Finding the plot in science storytelling in hopes of enhancing science communication

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Like the proverbial tree falling in a forest with no one around to hear it, science discoveries cannot have an impact unless people learn about them. The act of communication is part and parcel of doing research. And in an era increasingly defined by open access, crowdfunding, and citizen science endeavors, there is a growing demand for researchers to communicate their findings not just within their field—via institutional seminars, conference presentations, and peer-reviewed publications—but to general audiences as well. One of our main endeavors as scientists then, must be to present discoveries about which the public will care.

Borrowing communication strategies from the arts and humanities can help, and scientists would be wise to do so more often. As recent scholarship in science communications has suggested, an "information deficit" is not, by itself, the root cause of a poor understanding of science among portions of the lay public (1). Simply providing more information about a given issue won't necessarily change minds or prompt, for example, a skeptical audience to accept the science of climate change.

Recent work indicates that storytelling and narrative can help communicate science to nonexperts (2), within the wider context of "framing" as an important feature of public outreach. Creative writing—and fictional storytelling—offer clues on how to improve our odds of science communication success. Pursuing such strategies can help tackle what continues to be a monumental science communications challenge.

As noted in a recent National Academy of Sciences (NAS) report on the state-of-the-art of science communication, the complexities that stand in the way of effective science communication are many, varied, and very often interdependent (3). They are not limited to the difficulties posed by the scientific content itself; rather, they also entail the differing audience needs and perspectives, the belief systems or "mental models" that people hold to explain how the world works, and the numerous reasoning devices that color our

Storytelling and narrative can help communicate science to nonexperts and improve the odds of science communication success. Image courtesy of Dave Cutler (artist).

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interpretation of scientifically neutral information. This is especially true when the data presented concern controversial topics, such as climate change, energy, or food safety (3). To compound these obstacles, active scientists who communicate with the public can face lack of encouragement—and even open discouragement—from within their peer communities, although social media outlets may be starting to force a change (4, 5).

We must, the NAS report notes (3), endeavor to better understand the structures and processes that encourage effective science communication, as well as determine the best practices for communicating scientific uncertainties, and ascertain the role of narratives in communicating science. There is reason for optimism in this call to arms, as the rapidly developing science of science communication (6) works to systematize the available evidence from a growing body of literature, and produces testable hypotheses of what works and what doesn't in public science engagement.

Research into what makes for effective science communication may also benefit from considering how the arts and humanities engage society. Audience interaction is intrinsic to experiencing—and producing—art. As such, careful observation of human perception and behavior is a customary component of artistic training. A shared interest in the human experience has resulted in a rich tradition of cognitive researchers gaining and testing insights from artists, such as painters, sculptors, musicians, or magicians (7–10). This is where the power of the narrative can and should be used.

Plot Not Story

Edward Morgan Forster, the author of *A Room With a View* (1908), *Howard's End* (1910), and *A Passage to India* (1924), distinguishes between story and plot. "The king died and then the queen died" is a story, Forster writes in *Aspects of the Novel*. But "the king died and then the queen died of grief" is a plot (11).

The first statement amounts to a series of events in proper chronological order, Forster argues. The second statement goes beyond a simple time sequence. It gives the reader a reason, a causal connection between the events. "Consider the death of the queen," Forster compels us. "If it is in a story we say 'and then?' If it is in a plot we ask 'why?"' (11).

Plot-building and research narratives share certain parallels. As scientists, we observe events in the natural world and try to draw connections between them. We care not only about when things happen with respect to one another, but why they happen. If we are so lucky as to find out the why, then we have a tale to tell. But how do we make our chosen audience care about it?

In an opinion piece for *The New York Times* published last year (12), the physicist and popular science writer Laurence Krauss laments that fundamental science findings, such as the recent discovery of gravitational waves, come short of generating appropriate levels of public excitement.

"Too often people ask, what's the use of science like this, if it doesn't produce faster cars or better toasters," he says. "But people rarely ask the same question about a Picasso painting or a Mozart symphony." Gravitational waves have little relevance to our everyday lives, Krauss readily admits. Yet Beethoven's 9th, while also lacking practical value, does not fail to exhilarate us (12).

The answer to this riddle may lie in Forster's tale of the dying king and queen. Why is "the king died and then the queen died of grief" better writing than "the king died and then the queen died"? Forster is correct in that only the second sentence offers a causal link between two previously disconnected events. But is that the main difference between the two accounts of the king and queen's deaths?

Perhaps a more important distinction is that the first sentence is emotionally neutral, while the second is not. "The king died and then the queen died" need not evoke a mental picture in the readers, but "the king died and then the queen died of grief" forces them to consider what feelings they experienced after the loss of a loved one, or what feelings might follow such a loss.

Reading that "the queen died of grief" triggers (at least the glimmer of) an emotional reaction in the audience. So does listening to Mozart, or standing in front of Michelangelo's *Pietà*. Be it music, painting, or poetry, good art moves us. The corollary is also true: bad art fails to make us feel.

More than two decades ago, Antonio Damasio noted that the neural circuits that sustain our everyday thinking evolved in life-and-death conditions that evoked powerful sentiments. Descartes's error was separating feelings from rationality, Damasio argued, instead of realizing that "emotion is integral to the process of reasoning" (13). Today, our mammalian brains continue to assess incoming data in an emotional context. Information is meaningful insofar as it evokes emotion.

We place so much weight on our emotional experience that lack of practical value becomes a nonissue. When we chuckle at Don Quixote's misadventures or we tear up at the tragedy of Jack Dawson's death at the end of the movie *Titanic*, our thoughts are far away indeed from such mundane matters as making better toasters.

As a theoretical physicist and cosmologist, Krauss can ponder gravitational waves and feel as emotionally engaged as most of us do when we contemplate great art. His mind, too, is light-years away from more efficient toaster engineering. Trained scientists can appreciate a narrative (or a plot, in Forster's terms) that explains the why of an observation. But take away emotion, and the same description that thrills a scientist may bore a nonexpert to tears.

In fact, when scientists communicate within their fields, they can afford to downplay emotion. The research may speak for itself and elate those trained to recognize its worth. Upon discovering the structure of DNA, Watson and Crick famously wrote, "It has not escaped our notice that the specific pairing that we have postulated immediately suggests a possible copying mechanism for the genetic material" (14). The wry statement might have

been screamed from the rooftops. Biologists everywhere instantly recognized the finding as world-changing.

The background and experience of a theoretical physicist allows him or her to feel profoundly moved by fundamental discoveries about the fabric of the universe. The rest of us, who don't have the tools or speak the language, need a translator.

Emotional Gravity

Cognitive science research indicates that nonnative languages evoke weaker emotions in bilingual listeners than equivalent words in one's mother tongue (15). When a major scientific discovery generates little public interest, there is a similar disconnect between content and emotional impact. To bridge the gap, we must decode science to a narrative that generates feeling.

Krauss himself does precisely this in his article. His call for the reader to care about gravitational waves ends with an evocation of youthful astonishment: "Every child has wondered at some time where we came from and how we got here" (12). The newly discovered oscillations in space deserve the same childlike awe, he pleads.

Science news that engages us often captures the same sense of fascination that defined our early years. In 2006, the International Astronomical Union's announcement that Pluto was no longer a planet made headlines around the world because it struck an emotional chord with the public. Stemming from school-age memories of lessons about the place of Earth in the universe, and of Saturday mornings watching Disney cartoons, we cared about Pluto's fate, even if Pluto itself could not care less about earthling definitions of what counts as a proper planet.

Science breakthroughs that resonate with nonexperts despite lack of direct application do so because they engross our imagination and prompt emotion. Think about the cloning of Dolly the Sheep, or the discovery of *Homo floresiensis*, a new hominin species in the Indonesian island of Flores, nicknamed "hobbits."

As scientists, we are bound by facts, and it would be both dangerous and unethical to stray from them when we address the public. But facts alone may not be enough to engage wide audiences, especially in the case of discoveries that have no practical value, lack immediacy in their use, or are controversial. We should not separate facts from emotion, à la Descartes, but tap into emotion to bolster scientific facts (16). Such a strategy, assuming those who employ it are careful not to detract from the science, could make a difference in the public support of climate change and other science-based policies that may not affect us visibly today, but have grave repercussions tomorrow.

To succeed as science communicators, we must go beyond making the science facts accessible to general audiences. Science communication is an exceptionally intricate system, encompassing not just the content and format of the material being communicated, but also the individuals that serve as communicators, their diverse audiences, the communication channels used, and the political and social environments that encompass them. The NAS report calls for a holistic approach to this problem, particularly if the scientific issues in consideration are contentious. Here we have focused on a few isolated elements within a multidimensional array of factors affecting science communication, while being acutely aware of the existence of system-wide complexity (3).

It is within this integrated approach that we may consider a potential partnership between the science of science communication and the art of storytelling. Reaching a general audience while communicating scientific content is perhaps as much an art as a science, and successful art engenders emotion. Identifying and developing such emotional connections in the public might be a powerful path to a gripping plot.

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