

THE BREAKTHROUGH

Alex Trembath: Welcome to another episode of Breakthrough Dialogues, the podcast for pragmatists and problem solvers, brought to you by the Breakthrough Institute. I am Alex Trembath, your host and deputy director at Breakthrough. For this episode I spoke with George Sparks. George is the president and CEO of the Denver Museum of Science and Nature. I was introduced to George by Tisha Schuller, who's a board member at Breakthrough and whose episode of this podcast you should be sure to listen to if you haven't already. I really enjoyed this conversation with George. We talk about his views on science education and how he thinks science and scientists should function in a modern democratic society.

Alex Trembath: George, thanks for joining us.

George Sparks: Oh, glad to be here. Thank you, Alex.

Alex Trembath: So you've been running the Denver Museum of Science and Nature for almost 15 years and you're starting up the Institute for Science and Policy. I wanted to ask about the institute in particular and what led you and your colleagues to found it, and to start incubating it, and to tell us in that context a little bit, what's changing about science and science education today?

George Sparks: So those are two very different topics. So let's start off with the science and science education. For most adults, we think about science as what we get in high school and as we go out and talk to our visitors, we talk to them about nature and science and they have plenty of evocative stories and memories about their relationship to nature. As soon as you bring up science, they say, "Oh my gosh, chemistry sucked. I'm not... I don't like science. I wasn't smart enough." They have very bad feelings for it.

George Sparks: So I think a large part of that is due to the way that we were taught science. It was a lot of memorization. You had to take a lot of tests. The why of all of this wasn't really apparent, and I think that's changing pretty radically

now in the way kids are taught science in schools, a lot more inquiry-based learning. Down at Denver University, JB Holston who is running their engineering department, and I was not an engineer, he's actually flipped it so that the early fun courses where you do projects, they do those when they're freshmen and sophomores and then learn the theory later. So it hooks them in early about the why and... around engineering.

George Sparks: So it's changing pretty radically, actually.

Alex Trembath: And you've been developing exhibits for museums in science education for a while. So how have you approached selecting subjects and thinking about the best way to translate science in a compelling way, and how have you sort of chosen your subjects?

George Sparks: So we're a 120 year-old natural history museum, so our core competencies are, for the most part, builds around the ologies. Theology, paleontology, etc. And then health science and space science.

George Sparks: So we tend to focus on the ones where we have territorial expertise. We have 14 Ph.D. curators on staff here who do peer-reviewed research and publish a couple papers every year in well-respected journals. So we tend to focus on those areas, at least initially. We use our temporary exhibits to go onto other topics. Traveling exhibits, we'll bring those in just like most museums do but we stick pretty close to those six core competencies for the things that we put into the museum that are here forever.

George Sparks: We also have about 300,000 school kids come through the museum every year in school buses. So they love the museum. We had somebody come in the other day, they were standing in the hallway, looking through the museum and one of our staff went up and tapped him on the shoulder, and they just looked mesmerized. And the guy turn around and goes, "I was taken right back to the fourth grade when I come here as a student." And he was just bathing in the joy of those memories. So it's a really important place for informal science learning for students.

George Sparks: We also go to schools and we've changed the way we go to schools pretty radically. Now we have a program where we're shipping, much like a food delivery service like Blue Apron, the teacher will get online and say, "I'd like a lesson about energy in Colorado," and we'll ship 'em a box. They open the box and just like the food delivery system, you open up, the recipe's on top and all the things to have a class session are in that box.

- Alex Trembath: No way.
- George Sparks: And they use it for a couple days, maybe send it around the school and then they ship it back to us. It's especially good for the rural communities in Colorado.
- Alex Trembath: That sounds so cool. Is this a widespread evolution in science education? It sounds like the museum is being very intentional and very deliberate about it. Is this something that we're seeing across schools, across museums, across the country?
- George Sparks: Yeah, I think it varies. Schools have gone to what is... the term of ours is inquiry-based education but I think that's been implemented in the public school system in kind of a spotty way. There's a lot of theory behind it. You start with a problem and then you learn about it and try to solve the problem as opposed to memorizing the periodic table, etc.
- George Sparks: But I would say at best it's spotty. Within the museum industry, so to speak, I think people are very much further along than the standard public school system. For one thing, we're a free choice institution and if it's not interesting people aren't going to come here. So we have to make it interesting and fun and oh, by the way you learn an awful lot through informal science education by coming to the museum. We're seeing one of our program ...
- George Sparks: One of the things I'm proudest of is talking about these boxes we ship to schools. We have one called Power by Nature, and you open it up and it's basically a giant monopoly board-like game that's a map of Colorado. And on the map there're all the cities of Colorado and there're five of these boards and they go into a sixth grade classroom and there's half a dozen kids around each board.
- George Sparks: And their challenge is to deliver electricity to these cities in Colorado. And they have to buy power plants and transmission lines to do that. And they can choose coal, natural gas, wind, solar, or hydro. We give 'em \$130 million and say, "Go for it. Power these cities." And if they power a city they get so much revenue. If they use coal or natural gas, they get decremented for the pollution cost and the fuel costs, and if they do wind and solar it's... they get all the revenue.

- George Sparks: So the first pass the kids naturally go, "We're going all renewable." So they try to power Colorado with wind and solar and what they quickly discover is they go broke because it's too thin. The energy density's not there. And so after three or four rounds they figure out it takes all of these things to provide electricity for the state, and they get to make trade-offs between renewables and other things. That's a great way to learn about science, about collaboration, dialogue with each other, and then after a couple hours on their board, the whole class gets together and talks about, "Well, what have you learned?" "Oh, I never thought about doing it that way." So it's a great way to really inculcate in them this idea of thinking scientifically.
- Alex Trembath: I'm going have to order a few of these boxes for the next Breakthrough event.
- George Sparks: Oh, I think it would be a great thing for one of the breaks. Yeah, we can provide those. So we've also heard people say, "We think our gubernatorial candidates need to play the game before..."
- Alex Trembath: Yeah, I imagine a lot of folks, a lot of elites could use a little more... a bit more science education.
- George Sparks: Yeah.
- Alex Trembath: And we will actually get to that but first can you tell us a little bit more about the Institute for Science and Policy?
- George Sparks: So I think... I became frustrated over the last several years around the general polarization and tribalism around almost everything having to do with science, and then after the election there was the March for Science and our team here wanted to march in the March for Science, and I said, "Go for it. God bless you. It's your right. I encourage you to do that but the museum is not going to officially march because I see this as a partisan event. It's a protest against President Trump and I don't think it's an effective way to change policy."
- George Sparks: So I decided that we needed to do something to be more effective in changing policies so we come up with this idea of the Institute for Science and Policy with the explicit goal is: how can science be used more effectively in creating public policy? Not with any particular policy in mind but just that it's used as something that's presumably more objective

than ideology or religion or my personal opinion to create the public policy.

George Sparks: The best example that I've seen of this is the gerrymandering case back in North Carolina where they used mathematical models to decide, yes, there is gerrymandering taking place. Nobody said, "My model's better than your model." They all agreed that, yeah, this is right. Then they turned it over to policymakers to decide what to do about that, and it's working its way through.

George Sparks: I think many scientists believe that if you just knew what I knew, the policy is self-evident. And that's not the way the world works. So we're taking a little different approach and not pushing any particular agenda or point of view other than use science as what it's good for and then engage that into policymaking process.

Alex Trembath: Yeah, so how should scientists think about their dialogue and engagement with the policy space and with policymakers? Obviously, we want scientists doing good science with an eye towards informing the public and informing policymakers but how, I guess, policy-versed or in-dialogue or in the weeds should scientists be?

George Sparks: Well, our basic strategy is that we believe that journalists, policymakers, and scientists are the triad on how to inculcate science into good public policy. Our job with scientists is to have them understand that you can't go directly from science to policy. You have to participate in this sometimes ugly process of making policy and getting policymakers in the public informed. So how do we help them communicate their science... especially the important points and not so much the details. Scientists are really good at talking to each other, talking about their work, but it's a jargon and a language, if you will, that is not really known by either journalists or policymakers.

George Sparks: We work with journalists to have them understand that their job is to translate what the scientists are saying and to things the public and the policymakers can consume. It captures the real essence of it, doesn't go too much into the weeds, and doesn't make it hyperbolic so that they really are talking about the truth, if you will, of the science and not using their point of view to color it. So how can they write about this? And by writing I'm talking about print, video, blogging, everything social media.

George Sparks: And then the policymakers need to understand that... what is science? Science is not a series of facts. Science is a process of understanding the natural world. It is not immutable. It's always changing. I think a lot of policymakers and public in general think that scientists sit around, and it's like playing chess. They'll scratch their chin and go, "I have a hypothesis and I'm gonna test it. So I'm gonna move my chess piece one block and no, that didn't work. I'm a move it another block."

George Sparks: And they think it's this very cerebral, individual activity and what science really is, it's more like rugby. It's a team sport. It's really ugly. There's always changes happening. Occasionally, the ball spurts out the side and you have to go chase it down. There's lots of competition. Scientists are very skeptical. Eventually, the ball gets across the line but sometimes it's an ugly process and policymakers need to understand that as do the public, and that's why science changes over time. I mean the whole thing around this coffee... good for you this week and it's bad for you next week.

George Sparks: I think journalists play into that as do the public. People want certainty and they want facts and that's not the way the world works right now.

Alex Trembath: And it seems like scientists could probably in many fields have a little bit more humility about the messiness themselves. It's not just the public who's demanding facts or clear evidence but it's often scientists promising it in ways that are maybe a little more confident than they have any standing to do.

George Sparks: Absolutely. And if you study for... you go get a Ph.D. and then do a postdoc, you really have to believe in what you're doing. Well, scientists are human beings. They have all the same biases that the rest of us do so it's... The hardest thing in the world to do is to change your mind, but that's really a core of being a scientist. You want somebody else to actually disprove your science if it's the truth. Not everybody always follows that and sometimes we can be overconfident or not really be able to deliver on what we said.

George Sparks: Well, science is hard. A lot of things, especially in the social sciences, you do these experiments and some of them are not replicable or not as replicable as they would like to be because you're dealing with human beings and with small ends. Small number of subjects, if you will.

Alex Trembath: You mentioned different sciences, different scientists and we can talk about climate change, we can talk about vaccination, but you also

mentioned the March for Science earlier in 2018 where science is sort of presented as one big endeavor or one big community. I wanna ask you about the danger of that or the pitfalls of treating Science, with a capital S, if you will, as a special interest or interest group.

George Sparks: Now I think there are a lot of dangers with the way that was approached. I think it was very partisan. I think... Obviously, people were passionate about it and that's good, but I think there... The thing that science is one thing, which it's not, it's a multitude of things: a natural world, human beings, etc. It is not of one mind. You know, whenever I hear the word settled science, it always gives me a little pause because some of the things that we see today, like eugenics, were settled science a hundred years ago. They were taught at Harvard and places like that. And the more we learn, the more we know that we don't know.

George Sparks: So I think pitching science as one thing puts it in the same sort of partisan political environment as an ideology, or a point of view. It's not good.

Alex Trembath: How should... What's the flip side of that relationship? How should policymakers approach scientists or science?

George Sparks: I think they need to approach it the same way they approach evidence. And when I talk science I would scratch that out and put data or evidence or reason. They're very much the same thing. We happen to like science because that's what we do but there are a lot of people working around evidence-based policy and it's essentially the same thing. It's using rational thought as opposed to emotional intuitive or personal point of view, which are all important, but we do need to have some basis in rationality as far as creating public policy or living our lives.

Alex Trembath: Yeah, I've actually made sort of a similar shift over the last few years, away from using words like science or certainly settled science, and more using words like evidence. The facts on the ground don't always tell us exactly what to do in the way that it seems like a lot of scientists wish they would, or in a way that seems like a bunch of policymakers wish that scientists could provide them. Science is a tool. It's evidence in favor or against one course of action maybe, but it's rarely going to be the deciding factor or chart the course itself.

George Sparks: Yeah, life is complicated. I mean we're human beings. We're bathed in our biases and our self-interest, all of our values. We've spent a lot of time on

this earth and we've been influenced by the tribes that we've grown up in and the media and the experiences that we've lived. So it's a much more complicated environment than just one plus one equals two.

Alex Trembath: So maybe it'll all... and hopefully it'll get better in the future as organizations like yours, as museums like yours, as schools and science teachers around the country, around the world, come up with better ways to inculcate a passion for and interest in science or scientific issues. But certainly right now there's a lot of pretty prominently conversational scientific issues out there. You think climate denial, you think anti-vaccination, you think chemtrail conspiracies.

Alex Trembath: And one thing I wanted to ask you about on the side of the general public, not on the side of the scientists or the policymakers in this case, is that very often a lot of the skeptics are actually very science-literate. You talk to maybe someone who rejects the mainstream science on climate change, they actually know the atmospheric climate science pretty well. At least the fundamentals of it even, if they're pretty wrong about the conclusions. Similar with the anti-vaccination community or other skeptical groups and anti-genetic engineering, it's full of very scientifically-informed people.

Alex Trembath: So what do you think about that? What do you think about the issue of science literacy and how it doesn't always lead to the mainstream or to conventional scientific conclusions?

George Sparks: So after doing this for a year and a half, the most humbling thing for me personally is to discover that it ain't about the science. It's really about values and self-interest and history and biases. And those are the thing that cause or appear to cause, if you will, people to take different points of view around the same set of facts. And we have to understand that.

George Sparks: So if you go back to things like vaccinations and... Originally, when I went into this, I thought, "Oh my gosh, people that don't vaccinate your kids, how can you possibly do that? You must be an idiot." And then I began to read about this and learn about it and once you open up that black box, if you will, of vaccinations and discover some of the history and how we tested vaccinations on people that didn't give prior consent, or the doctors wouldn't let the smallpox virus be distributed by the government because it was a profit center for the medical field. You look at this and you go,

"Wow, there's a lot of stuff here that maybe I shouldn't trust the institutions, if you will, as much as I do."

George Sparks: And so they have a very logical approach to it. Or if you look at vaccinations, if you read the fine print, it turns out that there are... Three of a million kids that get a certain vaccination do have a pretty severe complication because of it, which in the big picture is fine unless your kid is one of those three out of the million that does have that complication.

George Sparks: Also in vaccinations, a lot of the people that are most opposed to it are the most highly educated and they're basically doing risk management for their kid. If 95% of the kids in school are vaccinated, my kid doesn't have to be vaccinated so they make an informed decision not to do that. Now I think that's an ethical issue as much as anything else but they're not completely illogical with the way they approach that.

George Sparks: Same around climate change. I think people see that as a values thing. "I don't want the government telling me what to do. I don't want to give up my current state of my life, if you will, to help other people in other parts of the world or even future generations." You can make an ethical and at least a philosophical argument that the world in the future will be so much richer than it is today.

George Sparks: "Let them worry about how to solve some of these problems. Why should I have to cut back my standard of living in order to protect future generations?" That is ... you can't build a logical case around that. I don't necessarily agree with that but there are people that do.

Alex Trembath: Yeah, that's all leads me back to a conclusion that has been nagging at me for a good while now which is that we probably need to... certainly more clarity but also more humility about how we treat science. I am as frustrated by the next person with anti-vaxxers or climate deniers or whatever, but there is this tendency where folks, often in the sciences, say that "Science is on my side. The facts are on my side. The science is clear. The science is settled."

Alex Trembath: When, in fact, those arrangements of facts or that science is very often a stalking house for a political or values' perspective. Those political and value-based perspectives are very valid themselves but it seems like it can be a lot more honest and a lot more humble about when we're

representing scientific evidence, when we're representing our political opinions, and when we're representing what our values are.

George Sparks: Yeah, we have this really simple model we use on how people make a decision to support or not support something. Originally, we thought if we could just get them together around the science... even though science is about probabilities and it's not a fact, it's maybe a lot of different data points, so to speak. If we could just get them together around the science they would start to understand this. As it turns out you have to get them together around their values first and you get to their values through their stories.

George Sparks: So it all starts back to us as human beings with our biases and the journey we've had. If we can look each other in the eye and say, "Josh, why do you believe that? What are the values that cause you to believe that?" Then I think we have a shot at influencing two groups of people to come together. But you can't do it through the data. No matter how, you just can't... more data is not going to bring us together as a people. It's all about our relationship to each other as human beings.

Alex Trembath: George, I wanna ask you about how you came to this career. You weren't always in museums or science education so how did you find this?

George Sparks: So my journey was, I grew up in a small coal mining town in southern West Virginia. Went to school at the Air Force Academy. Got a degree there in nautical engineering and then went off to become an Air Force pilot. And then went to MIT, got my master's in aero and taught aeronautical engineering at the academy. So I'm very much a technologist, a person of reason. Back then I was... it was really all about the science, so to speak. After that I went to Hewlett-Packard and Agilent Technologies, had a 25 year career in high tech, began to learn a lot more about...

George Sparks: This is really a people business. Technology is an enabler but it's not really about the technology, it's really about us as people and I decided when I was 55 to leave the business world or go find a non-profit to run, something around education, and I was lucky enough to get this job. And the longer that I'm in this job, the more I become philosophical, more I become scientific. It's more about the why than the how.

George Sparks: And then that combined with our increased tribalism and polarization was really frustrating in that we have some pretty significant issues to deal

with as a race, the human race, and as the world. And unless we solve these things, we have no goddamn right to be here. We can go extinct just like the dinosaurs. You tend to think about things differently when you run a natural history museum. And I think that's part of our role, is to help educate people and inspire them to think about what is our role here on this planet? It's the only one we've got, we better take care of it.

George Sparks: So that's really my personal journey, if you will.

Alex Trembath: We're coming towards the end of our conversation here, George, but I did want to ask since I've got you here, for some constructive feedback. We talked most recently in person at Ecomodernism 2018, Breakthrough's annual event outside Washington, D.C., You've been to a few of Breakthrough's events. And I just wanted to just sort of put you on the spot and ask how you think ecomodernists, from your vantage point, are doing in terms of translating and using science for our goals.

George Sparks: So I've become a big fan of Charles Mann and *The Wizard in the Prophet*, and to me ecomodernism is largely the wizard side of the equation there. I've given away scores of copies of it. And I really do believe fundamentally, again, working in a natural history museum, if you look at how humans have evolved to create civilization, it's always been around the technology. Whether it's chipping little bits off of rocks or learning to do agriculture and crossbreed plants and provide electricity to people, we've always been a technologically or science-driven species.

George Sparks: And I think ecomodernism, to me, is right at the heart of what it's going to take for us to continue to evolve and thrive as a species, because even though we have all this human foibles and our biases, in the end, we do have agency and we are able to control a lot of what happens. Notwithstanding the unintended consequences of how we implement that.

Alex Trembath: Thanks, George. And our listeners can check out the very first episode of this podcast if they wanna hear more from and about Charles Mann's book, *The Wizard and the Prophet*. Last question before we let you go, George. We like to close these conversations by asking our guest for an example of hope or optimism that they see in the world, so I wanted to end this conversation by asking you that.

George Sparks: We worry a lot about the future of the planet and I think one of the things that causes me the most hope now is the possibility and probability that we can extract all of this carbon that we put into our atmosphere through carbon sequestration, direct capture of carbon. The 45Q regulation that was recently put out and the omnibus bill. I do think there's some technological things happening... nuclear, the small nuclear reactors. I think there's some technological things happening that are going to have an enormous impact on this debate around climate that will allow us to solve this problem in a way without having to get so far down the weeds emotionally with each other.

Alex Trembath: I couldn't agree more and that seems like a great place to end things. Thanks so much, George, for joining us today.

George Sparks: Thank you, Alex, and keep up the good work.

Alex Trembath: Thanks.

Alex Trembath: Thanks for tuning in to Breakthrough Dialogues. If you like our show, tell your friends and rate us on iTunes and subscribe on whatever platform you get your podcasts. I wanna, again, thank my guest George and our producers Alyssa Codamon and Tali Perelman. Catch you next time.