Ethical Considerations of Using Narrative to Communicate Science

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Abstract

This article discusses three ethical considerations science communicators face when considering narrative as a communication technique for science policy contexts: (a) What is the underlying purpose of using narrative: comprehension or persuasion? (b) What are the appropriate levels of accuracy to maintain? (c) Should narrative be used at all? These considerations intersect with perceptions of the appropriate roles of communication and of scientists within democracy. By providing a clearer articulation of these ethical considerations, the authors hope that narrative can become a more useful communication technique toward informed science policy decisions.

Keywords

science, communication, narrative, policy, ethics

There is a growing sense that scientific information is not contributing what it should to controversial science policy. Social controversies surrounding topics such as climate change, evolution, and vaccinations are often claimed to exemplify either an ignorance of scientific data or its outright rejection (Baker, 2008; Forrest, 2001; Mooney, 2005; Zimmer, 2011). Science can

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never instruct society in what it should do, as personal and collective ethics define what a society values (Volti, 2009). However, confusion and mistrust of science undercut the foundation on which these collective values can best be achieved.

This perceived lack of scientific influence within policy making has not gone unnoticed. Initiatives such as the Communicating Science Program (Advancing Science Serving Society, 2009) have responded by offering researchers techniques to increase the clarity of their communication. Likewise, various strands of research have explored techniques for improving the effectiveness of science communication within a policy context, including framing (Durfee, 2006), trust building (Liu & Priest, 2009), and altering the top-down communicative model in which science communication is often conceived (Dickson, 2001; Nisbet, 2009).

Another technique relevant to the communication of science is narrative. Narrative describes a format of communication involving a temporal sequence of events influenced by the actions of specific characters. Examples of narrative range from short exemplars or testimonials that may be contained within larger messages to detailed and lengthy entertainment stories common in the movie and book industries. Research suggests that narrative communication is encoded using a unique cognitive pathway and results in effects that are quite different from argumentative or evidence-based communication. Specifically, narrative communication often improves comprehension (Graesser, Olde, & Klettke, 2002), generates more interest and engagement with a topic (Green, 2004, 2006; Green & Brock, 2000), increases self-efficacy through modeling (Oatley, 1999; Slater & Rouner, 2002), influences real-world beliefs (Dahlstrom, 2010; Slater, Rouner, & Long, 2006), and can be more successful for persuading an otherwise resistant audience (Moyer-Guse & Nabi, 2010). As such, narratives hold promise for improving the effectiveness of science communication to nonscientist audiences and have been examined with regard to science-related topics such as health (Hinyard & Kreuter, 2007; Winterbottom, Bekker, Conner, & Mooney, 2008), risk (de Wit, Das, & Vet, 2008; Golding, Krimsky, & Plough, 1992), and the environment (Dahlstrom, 2010).

However, while much research has focused on the effects of narrative communication in a science policy context, little has examined the ethical considerations of doing so. Narrative communication may offer benefits toward a particular set of communicative goals, but what ethical considerations exist at the intersection of narrative influence and the role of science within society? We will address this gap in the literature by exploring the ethical considerations scientists and science communicators face when

considering a narrative strategy for their communicative goals. To do so, we will first highlight the role of narrative and its relation to science communication. Second, we will define the scope of our discussion within the larger conversation of ethics in science communication. Finally, we will introduce three ethical considerations faced by science communicators when using narrative in a science policy setting.

Narrative in Science Communication

The relationship between science and narrative is often discussed in one of two conflicting contexts. The first context sets up a dichotomy between science and narrative based on differences in cognitive processes that underlie comprehension. Much of the literature underlying this context comes from discourse and cognitive psychology, which explores how the mind comprehends narrative information as compared with other types of information. The second context treats narrative as a communicative technique able to enhance the persuasive impact of scientific information. Much of the literature underlying this context comes from the field of narrative persuasion, which explores the often-covert influence of narrative on beliefs and attitudes. We will discuss each context in turn.

Narratives play an influential role in how individuals comprehend the world. At a cultural level, the concept of narrative has a close relationship with that of frames and metaphors in that they all organize perception through their symbolic power; their ability to relate beliefs, values, and actions; and their widespread recognition within society (Hertog & McLeod, 2001). At a cognitive level, narratives have been said to represent the default format for human thought, which form the foundation for decision making (Schank & Abelson, 1995). This reliance on narratives is suggested to be an evolutionary response to the need of humans to model the thoughts of other humans in the complex social interactions that define our species (Read & Miller, 1995).

Research into narrative crosses diverse disciplines (Kreiswirth, 1992), resulting in a confusing array of narrative conceptualizations. For the purpose of this article, we will define narrative as a form of communication involving a temporal sequence of events influenced by the actions of specific characters. This definition is not limited by medium, and narratives could be present in any communication format. Journalistic news articles, although often referred to as "stories," are not necessarily narratives as they are often more driven by fact and importance than character and chronology, but they can become narratives depending on construction. Even photographs, symphonies, and dances have been claimed to contain narrative properties (Scott, 1995). We therefore

conceptualize narrative as any communication that describes specific experiences of characters over time, noting that the most frequent format in our science policy context will be that of text or speech. Narrative defined in this manner is often contrasted with other formats of communication (Longacre, 1983), most notably with that of the evidence-based communication underlying science. Major differences between evidence-based argumentation and narrative often center on their treatment of certainty, context, and truth.

Regarding certainty, evidence-based argumentation seeks to communicate through clarity, relevance, and truthfulness. In contrast, narratives seek to "subjunctivize" information by communicating about human possibilities rather than settled certainties (Bruner, 1986). Narratives actively create implicit rather than explicit meanings and depict reality through the subjective view of a character rather than as an objective certainty (Bruner, 1986).

Regarding context, evidence-based argumentation deals with the understanding of facts, which can be transferred independently from their surrounding units of information. In contrast, narratives represent a mental representation that focuses on understanding people and their actions where meaning is imbedded within the context of the story. Units of information cannot be removed and communicated separately because narrative information relies on this context for its meaning (Felman, 1989; Graesser, Singer, & Trabasso, 1994).

Regarding truth, evidence-based argumentation searches for universal truth and is judged based on the accuracy of its claims. Narratives search for connections between events and are judged based on the verisimilitude of their situations (Bruner, 1986). This different conception of truth mirrors the division between deductive and inductive reasoning: Whereas evidence-based argumentation uses abstractions to infer about particular examples, narrative uses particular examples to infer abstractions (Strange, 2002; Strange & Leung, 1999). This difference confusingly allows evidence-based argumentation and narratives with opposing assertions to claim equal levels of "truth" (Bruner, 1986).

Such differences have led to a proposed division between a paradigmatic and narrative pathway of cognition (Bruner, 1986; Fisher, 1984). The paradigmatic pathway controls the encoding of evidence-based arguments, while the narrative pathway controls the encoding of situation-based exemplars. Empirical studies provide support for this division by finding different cognitive effects between narrative and evidence-based processing. For instance, when asked to discover a rule-based pattern regarding a set of images, participants viewing images of inanimate objects discovered the rule faster than participants viewing images of groups of people. The latter group focused

more on the potential relationships within the images rather than what was actually present and not only took longer to identify the rule but also retained their hypothesis longer in the face of negative information (Bruner, 1986).

Not only does research support the split between narrative and evidence-based thought, but it also suggests the balance is not equal. Narrative text is recalled twice as well and read twice as fast as evidence-based text (Graesser et al., 2002) and generates greater engagement, persistent attitude and belief changes, and self-efficacy (Appel & Richter, 2007; Green & Brock, 2000; Oatley, 1999; Slater & Rouner, 2002). Many of these benefits are due to narrative's cause-and-effect structure. Causal relations have been shown to drive much of narrative processing (Dahlstrom, 2010; Graesser et al., 2002), and the perception of events changing over time both provides a mental simulation of how the world works (Oatley, 1999) and serves to limit the possibility of future choices, making the resolution of the narrative seem inevitable (Curtis, 1994).

A tangible consequence of the difference between narrative and paradigmatic pathways within science communication can be illustrated by the controversy between childhood vaccines and autism. Scientific studies have repeatedly found no link between the two, but a significant group of parents and celebrities have mobilized under a convincing narrative that someone's child developed autism just after receiving the vaccination. This represents a strong evidence-based argument in direct conflict with a strong narrative, and the results are often troubling to scientists. When asked about the growth of the antivaccine movement in a *New York Times* article from June 2005, Dr. Melinda Wharton, Deputy Director of the National Immunization Program stated, "This is like nothing I've ever seen before . . . It's an era where it appears that science isn't enough" (Harris & O'Conner, 2005). Rather than a diminishing faith in science, it is probable that both sides are processing the same information differently, and the misunderstanding between paradigmatic and narrative processing may be perpetuating the conflict.

The second context relating science and narrative is not one of contrast but one of cooperation. In this context, science can use narrative to achieve its communicative goals by unobtrusively changing perceptions about the world through narrative's ability to create meaning with a veiled normative component (Bruner, 1986, 1991; Fisher, 1984).

Narratives imply a strong normative assessment of thought and action yet neither state nor defend the assumptions on which they rely (Bruner, 1991). Because "what makes a good story is different from what . . . makes it true" (Mink, 1978, pp. 129-130), incorrect narratives are rarely influenced by evidence and instead require a more convincing narrative to counter (Kreiswirth,

1992). The fact that narratives are able to construct reality and provide values to real-world objects without argument makes it difficult to counter their claims, and the ease with which they are processed amplifies their influence.

The field of narrative persuasion examines how communication practitioners can take advantage of narrative comprehension to overcome resistance to their messages. Studies often expose a participant to a narrative and afterward measure if he or she accepted the normative view of the narrative or the specific facts mentioned within, often contrasted with a nonnarrative or statistical treatment. Results suggest that individuals are often more willing to accept normative evaluations from narratives than from evidence-based arguments (Green & Brock, 2000; Slater & Rouner, 2002). A common barrier to traditional persuasion is the formation of counterarguments that block the acceptance of a persuasive message. However, persuasive narratives have been found to reduce the formation of counterarguments (Dal Cin, Zanna, & Fong, 2004; Green, 2006; Green & Brock, 2000). Acceptance of narrative evaluations has, therefore, been described as a default outcome of exposure, where rejection is only possible with added scrutiny afterward (Gerrig, 1993; Green, 2006).

It could be argued that fictional entertainment narratives should be discounted, or at least granted lesser weight than truthful narratives. However, studies generally find that individuals use information from fictional stories to answer general questions about the world (Appel & Richter, 2007; Marsh, Meade, & Roediger, 2003), and manipulation checks to ensure that participants understood that the story was not true show that individuals do not discredit information just because a narrative is labeled fictional (Green & Brock, 2000). Even when individuals perceive much of the information in a narrative to be inaccurate, the narrative is rarely rejected completely (Appel & Richter, 2007; Marsh et al., 2003).

Narrative persuasion may seem to imply a passive role for the audience, such that the audience is assumed unable to resist the effects of narrative communication. Yet audiences are very capable of rejecting narratives, most notably when the persuasive intent becomes salient and individuals react to the perception of being manipulated (Moyer-Guse & Nabi, 2010). Likewise, a review synthesis of narrative persuasion studies in a health context found mixed results involving other individual moderating factors (Winterbottom et al., 2008). Rather than imply a passive versus active dichotomy, where passive audiences are influenced by narrative and active audiences are not, narrative persuasion is more influenced by what type of active processing an audience chooses to use. The rejection of a narrative due to realization of its persuasive intent is an active cognitive process where an audience engages with the narrative as a communicative message. In contrast, absorption within

the events of the narrative world represents a different form of active cognition that often demands enough cognitive resources to restrict other forms of thinking (Gerrig, 1993). Successful narrative persuasion therefore depends on the realization that the audience has a choice between engaging with the narrative as a message or as a world and attempting to construct narratives that more often achieve the latter.

The relationship between narrative persuasion and science is one of both potential benefit and conflict. On one hand, narratives offer a format of communication with fundamental advantages in comprehension, personal relevance, and behavior modeling. The potential of science benefiting from the persuasive use of narrative has been explored in contexts as diverse as vaccines (Brodie et al., 2001), pro-environmental beliefs (Dahlstrom, 2010), and HIV awareness (Vaughan, Rogers, Singhal, & Swalehe, 2000), with generally positive results. Outside academic research, the Centers for Disease Control and Prevention (2011) can provide an example of the perceived impact of narrative on science perceptions as it has begun working with television producers to ensure accurate portrayal of science in sitcoms and other prime-time television programs.

At the same time, narratives have the potential to negatively influence science. Narratives do not play by the same rules as evidence-based comprehension, influencing perceptions not through spirited debate but through a whisper of suggestion. Such influence is not easily countered. In fact, accepted narratives are trusted to the extent that individuals rarely allow evidence to contradict them; the evidence is altered to fit their narratives (Shanahan & McComas, 1999). Such impacts may lead to the acceptance of incorrect scientific information or processes or the formation of negative stereotypes about scientists (Barriga, Shapiro, & Fernandez, 2010).

Using narratives in a science policy context introduces ethical considerations that intersect with the ethical role of science in society and the ethics of science communication in general. The next section will review these issues and define the scope of our ethical examination.

Ethics in Science Communication

Because the discussion of ethics within science communication stretches across multiple domains, it is necessary to define the ethical domain in which this article is focused. We will first articulate four ethical domains in science communication to define the scope of our discussion and then expand on our domain of contribution.

The first domain focuses on the ethical conduct of communication within scientific research. This domain is the focus for many STEM (science, technology, engineering, and mathematics) graduate research ethics courses, discussing the proper identification of funding sources, the disclosure of conflicts of interests, the use of informed consent to ensure no potential harm to human subjects, and the fair treatment, analysis, and reporting of research data (Horner & Minifie, 2011; Martin, 2008).

The second domain focuses on the traditional journalistic ethics of covering science. Well-established codes of ethics (Society of Professional Journalists Code of Ethics, 2012) as well as other scholars (D. M. Cook, Boyd, Grossmann, & Bero, 2007) discuss how journalists should "seek truth and report it" by being objective, not misrepresenting factual information, not plagiarizing others' works, and avoiding conflicts of interests. As most journalists are not trained scientists and are not familiar with technical information or jargon, the mainstream press is often criticized for poor science coverage (G. Cook, Robbins, & Pieri, 2006; McInerney, Bird, & Nucci, 2004).

The third domain focuses on the coverage of ethical controversies surrounding science policy. This domain moves ethics from guiding how a journalistic story should be covered to the subject of coverage and examines how the media covers existing ethical controversies surrounding science-related policy. Much of the recent ethically related work published in *Science Communication* represents examples of this domain, such as the examination of the autism vaccine controversy (Clarke, 2008), stem cell research (Leydesdorff & Hellsten, 2005), and biotechnology policy (de Cheveigne, 2002).

Our ethical discussion exists in a fourth domain that examines the use of communication techniques relative to the ethical role of science in society. While both scientific research and journalism have long histories of ethical discussion, this fourth domain, namely, the ethics of communicating science to a nonscientist audience, has received little consideration (Meyer & Sandoe, 2012; Pimple, 2002). The relevant literature within this domain has examined the role of communication within science policy, the role of scientists within science policy, and the role of communication techniques relative to the previous contexts.

What Is the Role of Communication Within Science Policy?

According to the public understanding of science (PUS) model, controversies about science are rooted in ignorance caused by a deficit of science literacy, and the role of communication is to rectify this deficit by educating the public and reducing the controversy (Miller & Kimmel, 2001; Miller,

Pardo, & Niwa, 1997). Implicit in this model is that controversy is not desirable and is something that can be remedied by moving away from irrational beliefs toward factual knowledge. This model treats the public as passive vessels needing more knowledge that scientists provide and communicators translate.

Contrasting this model is the public engagement in science and technology (PEST) model, in which controversies about science represent a necessary function of the democratic process, and the role of communication is to facilitate discussion about the benefits and risks of policy informed by societal values and technical information (Dickson, 2001; Walker, Simmons, Irwin, & Wynne, 1999). In this model, communication serves a two-way function, with the public actively engaging in deliberations about the benefits and risks of controversial science-related issues. Science communication scholars have shifted support from the PUS model toward the PEST model over the past decade, noting the necessary consideration of personal values and autonomy for appropriate scientific policy making (Besley, Kramer, Yao, & Toumey, 2008; Einsiedel, 2008; Irwin & Michael, 2003; Powell & Kleinman, 2008).

What Is the Role of Scientists Within Political Policy?

Pielke (2007) discusses the possible roles that scientists can personify when contributing information toward policy decisions. A *pure scientist* avoids commenting on policy options and instead summarizes knowledge from his or her particular field. A *science arbiter* answers technical questions about a particular policy but avoids prescribing what should be done. An *issue advocate* does prescribe a particular policy action, aligning with one side and limiting policy options. Finally, an *honest broker* expands policy options by commenting on existing policy and offering options that may not have appeared yet in the political agenda. Pielke (2007) claims that all four of these roles can be ethically appropriate.

What is inappropriate, according to Pielke (2007), is when a scientist claims that scientific information compels a certain policy action. In such an instance, the scientist is trying, consciously or not, to use the credibility of science to obscure the larger value debates underlying the controversy. Pielke calls this role a *stealth issue advocate* and uses climate change as an example where society is still arguing over the legitimacy of the science when the underlying value systems are driving much of the controversy. This critique about assuming that science has the power to drive policy has been echoed by others (Nelson & Vucetich, 2009; Nisbet, 2009) and suggests that while there

are multiple roles a scientist can play in policy debate, scientists should not use their credibility or the objectivity of science to suppress the deeper value debates intrinsic to controversial science issues.

How Do Specific Communication Techniques Align With the Roles of Communication and of Scientists Within Policy?

The communication literature discusses many techniques used to attract, hold, inform, and persuade audiences and offers empirical tests as to their effectiveness under varied contexts. Yet there is much less discussion as to the ethical considerations of using these communication techniques.

One field that does reflect on the ethics of using communication techniques is advertising. As summarized by Nebenzahl and Jaffe (1998), a communication technique's ethicality is a function of the degree to which it causes harm to consumers, such as by (a) manipulating and controlling consumers' behaviors, (b) infringing on consumers' level of privacy, or (c) violating consumers' rights to be informed.

Braybrooke (1967) argued that by repeatedly showing advertisements of a certain brand or product, advertising creates a limited set of choices for consumers and manufactures a new set of desires, potentially violating consumers' autonomy by preventing them from following their rational desire or will (Braybrooke, 1967; Crisp, 1987). Likewise, exposure to advertising is not always voluntary and may happen when consumers are not conscious of their own exposure (Nebenzahl & Jaffe, 1998). Product placement where a product is seamlessly inserted into a film may therefore result in the invasion of consumers' privacy (Nebenzahl & Jaffe, 1998). Since "listeners are entitled to know by whom they are being persuaded" (Federal Communications Commission, 1963), product placements and press releases where sponsors are not clearly stated could also be argued to be violating consumers' rights to be informed.

While these ethical considerations have been discussed in an advertising context, the relation of these concerns to science communication remains relatively unexplored. One of the only discussions of ethical considerations regarding a communication technique in a science policy context has focused on the use of frames (Nisbet, 2009). As defined by Entman (1993), "To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (p. 52). Nisbet (2009) has identified seven typologies of frames often used in science-related policy debates, such as framing the issue based on

social progress, scientific or technical uncertainty, or public accountability. The choice of how to frame an issue often has covert effects on an audience's beliefs and attitudes toward an issue (Cobb, 2005; Davis, 1995; Entman, 1993; Scheufele, 1999).

Nisbet (2009) recommended four guiding principles to determine the ethicality of using framing techniques within science policy: (a) frames should be used "to emphasize common ground and promote dialogue" (p. 70) rather than managing information in a top-down fashion, (b) frames should clearly communicate the underlying values guiding a policy choice rather than suggesting science information compels a decision, (c) frames need to remain accurate and not distort or exaggerate the meaning of the content, and (d) frames should not be used to typecast a particular social group or for political leaders to use deliberately for electoral gains.

While Nisbet's (2009) principles of ethical framing present a useful guide within our fourth ethical domain, considerations for other communication techniques, including narrative, have yet to enter the discussion. In the final section of this article, we extend the ongoing discussion of this ethical domain to the use of narrative in a science policy context.

Ethical Considerations of Science Narratives

We introduce three ethical considerations a science communicator faces when deciding to use narrative as a communication technique within a policy setting. We use the neutral term *science communicator* to represent any subject who desires to communicate about a science or technical issue, realizing that this classification includes a broad range of actors, including scientists, journalists, and public information officers, and we will differentiate when necessary. Likewise, our "science communicator" represents an actor with an honest desire to communicate truthfully; we are not considering an actor with the desire to spread misinformation as these actions introduce other ethical considerations and, in our perhaps optimistic opinion, represent a minority of science communicators within the larger democratic context. We also admit that much of science communication is less concerned with policy than with satisfying audience curiosity or providing information deemed useful for individual action. However, we focus on science communication within a policy context because of the frequency with which ethical challenges arise and the seriousness of their outcomes for society. Therefore, we explore the following three ethical considerations surrounding the use of narrative within a science policy context.

What Is the Underlying Purpose of Using Narrative: Comprehension or Persuasion?

This consideration requires a reflection on the appropriate role of communication within science policy. Why engage in science communication? The simple answer is to "inform," but such an answer often distracts from the underlying assumptions about what informing the public is supposed to achieve. Is the purpose of informing the public to reduce controversy about a science-related policy as assumed under the PUS? Or is the purpose of informing the public to facilitate the controversy necessary to reach a policy as assumed under PEST? Should science communication promote personal autonomy to make choices or create disengaged compliance toward a preferred outcome? This partition manifests itself in the narrative literature between the areas of narrative persuasion and narrative comprehension.

Narratives offer benefits of persuasion through their ability to make normative claims without needing to explicitly state or defend them. These benefits are amplified through factors such as a reduced ability to counterargue when processing narrative information and identification with characters designed to exemplify the central persuasive message. A science communicator whose assumptions underlie the PUS model may decide to design a narrative with the goal of reducing a science-related controversy and generating consensus through the persuasive benefits intrinsic to narratives. Creating a narrative for these ends could involve choosing a series of events that provide a causal explanation of the preferred side of the issue, portraying those events through the eyes of a character who either normatively agrees with the preferred side of the issue or learns to do so throughout the narrative and either concealing or undermining the values underlying the opposing side. Such a narrative has the potential to unobtrusively persuade an audience to be more receptive to a particular science-related policy.

Narratives also offer benefits in comprehension through their increased ease of processing and their ability to make information more relevant and contextual. Much of this benefit lies in the fact that narratives mirror daily experience and are therefore easier to understand and put into a human perspective. A science communicator whose assumptions underlie the PEST model may decide to design a narrative with the goal of facilitating informed debate by increasing comprehension of the science-related factors. Creating a narrative for these ends could involve selecting causal events that explain the factors underling the science issue, portraying the events through a character neutral to the issue at hand or through multiple characters in order to represent multiple sides, and personifying the underlying social values that

intersect with the issue. Such a narrative has the potential to engage a wider public in the debate, enhance understanding of the science, and create greater connections with existing knowledge. The area of narrative medicine can provide a relevant example of using narratives for these purposes. Formed partially in response to the critique of medical personnel treating diseases instead of people, narrative medicine claims that narratives are necessary to facilitate a two-way dialogue between patient and care provider and to increase comprehension for both (Harter & Bochner, 2009).

As evidenced by recent attacks on the PUS model as inadequate (Einsiedel, 2008; Irwin & Michael, 2003), it can be assumed that science communication scholars would support using narrative to facilitate discussion toward informed policy. In fact, three of Nisbet's (2009) principles for the ethical use of framing can be addressed by this comprehension function of narrative, namely, promoting dialogue, clearly stating values, and not using frames for personal gain. These principles raise the question of whether it is ethical to use a communication technique that must remain hidden in order to be effective. The persuasive impact of narrative has been demonstrated to decrease markedly once the persuasive intent becomes known (Moyer-Guse & Nabi, 2010). Yet the improved comprehension derived from narrative is not affected if its intent becomes salient. It therefore seems safe to assume that using narrative for increased comprehension is ethically justifiable.

However, it may be naive to assume that using narrative for comprehension in a science context is appropriate while using narratives for persuasion is inappropriate, as there may be instances where manufacturing compliance represents an ethical decision. Persuasion is often the underlying purpose behind health narratives trying to promote healthy attitudes or behaviors, either as veiled entertainment programs or as carefully selected testimonials within a larger nonnarrative message (Vaughan et al., 2000; Zillmann, 2006). In such cases, the social benefits of increased vaccination or environmentally conscious behaviors may justify reduced personal autonomy.

Such a decision may depend in part on the type of science issue. Pielke (2007) differentiates between two types of science issues: tornado politics and abortion politics. Tornado politics represent issues with high consensus where science can justify the best course of action (because everyone agrees they want to escape the tornado and wants to know how). Abortion politics represent issues with low consensus where science can never resolve a conflict of underlying values. Persuasion toward science policy may be more justifiable under tornado politics, where there is a clearly supported outcome, than under abortion politics, where values become more contested. Likewise, the decision may also depend on the normative expectations held by the

public about the communicator. Scientists and journalists are often expected to remain objective, and using narrative for persuasion may take advantage of this expectation. Public information officers, on the other hand, are expected to promote their employer, and persuasive narratives may be more justifiable because they are expected.

In sum, narrative can be used in a science context toward either increased persuasion or increased comprehension. The consideration of which underlying purpose should drive the creation of a science narrative will intersect with a consideration of the appropriate role of communication within science policy.

What Are the Appropriate Levels of Accuracy to Maintain Within the Narrative?

Implicit in the previous discussion is that the science being communicated in a narrative should remain accurate. Nisbet's (2009) third principle for the ethical use of framing states this explicitly, claiming that scientific accuracy in communication needs to be maintained. However, unlike evidence-based communication, where each fact can be individually assessed for accuracy, narratives rely on contexts for their meanings, which introduces differing levels of accuracy.

It may seem that the most obvious measure of accuracy may be whether the narrative describes a real, nonfictional series of events or an imagined, fictional account. While nonfiction narratives may indeed be more accurate, this level of accuracy may not always be necessary. Choosing to construct a fictional narrative may sometimes be more appropriate because hypothetical situations can be created to explain relationships that have yet to occur or to model an "average" or "extraordinary" experience that might not actually occur in the complex interactions of the real world, yet would be instructive in understanding the science. Likewise, many elements within a fictional narrative can still be accurate—such as scientific procedures, cause-and-effect relationships, or probabilities of risk—and much research has demonstrated that individuals learn facts about the world just as well from fiction as from nonfiction narratives (Dahlstrom, 2010; Marsh et al., 2003). To take a concrete example, consider constructing a narrative to explain the future impact of sea level rise due to climate change. Since the future impact has yet to occur, creating a nonfiction narrative would entail focusing on tangential events, such as how a particular scientist predicted the rise in sea levels or how an individual experiences the current impact of rising sea levels. Alternatively, a fictional narrative could describe how a hypothetical

individual might experience the world with sea levels at the predicted height to provide a more accurate perception of the future impact than could be provided by either of the nonfiction examples.

Beyond fiction versus nonfiction, the literature on perceived realism can offer vocabulary to describe additional levels of accuracy intrinsic to narrative. Busselle and Bilandzic (2008) define narrative elements that are accurate *relative to the real world* as high on external realism. The previous examples of potentially accurate elements within a fictional narrative show how fictional narratives may nonetheless be high on external realism. Likewise, a nonfiction narrative may actually be low in external realism, such as in a historically accurate narrative that bears little resemblance to the world of today. It is likely that external realism is being conceptualized when scientists and scholars speak of the importance of maintaining accuracy within science communication, namely, that it accurately represents the real world. One challenge, then, of creating science narratives lies in deciding what elements of the narrative need to maintain high external realism and what elements can be relaxed toward low external realism for the larger purposes of communication. This selective external accuracy is already present within science itself, such as when a scientist uses the impossible assumption of a frictionless surface or infinite plane to more clearly focus on some other aspect of reality. Some of the narrative elements that may or may not need to be high on external realism include types of characters, characters' motivations and actions, settings, situations, events, cause-and-effect relationships, procedures, chronologies, and time frames.

Again, to offer an example, consider constructing a narrative to explain the process of converting grain to ethanol by personification of the components into characters. Describing yeast as waiting until the proper temperature to eat its lunch of sugar is a cause-and-effect relationship low on external realism, but the inputs and requirements of the procedure can retain high external realism and accurately describe the process in an understandable form.

In contrast to external realism, Busselle and Bilandzic (2008) define elements of a narrative that are accurate *relative to the rules set forth within the narrative world* as high on narrative realism. Rules are established early in every narrative about how the narrative world operates, such as how a character relates to the world around him or her, the properties of an object, or the importance of certain objectives. If these rules are later broken, processing is hindered (Albrecht & Obrien, 1993; Kaup & Foss, 2005), persuasion is decreased (Green, 2006; Green & Brock, 2000), and the narrative may even be rejected (Busselle & Bilandzic, 2008; Hall, 2003). The influence of narrative realism becomes obvious in the case of fantasy, where a dragon breathing

fire is seen as more accurate than a dragon breathing water, even though both are unquestionably externally inaccurate. Narrative realism represents a second level of accuracy that is less often discussed in science communication, but the implications remain. A narrative that maintains accuracy through appropriate external realism may nonetheless be rejected because it is not accurate as perceived through narrative realism. For instance, constructing a persuasive narrative to promote the acceptance of genetically modified foods by showing a character benefiting from their use may maintain appropriate external realism, yet be perceived as narratively inaccurate if the character does not behave as earlier descriptions would suggest or if the narrative does not complete a story arc and feels incomplete.

Yet another level of accuracy within narrative communication lies in a narrative's representativeness. Narratives intrinsically lead to the abstracting of specific examples to general trends. Unlike the generalizable content of evidence-based communication, narratives provide a single or small number of exemplars relative to an issue. The representativeness of these exemplars will therefore determine the accuracy with which an audience can generalize to other contexts. Exemplification theory clearly shows the power of narrative to affect perceptions of representativeness. Even when base rate information is present claiming a particular risk is low, the presence of exemplars skew perceptions toward the typicality of the specific exemplar used (Gibson & Zillmann, 1994). This fourth level of accuracy raises the possibility of creating a narrative that maintains accuracy through appropriate external and narrative realism but fails to accurately depict a series of events that is representative of the larger science issue. For instance, a narrative of the experience of an individual who decided not to be vaccinated and developed polio may maintain the desired previous levels of accuracy, but it also represents a worst-case scenario that is not generalizable to what is likely to occur in such a situation and is therefore representationally inaccurate. Of course, selecting a nonrepresentative narrative could be beneficial for a science communicator attempting to use narrative to persuade an audience toward a predetermined end.

While accuracy remains crucial for appropriate science communication, the maxim of maintaining accuracy becomes more complex when considering narrative communication. While maintaining accuracy through narrative realism is likely necessary for any effective narrative, the choice in constructing a fiction versus nonfiction narrative, what elements of the narrative should exhibit high external realism, and whether to select a representative example will intersect with the science issue at hand, the nature of what is to be communicated, and the underlying purpose of using narrative in a science context.

Should Narrative Be Used at All?

Whereas some communication techniques are unavoidable, including the frames underlying Nisbet's (2009) ethical principals referenced throughout this section, narratives do represent a communicative choice—a choice between using evidence-based arguments through paradigmatic processing or a mediated experience through narrative processing. What are the ethical considerations of using one cognitive pathway over the other? It now becomes necessary to examine specific actors within our broad "science communicator" label. Journalists, public information officers, and other roles that specialize in communication are often expected to use narrative. In fact, the Field Guide for Science Writers specifically cites narrative as one of the effective techniques for covering science (Blum, Knudson, & Henig, 2006).

Scientists, however, hold a much different role in society, and their use of narrative raises its own considerations. Do the perceptions of scientists so closely align with evidence-based communication of the paradigmatic pathway that scientists will be perceived as violating normative expectations if they dabble in the narrative pathway? Could such normative violations cause particular scientists to lose their credibility in the public sphere or, worse, cause the science itself to lose credibility? Bruner (1986) expands on this idea, saying that a scientist caught using the presupposition or subjectification common in narrative would become the "butt of jokes" (p. 28), while a novelist could not maintain suspense or reader involvement without them (Bruner, 1986). While successful scientist popularizers, such as Carl Sagan, are often championed as the cure for poor science literacy (Nisbet & Scheufele, 2009), a 2006 survey of scientists' views of engaging with nonscientists reveals that scientists who communicate with nonscientists are often viewed by their peers as "fluffy" or "not good enough" for an academic career (The Royal Society, 2006). There is yet no research into what normative expectations the public holds regarding the communication of scientists to a nonscientist audience, so these questions cannot be addressed here.

Nonetheless, other communicators within the debate will likely use narratives, and a choice to avoid using narratives completely due to normative expectations may represent a capitulation to those who do. This dilemma may be becoming more salient as exemplified in a 2008 speech where National Public Radio science correspondent Robert Krulwich criticized scientists for not using their own narratives to counter the "beautiful" narratives of creationism and told young scientists that they should tell stories as a way to fight back (Krulwich, 2008). Regardless of any existing normative expectations aligning scientists to the paradigmatic mode of communication, it

may, in fact, be unethical for scientists *not* to use narrative and surrender the benefits of a communication technique to the nonexpert side of an issue.

The question of whether or not to use narrative at all in a science policy context is essentially a philosophical question. While all of the considerations thus far are relevant when evaluating the question on a situational level, it may be illustrative to ground the considerations in contrasting ethical theories. Utilitarianism is one such theory that focuses on the aspect of harm, stating that ethical actions are those that produce the greatest good for the greatest number of people (Rachels & Rachels, 2007). Following utilitarianism, the use of narrative is ethically justified anytime the effects benefit more people than they harm. In contrast, Kant's (1981) categorical imperative focuses on autonomy and states that ethical actions are those that respect individuals' rationality and do not treat others as a means to an end. Following this aspect of Kant's categorical imperative, the use of narrative is ethically justified anytime it does not attempt to restrict an individual's autonomy to make decisions.

To illustrate the contrasts between these two ethical theories, let us examine two possible questions about the use of narrative: (a) Are narratives always manipulative? (b) When is manipulation appropriate? The first question would be of utmost importance under Kant's (1981) categorical imperative, as narratives could only be ethically justified if the answer was no. Under utilitarianism, the first question is of little consequence, yet the second question demands careful consideration of the outcome of the manipulation. Returning to Kant's categorical imperative, the second question has a simple answer: never.

Rather than promote a particular ethical theory on which to ground a proposed ethical conduct of narrative, it is our purpose to articulate the relevant concerns that arise when considering the use of narrative in a science and policy context. Not only is it suggested that reliance on a single ethical theory is not how individuals actually make decisions (Daniels, 1979), but it also oversimplifies the complexities that exist when communicating science in a policy context among conflicting viewpoints. It is more important to emphasize that specific instances of communication are situational, and the decision whether or not to use a narrative should be one of the considerations.

Conclusion

Scientific information provides the foundation on which informed science policy can be assembled. The effective communication of science is necessary

to build this foundation, which is one of the impetuses for continued research into science communication. However, the ethical considerations underlying the communication of science to a nonscience audience are still in need of further reflection. It seems likely that at least some of the controversy surrounding many of our current science-related controversies is due to violation of some unarticulated ethical considerations.

In this article, we contribute toward this goal by exploring the ethical considerations underlying the use of narrative in a science context by introducing three considerations:

1. What is the underlying purpose of using narrative: comprehension or persuasion?
   a. Do I want to facilitate potential controversy through greater understanding or reduce potential controversy through greater acceptance?
   b. Can I justify manipulating my audience?
2. What are the appropriate levels of accuracy to maintain within the narrative?
   a. What elements of my topic must remain rigidly accurate and what can be relaxed to construct a more effective narrative?
   b. Is it necessary that my narrative portrays a generalizable example or can it justifiably portray an extreme example?
3. Should narrative be used at all?
   a. Will my audience accept a narrative from my position?
   b. Will others within my issue be using narrative?

It is our hope that through this clearer articulation of ethical considerations, narrative will become a more useful tool for science communicators to build a stronger scientific foundation for science policy decisions.

Future studies should enlarge this discussion by examining the ethical considerations of other communication techniques within a science policy. Future studies should also explore how different groups within the larger public expect scientists to communicate. Such an understanding of their existing normative expectations could be useful for science communicators in general, but it is especially so when entering science issues where deeply held values are at stake. It is also possible that the increased prevalence and prominence of science within political controversies may be recent enough that the public and policy makers do not yet have clearly defined expectations of science communication within policy. If this is the case, scholars may have

the opportunity to not only measure but also influence what the public and policy makers view as ethical conduct of science communication through a clear articulation of relevant ethical considerations.

Authors' Note

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