

Host: Robert Frederick

Welcome to The Conjectural — an experiment in science news, a show about curiosity, confirmation, and of course, conjecture. We live our lives without all the information. So, we conjecture.



I'm Robert Frederick. If your memory for voices is really good, you might recognize mine from when I hosted the *Science* magazine podcast or from my reporting on the *NPR* network here in the United States. For over a decade, I've been a journalist. I still am. It's great work and I enjoy it. But over the years I've learned that what's good for the business of mass media is no longer necessarily good for the business of journalism. Consider for a moment a few outtakes from a typical mass-media newscast:

Unidentified Voices:

Some terrifying moments for a California family and what a story this is...

Looked more like a crime scene than something from Flipper — the kids and the dolphin are screaming, there's blood all over the boat — not exactly Disney...

This is like the book-burning in Nazi Germany or something...

That's because in a growing number of cases, it can take only a matter of days for a home-grown recruit to make contact with ISIS and then go operational....

Host: Robert Frederick

Yes, mass media focuses on negative news, and one trope of mass media — if it bleeds, it leads — signals why: we humans have a bias — we pay more attention to negative news. Psychologists think we evolved our negativity bias because Nature selected our ancestors who responded faster to potential threats. In other words, the better our ancestors were at perceiving threats, or negative news, the more likely they were to survive. And today, mass media makes the news sound threatening. And threats really do get your attention.

Unidentified Voice

Early today, the State Department spokesman said the threats for the time being are not deemed credible.

Host: Robert Frederick

But with all that negativity, all that framing news so that it is threatening, it's no wonder why entrepreneurs write editorials about how "News is bad for you." Scholars write books titled "How the news makes us dumb." And polls show that journalism — as a profession — has dropped the most in public esteem.

So I've decided to take what I have learned about science — and what I continue to learn about science — and apply it to journalism. And journalism, thanks to science and the Internet, no longer requires mass media for distribution. My experiment: this show. My hypothesis: if we can figure out a better way to decide what science news is, then the audience for this show will grow and grow, perhaps including people who have stopped reading, watching, or listening to science news. I want to tackle the bigger problem concerning all of journalism...

... but this show is just about science journalism — what I do — and the way we decide what science stories to tell as well as how we tell them. This show is about experimenting to find what is truly newsworthy in science — what people should be informed about — and then telling some of those stories.



I think it's important to know the news because I believe when people are informed, they more thoughtfully engage in their communities. And when people are thoughtfully engaged in their communities, it benefits everyone. But a lot of the news that we hear just isn't worth listening to, or it's so overblown or so threatening, we just turn it off.

Guest: Fenella Saunders

It is a bigger question. It is a bigger problem. How do you actually reach those people in a way that they might find appealing enough to actually listen to you?

Host: Robert Frederick

That's Fenella Saunders, managing editor of *American Scientist* magazine, published by Sigma Xi — the scientific research society. We're sitting in Fenella's office in Research Triangle Park, North Carolina. I've just told her about this experiment: this show.

Interviewer: Robert Frederick

So I'd like your help.

Interviewee: Fenella Saunders

I'll do what I can.

Interviewer: Robert Frederick

If people who are already interested in science stories, like your readers...

Interviewee: Fenella Saunders

Yeah.

Interviewer: Robert Frederick

Get turned off by this show, this experiment that I'm running, I've gone the wrong way.

Interviewee: Fenella Saunders

But, it's...

Interviewer: Robert Frederick

You're already a science supporter.

Interviewee: Fenella Saunders

Right, exactly. I mean, there's so much more of the world out there that we're supposed to be serving, and in a way we're not because they're not listening to us. And in some ways we write them off.

Host: Robert Frederick

Yes, we do. And it seems to me to be entirely understandable that we do. Because in addition to how people normally are skeptical about the news — as they should be — people responding to science news sometimes go much, much further. They attack the scientific enterprise and deny the

science itself — sometimes it's for political reasons, sometimes it's for business interests, sometimes it's because science has been represented as if it were in conflict with other beliefs.

**Unidentified Voices:**

Carbon dioxide has not caused weather to become more extreme. And it is not causing polar ice and sea ice to melt. It's not causing sea level... rise to accelerate.

I've come to understand that all that stuff I was taught about evolution, and embryology, and big bang theory — all that is lies straight from the pit of hell. And it's lies to try to keep me and all the folks who are taught that from understanding that they need a savior.

Ethical standards have been lowered. Peer review has been corrupted. And we can't trust what appears in our most prestigious journals anymore.

Host: Robert Frederick

Now, that is engagement with science news, but not thoughtful engagement. It's not informed. And it's easy to write off uninformed people. But informing the public is the job of journalists — that's my job — and that's why I'm experimenting with this show because I think we can find better ways to decide what science news is, and how we talk about science. Thankfully, I've got a lot of people who want to help me run this experiment, including Fenella who reminds me as well of some of the challenges of doing so.

Interviewee: Fenella Saunders

It's a really big catch-22 of how do you make it something appealing that people are going to want to fund but at the same time hit all the things that maybe don't attract the big funding. So I think it's a really age-old question in a lot of ways.

Host: Robert Frederick

And that's particularly a tough question for a freelancer, like me. Speaking of which, support for this show comes from listeners like you. Find us at TheConjectural.com.

Now for this show's first experiment in science news, which I'm calling "empirical observation, experimentation, and nothing else." In other words, there's no conclusion.

In the mass media, the conclusion is absolutely critical. It's the conclusion that makes the headline. It's the conclusion that announces and summarizes the knowledge. But it's the conclusion that sometimes turns out to be wrong, later on.

Here are a few classic examples of science news headlines — conclusions — that later turned out to be wrong.

*The universe is fixed and unchanging.
Stomach ulcers are caused by too much stress.
Humans are the only animals that make tools.
The brain cells you're born with are all you get.*

So what's a news story about science like without a conclusion? Here goes, experiment number 1: a news story of "empirical observation, experimentation, and nothing else." Of course, please let

me know whether you think this experiment was a success or a failure, and share any other thoughts you might have about this first experiment — or the show — at TheConjectural.com.



Interviewee: Ben Santer

I try and study the nature and causes of climate change.

Host: Robert Frederick

Meet Ben Santer. He's a climate scientist who works at Lawrence Livermore National Lab in California. Like most climate scientists, he's very careful about not stating conclusions. There's always more to learn.

Interviewee: Ben Santer

It's a huge privilege, you know, to go in to work everyday and to learn something new about this strange and beautiful and complex climate system — something unexpected.

Host: Robert Frederick

Twenty years ago, Ben wrote in the consensus opinion for the Intergovernmental Panel on Climate Change that "the balance of evidence suggests that there is a discernible human influence on global climate." He still thinks that's the case. Here's why:

Interviewee: Ben Santer

In the real world, we only got one Earth. We can't do systematic experimentation with our planet's climate system.

Host: Robert Frederick

In other words, we've got data showing that we're increasing levels of heat-trapping greenhouse gases. There's data about our depleting stratospheric ozone. And we're emitting particulate pollution. But the Sun is changing. Volcanic aerosols are changing. And there are natural climate fluctuations, too — like El Nino and La Nina — and they're all happening simultaneously.

Interviewee: Ben Santer

There's no parallel universe where each of these things is happening individually so we can tease out the effect of that one thing — the climate impact of the Sun, volcanoes, human activities. But in the model world we can do that.

Host: Robert Frederick

And it's in the model world — on a computer — that Ben does part of his work.

Interviewee: Ben Santer

You know, Einstein was fond of these things called *Gedankenexperiment* — thought experiments — where you do the experiment in your mind that you can't do in the real world. Well, he would have loved computer models of the climate system because they're the ultimate thought experiment, where you change just that one thing — only human caused changes in greenhouse gases, only the Sun, only volcanoes — and that enables us to get a much better handle on what changes we expect to see with different factors that influence the climate. And then we can look for those in the actual observations.

Host: Robert Frederick

Doing so involves considering a lot of different data sources and asking a lot of questions.

**Interviewee: Ben Santer**

What changes have we documented — in the oceans, in the atmosphere, in the ice, in water vapor in sea level —? Are those changes consistent? Do they fit together? Do they tell the same story or are they telling us fundamentally different stories?

Host: Robert Frederick

But it's more that we're telling ourselves stories, and then testing those stories. So, for example, one documented change is that the surface of the Earth has warmed up a little bit over the past hundred years or so.

Interviewee: Ben Santer

And some folks have said "Well, it's all the Sun." So that entire warming of the surface is due to some uptick in the Sun's energy output. Well, that's testable. You know, that hypothesis — it's all the Sun — which we regularly read about and hear about — is testable.

Host: Robert Frederick

And for several decades now, we've been able to take temperature readings at every level of the atmosphere — with satellites and weather balloons. So, Ben says, if all of the surface warming were just due to some increase in the Sun's energy output...

Interviewee: Ben Santer

You'd expect to see heating through the full vertical extent of the atmosphere — essentially more sunlight arriving at the top of the atmosphere and heating the atmosphere from the stratosphere right down to the surface.

Host: Robert Frederick

And that's what Ben calls the "solar-only fingerprint."

Interviewee: Ben Santer

The solar-only fingerprint should involve more sunlight arriving at the top of the atmosphere, and heating throughout the full vertical extent of the atmosphere. But the observations just don't show that.

Interviewer: Robert Frederick

What do the observations show?

Interviewee: Ben Santer

Warming low down, in the troposphere, and cooling up high. And that fingerprint is fundamentally inconsistent with the notion that the Sun explains all surface warming.

Host: Robert Frederick

In the two decades since Ben Santer became famous for the sentence — "the balance of evidence suggests a discernible human influence on global climate" — there have been more thought experiments, more models, and further evidence suggesting that it's our fingerprints — our activities — causing global climate change.... Not that it's resolved.

Interviewee: Ben Santer

There's no parallel universe where each of these things is happening individually so we can tease out the effect of that one thing.

**Host: Robert Frederick**

But Ben's moved on to a slightly different problem.

Interviewee: Ben Santer

The seasonal cycle: so, freeze and thaw dates of lakes, the timing of events in the biological world — blooming of flowers, the growing seasons. Can you identify some fingerprint of human activities on the march of the seasons? On the timing of maximum temperatures, on the timing of stream flow, for example — runoff from snow-fed river basins with more runoff arriving earlier in the year? Can we in some statistical sense really detect and attribute changes in seasonality to human activities?

Host: Robert Frederick

We don't know what those look like, exactly. But, Ben says there are at least seasonal signatures, which suggests there are fingerprints to find.

Interviewee: Ben Santer

Things like ozone-depletion have very seasonally specific signatures. Aerosols from biomass burning — slash-and-burn agriculture, clearing forests, burning in the Congo and in the Amazon fire up at certain times of year — very specific signatures of those things. Sulfate pollution — another thing with a lot of seasonality in the production of sulfur dioxide. So a real challenge in what I do is connecting it all.

Host: Robert Frederick

The observations are there, there's data to move forward on looking for our fingerprints regarding seasonal changes, but, Ben says...

Interviewee: Ben Santer

We just haven't looked at that question from the physical sciences side of things.

Host: Robert Frederick

So there's no conclusion, yet. Indeed, the fingerprinting work Ben and others do is on annual and decadal time scales, not seasonal. And Ben's work to look at what's causing variation in seasonal cycles is only just beginning.

Interviewer: Robert Frederick

Well thank you very much.

Interviewee: Ben Santer

You're very welcome

Interviewer: Robert Frederick

I appreciate the time.

Host: Robert Frederick

And I appreciate your time. That was experiment number 1: “empirical observation, experimentation, and nothing else.” Please let me know what you think of it at TheConjectural.com.



Finally, I wanted to share with you a short story Ben shared with me about how he entered the world of climate science by climbing up a mountain.

Interviewee: Ben Santer

When I was eighteen I went to college in England. I didn't have a car. And I joined the rock-climbing club in order to see the country — to get to the Lake District, Wales, Scotland, and eventually to the Alps, and I was hooked. I love climbing and it's brought me to high-alpine ranges around the world — Cascades, Rockies, Himalayas. So from a relatively young age, I was in these places where stuff was changing: ice was changing, snow was changing, glaciers were changing — and that was a profound influence on me: seeing that over one human lifetime, you could be a witness. You could witness these amazing changes that happen so gradually on geological time scales. But we are witnessing now this acceleration in the rate of change. And even though it's still slow in terms of a human time-span, it's noticeable. That to me is the most powerful science experiment: seeing with your own eyes this evidence — hard physical evidence of change in snow cover, change in glaciers. Some of the alpine glaciers that I stood on when I was 18, 19, are fundamentally different now. You know, they'll be gone, probably in my lifetime, certainly in my son's lifetime. And that experiment — that long-term, multi-decadal experiment — is something that had and continues to have huge impact on me.

Host: Robert Frederick

You've been listening to The Conjectural. I'm Robert Frederick. Thanks to Fenella Saunders of American Scientist magazine and Ben Santer of Lawrence Livermore National Lab. Find us online at TheConjectural.com, give feedback and support, download a transcript, and subscribe to the show. We'll be monthly — at least to start — and any changes to that will be announced via the show and website — TheConjectural.com. Thanks for joining us!