CHAPTER

33 How Narrative Functions in Entertainment to Communicate Science

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Abstract

Entertainment media can use storytelling—narrative tools like drama, characterization, and conflict—to draw audiences deeper into scientific content. Without careful scrutiny of the content being conveyed, entertainment has the potential to distort scientific knowledge and warp beliefs, but entertainment also has the useful power to capture attention, increase engagement, and promote the understanding and enjoyment of science. Narratives are the underlying structure of entertainment media and represent a unique communication tool for portraying science in ways that intersect with human experience. This chapter provides an overview of the psychological, social, professional, and ethical ways that narrative formats of communication function within entertainment media to communicate science to public audiences. Three short narratives within the chapter embody the risks and potentials of communicating science with storytelling.

Key Words: communication, entertainment, narrative, story, storytelling, attention, scientific content

You are a climatologist, and you are rattled. As you hit pause on the video you've been watching, your post-doc calls from the break room, "Are we out of decaf again?"

"We've got worse problems than that," you say.

Emerging with a steaming cup in her hands, she reads your face. "What's wrong?"

You indicate the image on the screen. "This is a disaster."

"It's supposed to be, isn't it? It's a disaster movie."

"But with a happy ending," you say, pressing play. Onscreen, jubilant crowds around the world cheer Jumbotron images of a spacecraft dealing streams of thin refractive discs into orbit a million miles above the earth.

"What did you expect?" she says. "It's Hollywood. If they showed the irreversible damage a five degree increase will do—who'd pay to see that?"

"I never should've said yes to '60 Minutes,'" you say, as the music swells and credits roll. "They're going to be here any minute. What am I supposed to tell them?"

"You're not a movie reviewer. That's not why they asked to interview you. They want a reality check. Just tell the truth."

"What? That counting on being saved by a technology that doesn't exist is a dangerous distraction? That even if every country in the UN lives up to the two-degree target, which would be a miracle, there'll still be floods, famines, extreme heat waves, extinctions and 200 million climate refugees by 2050?"

"No—that'd just make people give up. It's not your job—not our job, as scientists—to connect the dots. Our job is to provide the dots. Leave the judgments to the policymakers. You've got the data. Just put it out there, as clearly and credibly as you can."

"If I do that, people will fall asleep."

"And what's the alternative? Dumbing it down? Telling scary stories? I came here to work in your lab because of the science you do, not because

you're some kind of . . ." She curls her lip. "Of entertainer."

Your phone rings. "Oh, hi," you say, as cheerfully as you can manage. "Come on up."

Entertainment media often communicate science. They use storytelling, drama, and conflict to draw audiences deeper into the content. Some people resist these devices; they perceive a dichotomy between the objective knowledge of science and the subjective spectacle of entertainment. While the dissemination of science via entertainment does indeed have the potential to distort its content, it also has the power to capture attention, increase engagement, and promote the understanding and enjoyment of science. This chapter is an overview of current understanding of the complex and sometimes surprising ways that entertainment media can communicate science to public audiences.

Narratives, Schema, Scripts, and Frames

The communication structure fundamental to most entertainment content is *narrative*. A narrative is a message that focuses on the actions of particular characters and the cause-and-effect relationships of their actions over time (Dahlstrom 2014). It is what most people mean when they say they are going to tell a story. While in some contexts "story" may imply falsehood or fabrication, the narrative form itself is not defined by truth—it can be used to structure any type of information, fact or fiction.

Narratives are related to, but distinct from, other psychological and communication concepts. *Schema* are psychological constructs of how knowledge is structured in the mind. They represent the mental aggregate of the individual cases of an idea that an individual has experienced, and they guide the interpretation of future information about that idea (Axelrod 1973). *Scripts* are schema with a temporal component; they represent generalized expectations about events within a certain process (Abelson 1981). A media *frame*, explored in Chapter 37 in this volume, represents the thematic focus an author selects to structure a message out of the many possible foci that could have been chosen (Scheufele 1999).

Narratives go beyond themes or abstractions. They offer a specific case of something happening to particular characters. For example, schema might associate fast-food restaurants with concepts such as low cost, bad health, and unexpectedly good ice cream. A script might abstract the fast-food process as waiting in line, ordering food, paying, and stepping aside to await one's order. A journalist could choose to frame a message about fast food in tern of its nutritional value, its economic place in indu trial agriculture, or its influence on public healt policy. By contrast, a narrative could tell a sto about individual characters who experience specif events and have personal reactions during a visit t a particular fast-food restaurant. It is this specificit of information embodied by characters' perspectiv that makes narratives unique.

Expository, Argumentative, and Narrative Formats

Narratives are one of three common formats fc communicating science. In an *expository format*, sci entific content is represented as abstract scientifi truth (Avraamidou and Osborne 2009). This fo mat focuses on the dissemination of knowledge. I dominates most science textbooks, as well as othe contexts where science is portrayed as an encyclope dia of understanding to which individuals can tur for answers. An *argumentative format* attempts t validate scientific information or its interpretatio through persuasion and evidence (Avraamidou an Osborne 2009). This format focuses on the justifi cation of scientific information. It is common i contexts where science may run counter to existin beliefs, where individuals may be expected to qu tion the validity of the information, or where adv cacy groups attempt to convince audiences to acce certain scientific position. The argumentative form also dominates academic journals, where scientis must justify their research to peer reviewers task with verifying the worth of the science within it.

A *narrative format* portrays science as the live experience of specific characters who interac with the scientific information (Dahlstrom 2014 Avraamidou and Osborne 2009). In contrast wit expository and argumentative formats, narrative focus more on the human experience that embodie the science than on the scientific knowledge itself For example, to convey the medical importance o handwashing, an expository format might state "Handwashing is an effective way to prevent the spread of disease." An argumentative format might explain, "Here are the reasons that handwashing is an effective way to reduce the spread of disease." A narrative format might say, "This is Laura. She washed her hands and reduced the spread of disease." Narrative formats are common in contexts where other messages are competing for audience attention, where audiences expect to find enjoyment rather than to acquire knowledge—a context common with entertainment. Each of these three

formats—expository, argumentative, narrative—can of course be present to some degree in any individual message.

The Power of Narrative

One aspect of narratives that has garnered the attention of science communicators and also aroused their concern is their ability to influence audiences. Narratives are powerful. They can convey information, but they can also purvey propaganda. They can teach, or they can misguide. They can make a truth more vivid, but they can also lend verisimilitude to a fabrication. The first great speculation on the risks and responsibilities of narrative comes in Plato's *Republic* (Plato 1930). The term Plato uses is "poetry," but we should not take this to mean a rarefied pursuit of the elite; in Attic Greece, as M. F. Burnyeat (1997) put it in his Tanner Lectures, poetry was "the most popular form of entertainment available, the nearest equivalent to our mass media."

The task of the *Republic* was to design the education most conducive to a good society. Geometry has its place in such a curriculum; it teaches reason, logic, and calculation—so does gymnastics, which teaches competition, grace, and endurance. The question for Plato is: What does poetry teach? Little good. The problem begins in childhood, when impressionable youths are exposed to tall tales, fables, allegories—stories that can indelibly stamp their minds with fantasies. As they grow older, they are exposed to tragedy, comedy, and epic poetry, imitations of reality that "settle down into habits and [second] nature in the body, the speech and the thought"(Plato 1930) Poetry's impact is not just mental; it is physiological. Audiences are dreamers, dangerously incapable of distinguishing fiction from truth, opinion from knowledge, story from history, fantasy from reality. To Plato, these poet-storytellers exploit our propensity to be spellbound by language, emotion, spectacle, illusion. The climax of this line of thinking arrives in Book X of the *Republic*, where poets are banished from the ideal state: "[I]f you grant admission to the honeyed Muse in lyric or epic, pleasure and pain will be the lords of your city instead of law" (Plato 1930).

Empirical research into the effects of narrative communication confirms these ancient warnings of potentially powerful influence. The mind uses a different cognitive pathway to process narratives than it employs for other formats of information (Fisher 1984). This pathway is more efficient, leading to faster processing of narratives and greater comprehension of them, than for expository or argumentative formats (Bruner 1986). This narrative bias occurs naturally during childhood development; by contrast, the more deductive, logical thinking requires training through formal education (Boyd 2009). This is why narratives are considered the default mode of human thought. They guide how we make sense of reality and act upon it (Boyd 2009; Schank and Abelson 1995). An idea not mentally organized by stories is not yet known.

Exemplification, Identification, and Transportation

This bias for making sense of the world through human experience is demonstrated within *exemplification theory* (Zillmann 2006). An exemplar is a specific case of an event occurring. This is contrasted with an abstract generalization, often conceptualized as a statistical base rate, of an event occurring. When both types of information are present in a message, audiences predominantly use the exemplar to form their attitudes and understanding (Zillmann 2006). For example, a statistical message noting that shark attacks are very rare can be reassuring to beachgoers. But include in the same message an exemplar of surfer Joe losing his leg to a shark attack and those same beachgoers are more likely to ignore the abstract statistics and swim in the pool instead, just to be safe.

In most entertainment contexts, where narratives are more detailed, other mechanisms lend them even more influence. Audiences may *identify* with characters in the narrative, leading them to take the perspective of the characters and to resonate with the emotions they express (de Graaf et al. 2012; Cohen 2001). Similarly, audiences may be *transported* into the world of the story; they may devote so much attention to processing and enjoying the story that they lack the cognitive resources to question the claims made in the narrative (Green and Brock 2000). Increased transportation into a narrative and increased identification with characters increase the likelihood that audience beliefs and attitudes will be consistent with the beliefs and attitudes within stories (Braddock and Dillard 2016; de Graaf 2014; Green 2004)—even in audiences who would otherwise remain resistant to their claims (Moyer-Guse and Nabi 2010). Unlike other forms of persuasion, which use relevance and credibility to win message acceptance (Trumbo and McComas 2003; Cacioppo and Petty 1984), narrative persuasion depends on engagement with a coherent story world, which renders the distinction between fact and fiction less relevant. This is why audiences

readily believe that information in fictional narratives is true (Dahlstrom 2012).

Narratives are not just convincing. They can end-run our reason, allowing us to believe things that our better judgment would otherwise question. As Burnyeat (1997) puts it, paraphrasing Plato, "It is as if eyes and ears offer painter and poet entry to a relatively independent cognitive apparatus, associated with the senses, through which mimetic images can bypass our knowledge and infiltrate the soul" (see also Green et al. 2004). Knowing that they are only narratives offers little protection.

You are a correspondent for a TV news magazine. You are showing a rough cut of your segment to your producer. Onscreen, in his lab, a climatologist explains a graph to you. "The black line," he says, "is carbon emissions to date. The red line is where emissions will be in 2100 without restraints to current greenhouse gas emissions." In the video, you ask him, "Which will be where?"

"A thousand parts per million of atmospheric carbon dioxide. Which will raise the global average temperature between 3.2 and 5.4 degrees Celsius."

"And if we put a trillion discs between the earth and the sun?" A clip from a sci-fi movie shows the earth protected by a solar radiation blanket. "Would that keep it to 2 degrees?"

"We need to remove 10 gigatons of CO2 a year from the atmosphere by 2050," he says.

"Which those discs would do?"

The climatologist suppresses his exasperation. "We have no data that speak to that."

"You don't know?"

The climatologist sighs. "It would be pure speculation."

Your producer closes her eyes and snores loudly.

"Wait!" you tell her.

Onscreen now is a politician on the stump. "They admit it!" he shouts. "They don't even know! They want us to give up our SUVs, give up our barbecues, kill our economy, kill our jobs—and they won't tell you this, but their so-called models are built on assumptions that resent your lifestyle. That's not science—that's bigotry! Elite bigotry!"

Your producer shakes her head, puts her hand gently on your shoulder. "Look, I get it. Conflict gets attention. But this he-says/he-says thing is so worn out. We've seen it a million times. What you need is a real story. Suspense. Adversity. Triumph. You need a hero."

"The star of the movie? You want me to do a profile of an actor?"

"No." She rewinds the tape. When we see a rugged man biking on a mountain trail, she hits play. One of his biceps is ringed by a tattoo of solar radiation-refracting discs.

We hear his British-accented voice. "The truth is—yeah. I actually did think that one day they'd make a movie about me. I just didn't think I'd still be around when they did."

"There's your hero," she says. "The entrepreneur who dared to dream big dreams. The real-life inventor who just may save the world. There's your story."

Dumbing Down?

Are narratives antagonistic to the goals of science? In some scientific circles, "popularization" is a pejorative term. It is interpreted as dumbing science down for nonexpert audiences and often distorting it in the process (Hilgartner 1990). Norris et al. (2004) assert that because science predominantly seeks to share information on abstract and recurring phenomena, the specific nature of narrative is less likely to be an appropriate format for science education. They note that narratives are "not sufficiently attuned to the requirement that scientific writing be cautious, circumspect and tentative" (Norris et al. 2004, 560). A correspondence letter in *Nature*, titled "Against Storytelling of Scientific Results," recaps many of the common critiques of narratives within science, including that they are unrepresentative, that they simplify the complexity of science, and that storytellers "embellish and conceal information to evoke a response in their audience" (Katz 2013, 1045). Public expressions of this critique often occur when news outlets ask scientists what a recent blockbuster got right or wrong about the science within it.

There are of course many examples of narratives leading people to distorted understandings of science. Consider the advertising industry, whose global annual revenue exceeds $500 billion (Tadena 2015). That scale would be unlikely if ads were incapable of evading the radar of our objectivity (Kaplan 2010). The pharmaceutical industry routinely uses narratives to sell products to consumers and distract audiences from disclosures of side effects, which is why the US Food and Drug Administration proposed limiting "discordant visuals and distracting music" (Edwards 2009). Or consider some of the

most contentious topics in public discourse about science, like climate change, or the purported link between childhood vaccinations and autism, or "intelligent design" as a worthy curricular counterpoint to evolution. It is easy to assume that empirical evidence should convince audiences of the existence of global warming, its origin in human behavior, and the grave jeopardy of the planet. Similarly, clinical data about the safety of immunization protocols should put parents' minds at rest. So, too, should the fossil record and the ability of evolution to account for complex biological organs and systems attest to the explanatory power of Darwinian theory.

But the belief that the dissemination of more facts with greater accuracy will overcome deficiencies of public understanding and win acceptance of science, an assumption underlying the deficit model of science communication, has long been discredited as naïve and ineffective (Wynne 2006). The proponents of scientifically unsupportable views are not suffering from a deficit of data; they are animated by an alternative narrative that is constitutive of their identity and cultural affiliation and independent of empirical disconfirmation (Kahan et al. 2012). Science does not intrinsically trump stories.

An Attention Economy

Entertainment narratives are not inherently anti-science. They offer science communicators a tool for achieving their goals. Science, like other discourse, faces an uphill battle to earn the attention of those it wishes to reach. Science communicators, like all communicators, have no alternative to meeting their audiences where they find them. But today's audiences face an exponential explosion of information. The digital universe is doubling in size every two years (EMC2 2014). Americans are estimated to consume an average of 15.5 hours of media—74 gigabytes of data—per person per day (Short 2015). In 1970, Herbert Simon (1971, 40–41), who would win the 1978 Nobel Prize in economics, noted that

> [w]hat information consumes is rather obvious: It consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.

There are two kinds of attention, top-down and bottom-up (Mangun 2012). Only top-down attention, often called the brain's "executive function," is capable of the efficient allocation Simon (1971) described. It is voluntary; we consciously control it (Katsuki and Constantinidis 2014). It is at the core of William James's definition of free will—the power to decide what to attend to (Perry 1936). It is what psychologist Daniel Kahneman (2011), the 2002 Nobel economics laureate, calls System 2 in *Thinking, Fast and Slow.* It is rational, and it is slow. But Simon's model does not accommodate bottom-up attention. Kahneman calls it System 1, and it is fast. It pays attention instinctively, emotionally, even irrationally. It pays attention, whether we want it to or not. We cannot help it; it is in our wiring.

What possesses the power to grab and hold our attention independent of our will? Evolutionary biology can account for part of the answer. Like many other animals, humans respond physiologically to certain stimuli. Natural selection favored species whose instinctual attention to particular sensory inputs conferred on them an adaptive edge. Danger (Oehman 2007), sex (Sukel 2013), novelty (Gallagher 2011), and play (Huizinga 1971) command our attention instinctively, emotionally, even irrationally. All of these captors of attention are present within storytelling, a capacity unique to humans, which is why *Homo narrans* has also been proposed as a name for our species (Fisher 1989). In English there is a word for something that possesses the power to occupy our attention: entertainment (Gabler 2000). The root of entertain is "tenir"—to hold. What is held is our attention, and the mechanism that holds it is narrative. In that sense, the power of narrative is precisely the power to entertain.

Entertainment-Education

The field of entertainment-education takes advantage of these traits by embedding prosocial messages into entertainment narratives to earn the attention of audiences while influencing them through the narrative pathway of cognition (Shen and Han 2014). Rather than explicitly stating what audiences should believe or do, entertainment-education messages portray stories of individuals who make decisions about a target issue and face its consequences. The majority of entertainment-education research has centered on health issues, creating narratives that influence audiences about topics such as mental illness (Ritterfeld and Jin 2006), binge drinking (Kim et al. 2014), and dietary choices (Ayala et al. 2015).

To take an example, Tanzania began a national family planning campaign in 1992 to promote the use of contraceptives in an attempt to slow population growth (Vaughan et al. 2000). Part of the campaign involved developing a radio soap

opera, titled *Twende ta Nakata*, featuring characters designed to serve as positive and negative role models. Over four years of broadcasts, compared to a control group, listeners reported increased self-efficacy for and approval of family planning and increased use of contraceptives (Vaughan et al. 2000). The program was also the source of 25% of new patients to the Ministry of Health clinics (Vaughan et al. 2000).

Like *Twende ta Nakata*, the most impactful entertainment-education campaigns have been in developing countries where media systems are rudimentary and single programs can have greater reach and influence (Sherry 2002). Yet even in countries with sophisticated media systems and diversified content, entertainment media can still influence audiences about scientific information. Individuals who watched the climate change disaster movie *The Day After Tomorrow* reported greater concern about climate change and increased intensions to engage in behaviors to address the problem (Leiserowitz 2004). Similarly, a survey of viewers of the emergency room drama *ER* found that half reported that they had talked to their family and friends about health topics from the program, and a third said they had used content to inform their personal and family's health decisions (Brodie et al. 2001). Such evidence has led the Centers for Disease Control and Prevention, since 2001, to support the Hollywood, Health & Society program at the USC Annenberg School's Norman Lear Center, a free resource to screenwriters seeking accurate public health information (Hollywood Health & Society 2016); a similar appreciation for the impact of storytelling on audiences led the National Academy of Sciences (2016) to launch the Science and Entertainment Exchange in 2008.

While potentially effective, the incorporation of science into entertainment narratives can raise some ethical questions (Asbeek Brusse et al. 2015; Dahlstrom and Ho 2012). Scientific information embedded within entertainment narratives can gain acceptance through the very same mechanisms that scientists often decry—the ability of narratives to influence belief without careful scrutiny of the content. When should the goal of science communication align with the power of narrative to influence public opinion? Some may argue that using such tacit persuasive tactics to build consensus on public health and public policy goals such as vaccination, climate change mitigation, and obesity prevention is warranted. Others may oppose any use of narratives to convey scientific knowledge in order to affect audiences without engaging their thoughtful consideration.

However, narratives can also be effective when the goal of science communication is to disseminate knowledge to enable individuals to arrive at their own conclusions within a controversial context or to engage audiences with abstract scientific concepts that might otherwise be ignored (Cohen et al. 2015; Dahlstrom and Ho 2012). The more efficient narrative-processing pathway can increase comprehension of scientific content and convey its relevance to human experience while remaining accurate and representative. However, increasing scientific knowledge does not necessarily lead to greater consensus. In fact, individuals with greater scientific knowledge about controversial issues tend to also be the most polarized (Kahan et al. 2012). Science communication spans a variety of contexts, each with distinct goals and expected roles for communicators (Pielke 2007). Deciding when and how to use narrative entails ethical considerations arising from the personal, organizational, and situational boundaries of a particular science communication context.

Future Research

Narrative can be a powerful tool for achieving science communication goals. As research cited in this chapter demonstrates, narrative is a distinct communication format that can draw attention and grant greater influence over our beliefs and decision-making. Some in the scientific community view narratives and entertainment media as frivolous or even antithetical to science, and there are many examples of narratives that attempt to persuade audiences to hold views unsupported by scientific consensus. But there are also examples of scientists and communicators deploying narrative to engage audiences more deeply with scientific knowledge.

Narratives are complex message structures embodying specific choices about elements such as settings, characters, and perspectives (Bal 1997). While people engaged by narratives may exhibit strong effects, it is much harder to predict what combination of narrative elements will engage specific audiences. Future research needs to move beyond testing the mere presence or absence of narrative messages and continue exploring how specific narrative elements interact to increase and affect engagement among varied audience segments.

Research has explored the effect of entertainment narratives on science perceptions, but less is known about the actual distribution of narratives relative

to scientific issues in the media environment. For example, there is some evidence that anti-vaccine proponents use narratives to a greater extent than pro-vaccine supporters (Shelby and Ernst 2013), but a more detailed mapping of which advocates and which arguments about which issues are using entertainment narratives in their communication will help science communicators better assess when and how narratives might be appropriate for their own communication contexts.

Most studies of science communication assume the goal is to disseminate knowledge about science or change attitudes and behaviors relative to scientific issues, which is indeed a widespread goal among scientists themselves (Besley et al. 2015). Yet an additional goal is to inspire or instill wonder in the audience about science. While some work has begun to explore perceptions of awe from a psychological perspective (Shiota et al. 2007), there has been next to no research on how mass science communication may share this ambition or on what effects awe may have on perceptions of science. Because narratives connect the abstractions of science to the emotional experience of individuals, they are a logical starting point for this line of inquiry.

Much of what is known about using entertainment narratives to communicate science has been studied from the perspective of the science communicator. While science narratives can affect audiences, audiences have agency; they actively select, evaluate, and interpret the narratives they consume. What are they looking for when they choose science narratives? How do they interpret the science contained within entertainment narratives? How do they evaluate whether their needs were met? Work is beginning in these areas (Asbeek Brusse et al. 2015), but a better understanding of the uses and gratifications of the intended audiences could enable producers to address those needs and, in so doing, communicate science more effectively.

Entertainment narratives should not be viewed as inherently adversarial to science, nor should they be seen as a magic bullet for the dissemination of science to nonexperts. Narratives instead represent a unique communication tool for portraying science in ways that vividly intersect with human experience. For science communicators who want to engage individuals with a particular facet of science, the substantial power of that tool is worth understanding and wielding.

You are a social psychologist who has just presented your findings about climate change attitudes to a foundation that funds climate change nongovernmental organizations. You invite questions.

Q: There's a disaster movie about climate change that just came out. Have you seen it?

You: The geo-engineer who rescues planet Earth? No, not yet, but I have seen the "60 Minutes" piece about it, and I must have seen the ads for it at least a dozen times, and it's all over the buses and billboards. My son saw the movie. He said the 3D is awesome.

Q: What do you think its impact will be? Will it move public opinion? How would it compare with the climate change messages that the groups we're funding are trying to get out?

You: Well, I'd bet the ad budget for that one movie is what you've spent on all your climate change media grants put together over the last five years. If it turns out to be a monster hit, by the time anyone with a cell phone can download a bootleg copy, which won't be long from now, a billion or more people around the world will have been directly or indirectly exposed to it.

Q: And what difference will that make?

You: So we know that in some contexts, narratives can be persuasive. If you're someone who's been thinking humanity is doomed, maybe this movie will make you more optimistic. On the other hand, the more people there are who think we'll be rescued by some pies in the sky 30 years from now, the harder it could be to get a politician to vote for a carbon tax 30 months from now.

Q: A lot of our grants fund communication. We support documentaries. Climate change desks at public radio stations. Climate change verticals on news sites. A ton of apps. Media training for scientists—though sometimes that can be a real uphill battle.

You: Yeah—they think Introduction, Methods, Results, and Discussion is already plenty of story.

Q: The narratives we're funding – what do you think their message should be? What's the most persuasive case we can make?

You: Look. Everyone in this room knows what it will take to avoid the nightmare we're heading toward. The biggest change in collective human behavior ever—quickly, consistently, and in every single year for the next 50 years. If you want to inspire people to sign on to that, it'll take more than some app. It'll take telling the most compelling story in the history of the world.

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