additionally, this finding may indicate that implementing safeguards, such as

those discussed, in humorous science communication should be considered to mitigate pitfalls concerning both forms.

RQ3: Who is the author of the humour, and who is the author of the research being discussed? If the authors are different, what does this mean?

Non-scientists authored more humour than scientists, overall. This result could be explained by the fact that scientists may tend to view science with deference (and thus authority), which does not easily lend itself to humour. The format of the show itself expects and responds to this tendency by bringing in comedians or individuals who are involved in science-engagement to add the humour with their more irreverent, comedic perspectives. This finding suggests the usefulness of non-scientists in facilitating humorous science communication.

Additionally, the vast majority of humour (>95%) was made by either a non-scientist (e.g., a comedian) or scientist who was not the author of the related science. This result makes sense since the topics of each episode rarely dig deep into specific studies. Rather, as is likely more accessible to a lay audience, the topics touch more broadly on fields of science or larger scale questions that can be addressed through science, e.g., “What is Life?” (Cox & Ince, 2020d). The answers would thus often involve well-known scientists’ foundational work or theories on the topic, rather than the scientists’ current research. The large amount of humour authored by individuals who did not author the scientific content involved in the humour could indicate that the humour was more likely to misrepresent the science (as these authors, in theory, would likely not have as much in-depth knowledge about the science as its author(s) would). However, the focus on broad and well-known scientific topics, along with the eager-to-correct-panel format as discussed, may make this pitfall somewhat less likely.

At times, a scientist would discuss their own research, but often not in a humorous way. Scientist-authored humour about their own research may portray the science most accurately as the author would have a deep understanding of the content. However, if the joke is too complex (e.g., irony) and requires the audience to have a similarly deep understanding, this could lead to potential for misinterpretation of the joke and/or the science (Cain, 2019; Riesch, 2015). In this sample, however, the types of humour used most frequently in this case were not very complex forms (i.e., teasing, absurdity, anthropomorphism, peculiar voice, etc. (see Figure 2)), indicating that this pitfall is less likely to occur in this sample. Again, the panel and hosts were also quick to chime in if a joke or a statement by a scientist or non-scientist was unclear, so even if a complex joke was to be made, it is likely that the panelists and hosts would ensure the audience understood the joke. The panel, thus, could be useful to ensure that scientist-authored humour about their own research (and the science) was interpreted correctly.

Overall, the author of humour involving science may be an important consideration. Scientists may offer more credibility as authors, and non-scientists may offer an important, relatable lay-lens as authors. Additionally, mixing of both author types may work to make humorous science communication more accessible.

Limitations

This section discusses potential limitations in this MRP. As content analysis is a method that requires transparent methodology, limitations regarding the methods used as well as generalizability of the study are considered.

One limitation of this MRP is the lack of ability to measure inter-coder reliability, as only I performed the coding – I cannot definitively say whether another individual would come up with

the same results as I did. To attempt to code as objectively as possible, I provided myself with clear definitions and examples of humour types from the authors that developed the categories, as provided in Table 1. However, I got the sense while coding that RQ1 (type of humour) and RQ2 (central or tangential) may be more difficult to gauge despite the provided definitions, and thus more subjective than RQ3 (author type), which was fairly clear and not up to interpretation. In future studies using this method, multiple coders may be useful to obtain such inter-coder reliability.

Additionally, regarding coding the different types of humour, it is possible that panelists used specific humour tools in the broader category of humour that I have recorded for a given instance of humour. For example, satire is a fairly general humour type, and a satirical joke may incorporate more specific types of humour such as funny analogies or metaphors. The two lists of humour that I used to code, thus, are not an exhaustive list of all humour that exists – Buijzen and Valkenburg's (2004) categories were created inductively from humorous television commercials, and Long and Graesser's (1988) categories are their "Taxonomy of Wit" developed from television talk shows. It is therefore possible that coding using other lists of humour could yield results in terms of these more specific, alternative humour types.

Finally, the use of humour in this sample was likely varied because of the wide variety of panellists, and thus, comedic styles on the show. This was anticipated as being good for generalizability of the current findings, however I can now note that although some panellists resided in North America (e.g. Conan O'Brien, American and Canadian astronauts), many of the panellists resided the United Kingdom (which makes sense, as this is a BBC podcast). As Martin and Sullivan (2013) note, there are known cultural differences between the United Kingdom and other countries such as the United States, and humour is likely also culturally-dependant as seen

in preferences for region-specific comedic television shows. It is therefore possible that the findings of this MRP are more specific to a United Kingdom-style of humour use.

Despite these limitations, this MRP provides a set of findings that may serve as a starting point for future research into humorous science communication.

Conclusion

This final section discusses both this MRP's contribution to the field of humorous science communication research, as well as provides suggestions for future research.

Contributions to Humorous Science Communication Research

This MRP has provided evidence of the most and least common types of humour used in a science podcast, how they were used, and differences in humour use between scientists and non-scientists. As described in this section, this evidence can provide a starting point for both future research into humorous science communication as well as for practical applications, including for those looking to take part in humorous science communication.

Firstly, the evidence that certain types of humour were used more so than others can provide a basis for future research looking to investigate, for example, actual effects of those most common types of humour on engagement with science. The following "Suggestions for Future Research" section delves more into how this MRP may be expanded upon.

As discussed in the "Discussion" section, this MRP has also suggested that the design of this podcast may provide some safeguards that may mitigate the risk of potential pitfalls of humorous science communication. For example, the presence of a panel can ensure understanding of the humour, and the laughter of a studio audience may contribute to mirth and help the audience

identify instances of humour. The theoretical role of these safeguards may provide some guidance for future humorous science podcasts to similarly attempt to mitigate pitfalls. For example, even having a cohost to laugh at jokes or act as a lay audience, or using less complex humour to discuss science could (pending future research) potentially act as safeguards even if a panel or studio audience are not feasible.

Additionally, evidence that comedians contributed more humour than scientists may support the notion that comedians or science-engagement specialists can add a humorous angle to science communication that differs from that of scientists. Additionally, this MRP provided evidence of a potential role of humour that is tangential to the scientific content, whereby frequent use may add mirth that could increase engagement with a dry topic, even if it does not contribute to understanding of the material, directly. These findings may provide guidance when attempting humorous science communication, even beyond podcasting.

To further extrapolate this guidance beyond podcasting, Pinto, Maçral and Vaz (2015) conducted a study wherein they hosted a live (in-person) science stand-up comedy event. This format of science communication is innovative, and this MRP's findings may apply to such an event because of similarities to this podcast's format (i.e., conversational, in front of an audience). For example, if attempting to involve scientists in such a science comedy event, this MRP has provided some evidence of which types of humour they use, and that they don't use humour that frequently, when discussing science. Expanding on this research can help to decide how to train those scientists in comedy to perform at such an event. For example, if satire really does help to relate the science to society, it could be fruitful to train scientists to use satire if that is a goal of the event – this would apply to the other commonly used types of humour as well. Another example could be that it may be useful to have two scientists or even a scientist and a

comedian (as is close to the format of this podcast) as a duo to tease each other or use self-deprecation to make themselves more accessible to their audience. And a final example includes relaying the potential benefits of adding humour tangentially to add mirth, not just centrally (as scientists did more often in this sample). This is just a sample of examples, but this MRP may provide a starting point to consider for these sort of science communication activities.

Suggestions for Future Research

To address the limitations of this MRP, future studies could conduct similar research with multiple researchers to code with higher inter-coder reliability. Future studies could also examine any humorous science podcasts from other regions, such as North America (e.g., ASAP Science, a Canadian podcast which was another contender for this MRP) to see whether the use of humour differs from the current findings. Additionally, other lists of humour categories (that perhaps are more in line with stand-up comedy) could be incorporated into similar studies in case those categories better describe the humour in podcasting when comedians are involved. Finally, other forms of media besides podcasting, including stand-up events, etc., could be analyzed in a similar fashion to this MRP to expand on its findings.

Additionally, this MRP focused solely on the use of humour and its theoretical role in increasing engagement with science in podcasting. Future research could investigate whether engagement with humorous science podcasts actually differs from those that are non-humorous.

Also, demographic data of the audience of this podcast was not readily accessible online, but selection of humour types, for example, may be partly informed by cultural or educational aspects of its audience. Future research could investigate whether audience demographics play a role when selecting humour-types.

Finally, this MRP sampled episodes in a wide range of scientific fields. If applied to a particular issue such as climate change, for example, future research could investigate whether certain types of humour are used at different rates or in different ways, by different authors etc., according to the type of science or within a particular field of science. This information could elucidate whether humour's use or disuse contribute to how a field of science is framed – for example, whether any theoretical pitfalls of humour such as downplaying severity of an issue are of particular concern.

It is my hope that this MRP has provided a starting point for future research or funny science communication endeavors. Maybe one day, instead of laughing at videos of people falling off of treadmills when in our dentists' waiting rooms, we'll all be laughing at the explanation of the physics that make those falls possible.

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