Why we need to stop explaining science

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The best part of my job as a science writer is when scientists explain their work to me. I like it when they go into far too much detail (which I then have to leave out of the story).

But I don't think I am normal.

Throughout my physics studies, I loved to tutor students, take tours though the lab, which led me into a career in Science Communication. My first real job in Sci Comm was at the University of Sydney, working with a lot of teenagers.

But I found that not all the teenagers were as interested in physics as I was. (Who would have thought?) So I started explaining harder, with more creative analogies and more engaging presentations.

Which helped a little.

But I still remember a presentation at a school on the semi-rural outskirts of Sydney, when there was a posse of kids at the front lapping up my superconductivity and projectile motion demos. But three-quarters of the year eights were bored out of their brains. The back row were running in and out of the theatre playing chasies, despite their teacher's best efforts. How could they not care about a levitating magnet at -196° ?

Around the same time, I'd been reading Bill Bryson's *A Short History of Nearly Everything*. I actually usually prefer novels to non-fiction, but Bryson's non-fiction completely sucked me in with its stories of how we learned about the world around us. Surprisingly, it was his descriptions of the humans who made the discoveries that captivated me. No lecturer had ever told me

Newton was mad (possibly mercury poisoning). No exam had ever asked whether Hubble was a compulsive liar.

Yet, these characters were making this book such a page-turner, even though I knew a fair percentage of the science facts he was relating.

The pieces started to fall into place when I went to my first ever non-physics conference—the Australian Science Communicators Conference. Here were people studying the very issues that were troubling me.

It was a lecture from a biophysicist turned social scientist that really rocked the boat. In a 15-min talk, Professor Joan Leach, then at the University of Queensland, suggested there were other ways of presenting science to audiences than just a series of facts in a logical order. Exploratory learning. Historical re-enactments. Human stories.

I couldn't wait to get back to work and try these ideas out. Soon, I was trying out things like a high school workshop in which the clues to a code were embedded in 15 experiments in the lab—inspired by the Dan Brown's *The da Vinci Code*. My student feedback started climbing.

(Not all my experiments were successful—my tip: Don't ask shy, geeky teenagers to do dramatic re-enactments of famous experiments in front of their peers. Far too scary!)

There was one thing I still couldn't come at. I had the good fortune to visit Princeton's Institute for Materials, where they had an exhibition of science art. And I also saw Quark Park, a science sculpture garden. I'll admit, some of it looked quite nice. Some of the sculptures were kinda cute, but what was I supposed to learn from it? It didn't demonstrate deep scientific principles nearly as well as a graph or an equation.

While I muttered about uselessness on the train home, worlds were clashing at a much grander scale.

The world's climate was changing. Proving that it was actually possible to herd cats, researchers from all kinds of disciplines and countries came together to form the

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Intergovernmental Panel on Climate Change, and presented a united and terrifying view of the effect humans were having on the whole planet.

People began to listen. Al Gore took the bull by the horns and people began to think about how to change. But then it all went wrong.

People started popping up and disagreeing with the research. The scientists were gobsmacked. They'd managed to come to a consensus, surely no one would believe people with no scientific credentials, sponsored by the fossil fuel industry?

But sure enough, public opinion turned around. Seeds of distrust were sown, the truth became inconvenient and no matter how hard scientists explained their research, the number of climate change deniers grew and grew.

The arc continues today, with the election of Donald Trump. It's now a post-fact world. It's so clear that the adversarial approach of presenting facts to back up your argument doesn't convert your opposition. In fact, it entrenches their views (after all, who likes to be proven wrong?).

Again, a social scientist, engineer turned science communication researcher, Professor Will Rivkin, then at UNSW, rattled my cage, with a 5-min talk about trust. About how people need to know not only that someone is competent, but also has their best interests at heart before they trust them.

A fascinating blog post on Scientific American website by Bora Zivkovic went into it more deeply (<https://blogs.scientificamerican.com/observations/the-line-between-science-and-journalism-is-getting-blurry-again/>). Went into it more deeply. In short, the things that we humans have traditionally used to judge people, to form our first impressions, are very subjective. We decide whether someone is a danger to us from cultural clues: whether they look, speak and behave like us. Do they share our emotions, our vulnerabilities, our humanity?

But, of course, good science goes out of its way to remove all those cultural influences. As objective as possible.

And when science is presented in that way, people don't naturally trust it. It seems robotic. Who's saying this? Do they have my best interests at heart? I don't know because it's all written in the passive voice!

So when scientists ask me how to communicate, I tell them to use their emotions. Sure, facts are facts, but your reaction to them is your own. I say, "the evidence shows a clear rise in global temperatures, and that terrifies me!"

People without a scientific background will connect with that emotion; it tells a much more compelling story for them than the hockey stick graph that terrifies me.

But still people will turn away if they don't want to hear. They didn't come here to learn something, especially not something uncomfortable, threatening and with no easy answer.

It clicked for me as I listened to a marketing pitch from the editor of the Australian science magazine *Cosmos*, trying to

persuade my University to buy advertising. He talked about the space his readers were in—not a busy newsy space like *New Scientist* readers, but a broader, slower more absorbed space.

That weekend, as I sat listening to my economist father-in-law explaining the intricacies of the free market's spread into former Eastern Bloc countries, I thought, I'm not in this space. This is a BBQ; for once, I didn't come here to learn anything.

Suddenly, I got the art park. It was hard for me to swallow, but maybe people didn't always want science explained to them. They just wanted to look at something nice. Engage with something on an aesthetic level, without battling challenging concepts or non-intuitive quantum contradictions.

My journalism teacher had told me, entertain first, then inform. Because if you don't entertain, no one will read it and, so, there'll be no informing at all.

So it was in the art park. People would walk away with a good feeling about science. An emotional connection that helped them to not feel alienated. To trust science, even.

It didn't actually matter whether they could now pass a test about Schrödinger's equation, and the shapes of S, P and D orbitals. If they decided to find out more, Professor Google would help them, when they were in a learning mood.

So I started incorporating songs into my science presentations (Fig. 1). I can't help myself but explain stuff first—but then I take a song everyone knows, change the words to be about the science I've been discussing and get the audience to sing along. The Beatles' *Hey Jude* becomes *Hey Plute*.

Australian audiences are a little unsure about this, but after a beer or two, they usually get into it, and end up loving it. There's something magical about singing together (plus it breaks up the quietly listening audience paradigm, but that's a whole other discussion).

It feels almost underhand, like Hitler manipulating crowds with stirring marches. But that's what science is up against. Well-orchestrated marketing campaigns use all the arts and

Fig. 1 Dooley provides a live accompaniment for an audience demo at Physics in the Pub, Sydney. (Credit Shane Hengst)

social sciences to woo their audience at an emotional level, and that will trump facts every time (pun intended).

I came across a little story from my Anglican childhood recently, about a man at the pearly gates, looking back at his life as a walk along a beach. Noticing a second pair of footsteps, the man asks Jesus whose they are. Jesus says they are his, he walked beside him his whole life. But the man sees the dark parts of his life, and only one set of footsteps—why did you abandon me? No, I didn't Jesus says; I carried you.

Now, that didn't happen. Someone made it up. It's a lovely story, and it made a big impact on me as an 8-year-old, but it's just not real.

Can science ever prevail when made up stories are so powerful (Fig. 2)? Time will tell. But in the meantime, I decided to make some stuff up too. I wrote a science fairytale, about a prince searching for love, who is courted by scientist would-be princesses. There's black-body radiation, Mars exploration, genetic modification of chlorophyll, solar spectra, Rayleigh scattering, love and a happy ever after.

It doesn't matter that it never happened—human brains are hard-wired to remember stories. And if people want to find out more about why photosynthesis is so terribly inefficient that there is no way an intelligent designer would have made it that way, the internet is there.

This is my challenge to the scientific community. Don't be afraid to be a human, a scientist with emotions. Of course, keep your research as objective as possible, but when you're out of the ivory tower, embrace the arts. Give them a science flavour, tell your own story as a human.

Just don't explain it.

Fig. 2 An astronaut courts the sci-curious prince in Phil Dooley's sciencey fairytale

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