In These Times, Season 3 | Facts vs. Feelings (Episode 1)

Alex Schein:

Science encompasses a lot, everything from the big bang to the smallest quark, from the speed of light to deep time, as intimate as our own bodies and as distant as the edge of the universe. If you're not a scientists, and even if you are, the scope and scale of everything we call science stretches the imagination. The vastness of scientific information can cause us to look up at the stars with awe but can also cause other reactions like skepticism and disbelief, denial and discomfort and even fear.

On this season of the OMNIA Podcast, we talk to scientists and other scholars about scientific ideas that cause big reactions. We'll look at stories of science getting knocked around and standing back up again in a world full of polarization, politics, misrepresentation, and simple misunderstanding. Welcome to In These Times: Fear and Loathing and Science.

Speaker 1:

Do you believe that COVID-19 can be spread from people not wearing masks?

Shiva:

It can be spread no matter what. Those masks don't do anything.

Speaker 1:

You don't think the masks help.

Shiva:

They don't help.

Speaker 1:

Shiva, a lot of people are going to say that you guys are ignoring science and scientists who are telling us to wear masks.

Shiva:

Well, that's only pseudoscience.

Alex Schein:

One of the more unexpected side effects is COVID has been the rise of a new strain of resistance to scientific information, from anti-vaxxers and anti-maskers to those who believe that the pandemic is a hoax. But science denial didn't start with COVID. Rejection of science evidence is part of the history of science itself, and in the US it's how intelligent design found its way into science classes and why the health effects of tobacco were ignored long after they were documented and why the reality of climate change continues to be a disputed fact. How did the search for understanding and truth find itself in the crosshairs of US politics?

In this episode, we'll hear perspectives from a particle cosmologist, along with a scholar who examines the role of emotion in religion and secularisms. They'll be discussing what makes people feel the way

they do about scientific information, the challenges scientists face when communicating about science and why it's important for them to try. Welcome to episode one, facts versus feelings.

As a particle cosmologist, you could say that Mark Trodden's research boils down to understanding just two things: The physics of the smallest components of matter and the way that the universe itself works. Trodden is the Fay R. and Eugene L. Langberg professor of physics, co-director of the Center for Particle Cosmology and chair of the Department of Physics and Astronomy at Penn. As a theoretical researcher, Trodden uses mathematics to explore some of the biggest questions of all.

Mark Trodden:

I think that most people know that over the course of the 20th century there were two enormous revolutions in fundamental physics. The first one really involved what you might think of as the physics of the small. Understanding that at its constituent level, matter is not really made up of hard, little balls that are particles but really of something that we call quantum fields, and so that really all constitutes the physics of the tiniest things in the universe.

The other major revolution that happened in the 20th century was the development of general relativity, which was Einstein's major contribution, and that was the description of things that gravitate; big, heavy things; planets, stars, things like that. And it completely changed the way we think about gravity but it also did something fundamental; it changed our notion of space and time. Our notion of space and time no longer was the notion of ways of describing where things happen and when things happen that are agreed upon throughout the universe, it was instead that space and time are dynamical things that can change depending on where you are in the universe and what's going on. And that really completely revolutionized the way that we think about gravity.

And for awhile, I think people thought that those two things were completely disparate, distinct things. And the way I've described them, they sound that way. One involves the tiniest things in the world, the other involves very big, heavy objects. But pretty soon, if you think about it, you start to reach the conclusion that the only way to have a theory of physics writ large that explains everything is if those two different arenas can be made to play well together.

Alex Schein:

Professor Trodden and his fellow cosmologists are, in their way, the rockstars of science. They have a following. Their public talks routinely attract people of all ages; non-scientists who are trying to understand what the latest observation instruments have uncovered and how the theories are reconciling with new findings. As Trodden sees it, the explanation for this fan culture is simple; it comes down to beauty and big questions.

Mark Trodden:

I think we have several obvious advantages. Number one, you can see the universe. It's out there, it's vast, it's everywhere around you, and it's very beautiful. And particularly in recent years, that beauty, because of things like the Hubble space telescope and things like that has been brought into everyone's homes, and so I think people have this existential, natural question about the universe that surrounds them. What is it? What is my place in it? And I think we get that for free. We don't spend most of our

lives sitting in our offices pondering why we are here but people make that natural connection and that's great for us.

I think another thing is that... And I don't really know if this is a chicken and egg issue, but some of the very best known popularizes of science have come from the fields that I'm working in, and so... Now, that might be that it's easier for them to popularize what they do but there is a multiplier effect there where the more you see people on television and in books writing and speaking about these kinds of science, the more people think it's the thing that people should be interested in and understand.

Alex Schein:

And, as Trodden notes, it's the kind of science that makes for good stories.

Speaker 2:

Captain, Voyager 6 disappeared into what they used to call a black hole.

Speaker 3:

The ship doesn't really go faster than light. What it does is it creates a dimensional gateway that allows it to jump instantaneously from one point in the universe to another light years away.

Speaker 4:

How?

Speaker 3:

Well, it's difficult to... It's all math.

Speaker 5:

Try us, doctor.

Mark Trodden:

A lot of the big stories in science fiction are connected one way or another, and certainly a lot of the best ones, to a nugget of the kind of physics that we're interested in the Center for Particle Cosmology: Dark matter or wormholes, black holes, time travel; these are all things that lend themselves to big, flashy plots, and yet they're grounded in some of the most technical aspects of these theories we study.

Alex Schein:

Unlike some areas of science, we don't see politicized debates about dark matter and wormholes today, but Trodden says there are still plenty of people who don't embrace the new understanding of fundamental facts about the universe, facts that have been revealed at an accelerated pace in the past few decades.

Mark Trodden:

If you believe that the world is 6,000 years old and therefore evolution cannot possibly be correct, then you're really going to be unhappy with cosmology that tells you not only is the world, and in fact the universe older than 6,000 years but it's about 14 billion years old, and we know that, and so we get a lot

of that. I think the kinds of people who are prone to heap that kind of abuse on us, spend most of their time, heaping it on the evolution people, and so we avoid it for the most part. But I've given public talks and had this question brought up to me, both directly and indirectly.

And I think the other thing is that, you ask me why people are fascinated by this stuff. Why is it easy to get people excited about this? And I made the point that the universe is all around you, and it's wonderful and mysterious. Of course, that leads people to think that you are tackling the same questions that they think are tackled, for example, by religion. And so, no one is going to grab a material scientist and tell them that their work is at odds with some origin story, but really, origin stories is a lot of what we're about. And so, we're spared some of what could come our way, but not completely.

The other thing, which is slightly different to what you asked. But I think connected, is that we get an awful lot of people who are absolutely convinced that Einstein, and his cohort, and us are wrong about everything. Now, I really don't think there are a lot of people, again, working on, for example, material science, let's say, who get people writing to them every day and telling them, "You have the theory of graphing wrong," but there are people who write to us every single day, and I really mean every single day telling us that relativity is wrong. Theories of cosmology are wrong. They have the right idea, usually with very little math involved. And yeah, so, we get that.

Alex Schein:

As Trodden knows from his own experience, it can be hard to explain science to those on the outside of the process and recent events have made this challenge even more apparent.

Mark Trodden:

I mean, certainly as a scientist, I've watched what has happened over the last 19, 20 months. And I have friends who are not scientists, and explain it to them, people who are thoughtful people, but I explained to them the statistics alone, I mean, statistics is something we do know quite a lot about in physics, and so, it's not intuitive some of the statistics. And whether it's explaining how good the vaccines are, or what it means when some fraction of people are getting infected, versus some other fraction, what it means when you hear about breakthrough cases. And they are most of the cases in a population that is mostly vaccinated. I'm trying to explain even that simple statistical question of why that's not something necessarily that is bad; it would be expected. That's tricky alone, and I'm not blaming anyone for that. I think that's just made me appreciate how difficult it is communicating even those relatively simple things.

Alex Schein:

So you might say, obviously it's difficult to explain complicated things, or things that just aren't intuitive, but Trodden notes that deeper level to the problem; a more fundamental misunderstanding of how science happens.

Mark Trodden:

I mean, I think he does hammer home that people don't understand, or are not adequately told, A, about uncertainty and science, right? Science is an ongoing process, and answers are generally not final, but they're also not taught about the difference between that uncertainty and not knowing anything. When scientists give you an answer and say they don't know the complete answer, but they know this,

they do know this, and that thing matters. None of this is really, I think me telling you, "I know how to do better," it's just things I've noticed. And I mean, the clash between what uncertainty means in science, or if you like aerobars mean in science, and how messy that makes the interpretation of scientific data, versus the goals of politicians, or the goals of media, or the need for a simple, digestible messaging to get people to do the right things. It's easy to say, "We should do a lot better," it's much harder to know exactly how we should balance those different things.

Alex Schein:

In addition to his own research and many academic responsibilities, Professor Trodden is a frequent speaker at events geared towards general audiences. Those non-scientists fans of cosmology. For him, there are many reasons to do this, but the most compelling one is simple: the desire to share with others, his own wonder at what is an amazing story.

Mark Trodden:

Modern cosmology really is amazing. You and I just had this discussion of all the amazing things that we've learned about the Universe, and how people are so fascinated by them. What's more amazing, I think, is that most of what I would classify as modern cosmology really exists in the period from about the time my grandfather was born to today. Right? I'm not that old. And so, that's an amazing story. And I think, who wouldn't want to tell people about that if you get to work on that? So I think it's important, mostly because I really love doing it. It's very exciting to tell people about these fantastic things.

Alex Schein:

Understanding how people respond to science is an academic pursuit in its own, right? And it engages scholars from a variety of fields. Donovan Schaefer is an Assistant Professor of Religious Studies who writes and teaches on science and religion. He comes at the problem of science denial from another angle; exploring how the connections between thinking, feeling, and belief play out in the making of, and reactions to science. And like Mark Trodden, Donovan Schaefer starts with Einstein.

Albert Einstein:

What science strives for an utmost preciseness and clarity of concept as regards their mature relation and that correspondence to sensory data.

Donovan Schaefer:

Einstein is a really interesting figure. He is a numbers guy, he's fundamentally a numbers guy, but he's also somebody who reads a lot of philosophy. This is very well known that Einstein has this sophisticated understanding of the relationship between religion and science, that he doesn't see them as being in conflict. But, what a lot of people who are commenting on this overlook, is that before Einstein, that continence between science and religion is really about feeling. It's really about the way that we feel our way towards both science and towards religion. And he thinks that they both come from the same place, which is fundamentally a feeling.

Alex Schein:

Professor Schaefer's new book, which will be coming out this spring is called *Wild Experiment: Feeling Science and Secularism After Darwin*. In it, he considers how scientists feel about the work they do, acknowledging the kind of passion and enthusiasm that we heard in our conversation with Mark Trodden.

Donovan Schaefer:

One of the things that I'm arguing against is the idea of that science is something that is fundamentally emotionless, that science is something that we do without feeling. If you talk to scientists, scientists actually have a very deep set of intuitions about how they are using feeling in order to make science better. They're using the excitement that drives them forward as they're building a chain of discoveries, but they're also using the fear of embarrassment in front of their colleagues as a way of compelling themselves to scrutinize their own findings even more carefully. And there's a whole library of ways that science is shot through with feeling, and that's one of the arguments that I'm making in the book that I wrote.

Alex Schein:

Shaffer applies the term, "Cogency Theory," to describe a collection of ideas relating to thinking and feeling which are often understood in science as being an either/or proposition, but in his view are a continuum.

Donovan Schaefer:

So, cogency theory, as I see it, is a way of gathering together, lots of different, smaller theories and philosophical perspectives, theoretical perspectives and scientific perspectives from a range of disciplines from all around the globe that have talked about the relationship between thinking and feeling. Our conventional wisdom is that thinking and feeling are separate but there have been all of these voices, all of these philosophical voices, all of these religious voices, all of these scientific voices that have actually tried to draw links between thinking and feeling and see them as part of a continuum rather than seeing them as binary opposites. Cogency theory for me is the collection of conversations. It's not necessarily one single framework but it is a collection of perspectives that meditate on the relationship between thinking and feeling. If it can be reduced to one thing, it's that there is no binary between thinking and feeling. All of the thinking that we do has a feeling element to it.

Alex Schein:

Cogency theory, according to Shafer has important implications for understanding people's reactions to scientific information.

Donovan Schaefer:

So, I would say one of the main things that I take away from cogency theory is that the problem is very often not a problem of not enough information. It's about the way that when information comes to us in a particular package, when it comes to us under the guise of science and with the trappings of scientific authority, how we feel about that speaker, how we feel about that individual, how we feel about that institution and how we feel about that government when it is speaking in the idiom of science.

Alex Schein:

It's difficult to go much further in the conversation about the sources of science denial without acknowledging the connections to religious belief. Shafer is careful to point out that religion is not a single monolithic presence and that there are a range of different responses to science in Christian religions alone, but he also acknowledges how a person's religious identity may impact their response to science.

Donovan Schaefer:

I don't think that it's in any way wrong to say that science has come to be perceived in some religious corners as being a kind of secular attack dog. It's come to be perceived as something that is adversarial to a certain religious identity. And what that means is that science comes to feel like the enemy. It comes to feel like something that is laying siege to you rather than something is here to communicate with you.

Alex Schein:

According to Schaefer, Darwin represents a pivotal moment in the evolution of this uncomfortable relationship between science and some corners of religion.

Donovan Schaefer:

There certainly is something that happens with the Darwinian change in the history of evolutionary biology that seems to be shuffling the decks. It's not an immediate thing. There are lots of religious people who seem to think that Darwinian biology, the Darwinian way of looking at the world is completely compatible with being religious in various different senses. And yet it's also undeniable that it's provoking a counter attack. There are all of these new religious alliances, these new groups that emerge in order to push back on this. And I do think that in US history in particular, when we look at the dynamics that have surrounded creationism and intelligent design in the US, there's a parallel. There's a special formation in the US of resistance to Darwinian evolutionary frameworks that I think is feeding into the way that climate denialism is playing out today.

Alex Schein:

The alliances and divisions that rose alongside Darwin's ideas are also playing out in today's lingering COVID crisis.

Donovan Schaefer:

And as the conversation becomes more and more politicized, more and more stratified, more and more sectionalized, people increasingly come to see themselves as being fundamentally on one side or another side. So, there was an example. I was reading interview with a man who was ill in the hospital with COVID. And one of the first things that he said was, "I'm a very strong conservative, so I didn't get the vaccine." And that way of thinking, of seeing vaccine science as them, as just not belonging to us and as not properly associated with our bodies is very deeply ingrained at this point.

Alex Schein:

For science to be heard and accepted by a non-scientific public, it has to compete with alternate explanations, including explanations that may be more compelling than the story that scientists can tell.

Donovan Schaefer:

I do think that there are some ways of arranging the information that are more exciting than others. And that essentially is how I see conspiracy theory. Conspiracy theory is basically a way of curating the information that is coming to you from all kinds of different sources and preferring the most exciting interpretation. Deciding that the most enjoyable, the most interesting, the most electrifying way of arranging all of these little dots into a story has to be the right one. And I think that's why conspiracy theory is so powerful. Conspiracy theory gets its hooks in us because it's so exciting because it allows us

to treat this kind of world of information that we're increasingly immersed in as basically a playground and say, "Well, what are the most exciting ways that we can talk about the different things that are happening around us?" One of the counter arguments to conspiracy theory and the conspiracy theory literature is that it assumes that people are much more effective than they actually are.

Like a conspiracy requires a lot of planning. It requires a lot of collaboration and then it requires a huge amount of people to be incredibly disciplined in never giving the game away. And that's just not how the world works. Anybody who's worked in a large institution knows that it is by and large, just kind of shambling from one problem to the next. But that's not an interesting story to tell. It's a much more interesting story when there's a shadowing master plan waiting in the wings. That's just a better story. That's why we never see movies that are about a kind of villainous person who's just sort of stumbling through life. We see movies about a villainous person who has a master plan to take over the world because that's a more interesting story. So, my thinking is that conspiracy theories have this greater capacity to tell exciting stories out of this mess of information that we're always surrounded with.

Alex Schein:

Schaefer sites an additional obstacle to forming a shared scientific understanding: What is obvious to one person or to one scientist may not be obvious at all to another.

Donovan Schaefer:

Could there be a circumstance in which two people look at exactly the same information, they have exactly the same data in front of them and yet arrive at two separate conclusions? Possibly even contradictory conclusions. And I would say that the answer is yes. I think people can absolutely look at the same information and arrive at different conclusions. And that's because the way that they are thinking about that information, the way that they are organizing it is different. Their starting points are different, even though the information that they have in front of them is the same. I also think that, that organizing logic is not just another intellectual framework. I think that there is an emotional aspect to it.

So I think that when we encounter climate denialism, we need to seriously consider the possibility that the people who are denialists have a lot of information and they are refusing that information for reasons that are external to the body of information itself. Their refusing that information because of the way that they feel about that information, because of the way that it triggers a particular affective chain reaction for them, and that in and of itself shapes the way that they think about it. So what becomes obvious to them is very different from what might be obvious to a different observer, because the way that they feel about the information in front of them has diverged.

Alex Schein:

Finally, it's important to acknowledge that science is not a perfect institution, it has skeletons in its closet, with a history that includes bad results and racist agendas, as well as stunning advances. The distrust and occasional hostility surrounding science reflects this imperfection. But [Schaefer 00:26:12] seeks to reconcile these two aspects of science.

Donovan Schaefer:

You need a theory that explains both why science works and why science fails. Traditionally, philosophers of science have focused a lot on the social aspects of science. So they will say science

succeeds because it is checked by a lot of different people, because it is produced in groups, it's produced in communities, and that is what makes science strong. Is that it is actually coming from a lot of different people who are in some kind of inter-subjective agreement about what is being said. And by the same token science fails because it's still social. And so you can have a laboratory that gets into a kind of group think, and that group think prevents the scientists from seeing something that's right under the noses. And so they make a mistake and they publish it and hopefully other scientists, other groups, other communities will then push back on it and refine it. So that's what a lot of philosophers of science and people in science studies will say science does. And that's their explanation for why science works and also why it fails.

Alex Schein:

Like Mark Trodden, Schaefer feels that most people don't understand how science works and that's an obstacle for those who need to communicate about science.

Donovan Schaefer:

So I think that one of the problems that we have in science communication now is that most people don't actually have a very textured understanding of what science is or how science works. There's an assumption that when a scientist, let alone a scientific community, says something that that is either absolutely right or it's absolutely wrong. But scientists are experimentalists, they're always putting forward ideas with the hope, with the idea that they will be developed as new findings emerge. So one of the problems is that science is both held to an impossibly high standard of producing perfect knowledge all the time, and it's viewed as something that can't really be trusted for exactly that reason. So when scientists change their minds about things, that's perceived to be evidence that science as a whole needs to be jumped or that science as a whole can be pushed away or dismissed.

Alex Schein:

Professor Schaefer also share some thoughts on one additional problem, what do you do when you encounter a science denier? How can you change their minds?

Donovan Schaefer:

Part of the problem is that we have no connection with them. So they are just not going to be open to the kinds of things that we're saying to them. But that doesn't mean that we should treat an interaction with a stranger where that person is almost certainly not going to be in that persuasion zone for us as typical of how persuasion works. A lot of the time, it is about relationships, it's about connections that you already have with people. Maybe you know that they see things very differently from you but that connection is still an important resource for bringing someone into the persuasion zone. That's the complete opposite end of the spectrum from a random person that you're arguing with on Twitter, that person is not in the persuasion zone for you, and you're not in the persuasion zone for them. But the fact that you can't persuade them and they can't persuade you doesn't mean that persuasion is dead, it just means that we're not thinking strategically about where these persuasions zones actually are.

Alex Schein:

This concludes episode one of In These Times, Fear and Loathing and Science. To hear bonus content from Mark Trodden, where he summarizes major discoveries from the past 20 years of science of the universe, visit the series website or listen in the Omnia Podcast feed. Join us for episode two, talking the

talk, we'll be here from a linguistics professor on language and how we use it, experiment with it and attempt to control it.

The Omnia Podcast is a production of Penn Arts and Sciences special. Thanks to professors, Mark Trodden and Donovan Schaefer. I'm Alex Shine, thanks for listening. Be sure to subscribe to the Omnia Podcast by Penn Arts and Sciences on Apple iTunes, or wherever you find your podcasts to listen to all seven episodes of season three of In These Times, Fear and Loathing.