EDITOR'S BLOG

A conversation with Mythbusters' Adam Savage

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The television show *MythBusters* inspired a generation of scientists who are now entering the workforce. I had a chance to talk with co-host Adam Savage, now host of the YouTube channel *Tested*, about what the show taught him about the scientific process and science communication for an Editorial. Here's the full text of our interview.

Holden Thorp: When I was the chancellor at UNC [the University of North Carolina] Chapel Hill, I interviewed you and [*MythBusters* co-host] Jamie [Hyneman], and you guys were kind enough to have brunch with my children, who are very firmly in the *MythBusters* generation.

Adam Savage: Well, I apologize if they burned down the garage.

Holden Thorp: Actually, my son is about to defend his PhD thesis in neuroscience at Columbia. I think if I asked him whether he's a scientist more because of me or *MythBusters*, he probably wouldn't want to answer my question.

Adam Savage: Well, let him know that one day I'll call upon my army, okay?

Holden Thorp: Okay. There you go. Well, you've got a big army out there and a lot of them read our magazine and they're just coming into being leaders.

Adam Savage: It has been a remarkable progression over the past 20-plus years. People were saying, "Hey, you got me through high school chemistry," and now they're saying, "I've sold three startups and *MythBusters* got me interested in science at the very beginning."

Holden Thorp: I just found one of your videos, which I thought was awesome, and it was great to see you still in your element doing your thing. So, for your fans, tell us what you've been up to since the show went off the air. I know a lot of that's on your YouTube channel, but they may not have seen that yet. Hopefully this will drive them to it.

Adam Savage: Yeah, we wrapped the show back in 2015—2016 was the last airing of the last season. Since then, I've made a couple of television shows, *MythBusters Jr.*, with eight amazing young colleagues and *Savage Builds*. For *Savage Builds*, we made 10 episodes of all the things I've ever wanted to build, including putting laser tag guns on some of [film director, screenwriter, and producer] Peter Jackson's World War I airplanes and enjoying laser dog fights over New Zealand. My YouTube channel had always been a side project while I was working on television. When COVID hit, that relationship reversed. Frankly, I'm happier now, professionally and creatively, than I have ever been in my life. I have this lovely small team here, six of us, working on *Tested*, my YouTube channel. We put out between 300 and 400 videos a year, and I am in this cave here in a San Francisco building almost every single day.

Holden Thorp: Yeah, that sounds awesome. Is it different viewers than you had on TV? How has the audience changed?

Adam Savage: First of all, as someone who likes to peek behind the curtain of the workings of things, it has been fascinating to ride the engine of fame from being a nobody to having a hit television show to seeing declining ratings to being on YouTube, and experiencing all the different levels of fandom that occurred along the way. The YouTube fandom skews a lot younger than our television audience did and also seems more diverse. Our viewership on Discovery was 85% male. I don't know the actual metrics on YouTube, but it definitely feels like a different set of demographics.

Holden Thorp: And are you on TikTok too?

Adam Savage: Yeah, we are. We're exploring the short forms, but every time you delve into a different format, it is almost always at the expense of some of your other formats. So we're creeping gently toward TikTok and the shorts because we are so comfortable with the narratives that we build for YouTube.

Holden Thorp: All right, let me ask you some more provocative things about what's going on and how we can learn from you. You're probably following the discussions about research integrity and errors in science. We have always dealt with mistakes that were made in papers and figuring out how to correct the record. But now it's all over the news. The president of Stanford had to resign because he published some images that were wrong. There was a huge thing on superconductivity at the University of Rochester and a whole bunch of stuff about behavioral economics. Then we had a plagiarism story about the Harvard president. Now there's a huge problem at Dana-Farber. When people disagreed with your conclusions about the myths you confirmed or busted, what did you do if you thought they were credible?

Adam Savage: We took them seriously. Revisiting a myth was one of my favorite things that we did on the show, and we did it from the start. Before the end of the first season, we were getting word that we had gotten some experimental methodology wrong. And there were several stories, like "chicken gun" and "rocket car," that we tackled multiple times based on new data, new information, and new methods of execution.

Discovery always had to be dragged to do the revisits. But to me, it was the most scientific thing we did. We're experimentalists. The result we have isn't a fact, it's the best story we currently have. And if a new, better story comes up, you explore it.

I have been paying attention to the crisis in reproducibility that's been happening in the soft sciences as well as the hard sciences. And I'm a big proponent of open [access] publishing. I personally feel like a lot of the blame for the current crisis in science lies with late-stage capitalism, the bizarre incentive models, the "publish or perish" pipeline, and the strained resources we've had for the past 40 years in academia.

I feel like culturally, we talk out of both sides of our mouth sometimes about what we spend on education. Half the people are complaining that people are overeducated, and the other half are complaining that they're undereducated. And really, I feel like a lot of this would be solved if all of our scientific publishing was totally open source. Absolutely, it's unassailable that anything that's government funded should be open source immediately. I can't believe that's still a debate.

Holden Thorp: Yeah, and there are lots of us working on different solutions to that problem. Ours is we allow everybody who publishes with us, even if it's in a journal that has a paywall, to send the accepted version of the manuscript to any repository they want to. It's taken decades to get to that point, and we've only gotten there recently, but for every one of our journals, either the published manuscript is accessible, or if it's content in a subscription journal, the next to last version, which has all the data in it, is available.

But you said something profound that is very, very similar to what we see in science: that Discovery didn't want to do the retests. We see the same thing with the institutions.

If somebody complains about a paper, a lot of times the author will fight us on trying to work out if there's something wrong. But we get by far the worst behavior from the institutions, who send us statements that say something useless like, "Our institution is very committed to research integrity," and then tell us it's going to take forever to do the investigation and bury us in paperwork. And all we want to do is put a correction or retraction on the paper. We don't care about all that other stuff. We just want people to find the right answer. So elaborate on that some more. You went to Discovery, you said, "Hey, look, we screwed this up." What was their reaction?

Adam Savage: We didn't say we screwed it up. We said, “Hey, there’s an opportunity to tell a whole new narrative and we've got footage we can use from the old narrative to get people involved.” We’re giving people who want a certain result another chance to yell at us. And the ratings for our revisit episodes did great. And frankly, the show was a hit before we knew how to make it. Discovery was a reluctant partner to some degree in doing the revisits, but it wasn’t like they fought us tooth and nail whenever we put our foot down and said, “This is something we want to do.” They were in general really great partners. The third time we wanted to do “rocket car,” we were like, “Hey, we want to do rocket car a third time and this time we need another $50,000 or $60,000.” And they were like, “Absolutely. That’s great.”

Holden Thorp: Sometimes I’ll write to somebody and say, “Someone’s raised this question about your paper,” and they reply, “That person’s just out to get me” and won't engage, but we think it’s serious. Do you have any advice for me on how to get them to loosen up?

Adam Savage: Wow, it’s a great question. So in about the third or fourth year of the show, I started feeling more confident in my ability to read abstracts and interpret people’s results and talk to them about what they were working on. I found this really interesting study equating a distance between two people and their ability to recognize each other with blurriness. The researchers had found—this was for witness identification—that they could equate a linear relationship between distance and a certain amount of Gaussian blur so that we could interpret what a person could see from, say, 40 yards away.

I thought the study sounded really interesting. However, they did their whole experiment with static images. As people move, we get all sorts of topographical data about the face shape that are different from blur. So I wrote to the lead researcher and said, “Hey, I host this television show and I was reading your study and I thought it was really interesting. I'm curious about the effects of movement on the recognizability.” And I got back a very short letter that effectively said, “Stay in your lane.”

I was like, “What?” When Jamie and I traveled around, we were able to talk to the top scientists, and we never encountered that kind of gatekeeping from people who run their department. They're totally comfortable talking about science, talking about discovery, being wrong. But when you email a random researcher, I found a couple of times I got this reaction like, “Yo, television guy, we don't really care about what you think.” Over the years of *MythBusters*, one of the great graces of doing the show was realizing at a certain point that both Jamie and I were actually engineers and actually scientists. And I feel comfortable saying that. When I’ve said that over the years, some people say, “Does anyone get upset about that?” And the answer is yes. There’s a small group of people that get upset when I call myself a scientist, and those people are grad students, but everyone else is pretty cool with it.

Holden Thorp: Well, I see lots of people who do and don't have degrees or do and don't have all kinds of academic accolades and it’s not nearly as correlated with accomplishment as you might think.

Did you ever have to change whether a myth was confirmed or busted as a part of one of these redos?

Adam Savage: Absolutely. We came to different results lots of times. I think running in the rain is one we did three times and came up with three different results.

Holden Thorp: And what is the final result on running in the rain?

Adam Savage: The final result is that running and walking will yield a difference in the amount of rain you receive. And it depends on wind direction and the speed at which you’re running and the amount of time you are spending out in the rain, because of course over a certain period of time everyone gets the same amount of wet. But the fundamental difference is on the order of grams of water, maybe less than a fifth of an ounce—or about a tablespoon—of water.

Holden Thorp: I think about your show every time I go out in the rain. To me, the lesson is it’s not worth the extra effort to run.

Adam Savage: No, it’s totally not. One of the things that I found really interesting was that when we would go back, we never cared what the result was going to be. People sometimes ask, “Did you ever want to bust something or want to prove something and you didn’t?” But that never happened. We were very, I think, pure in a lack of bias toward a certain result. One of my all-time favorites on that front was: Can a cable slice through you like a sword? This is a fisherman’s myth, and every fisherman will guarantee you that if a braided steel cable on a ship gets stressed to its breaking point, once it breaks, it will whip around and slice through you.

So we did this whole methodology where we found a location with a bollard deep in the ground, we stretched a cable around it, and we did some tests to figure out the point of the most inertia as that cable whipped around the bollard after breaking. We placed a pig's carcass there and we tried 8-inch, 1/4-inch, 5/16-inch, and 1/2-inch cable, and none of the cables cut into the pig. They were moving at impossible speeds, and they were still just denting the pigs. At lunchtime, I called up the producer on that, Linda Wolkovitch, and I was like, "Linda, do you have any first person accounts witnessing this happening?"

And she was like, "I'm sure, let me get back to you." She went back and looked at her research and then called me back 20 minutes later and said, "No, all the accounts I have are secondary accounts." And I said, "I think we're going to come to a completely different result." I was so looking forward to this high-speed shot of the cable slicing through pork flesh, and we finished the episode busting it completely, and I will go toe to toe against any fishermen. It's never happened. It just cannot gather enough force.

Holden Thorp: Yeah, that's awesome. All right, let me switch to science communication. We're living through another crisis, which has always been there but taken off in the past 5 years or so: people doubting scientific evidence and ignoring it. COVID and recent political events have accelerated this problem. Doubting science has also become more of a partisan issue than it has been in the past. You can't advocate for science in a world of whataboutism without people saying, "Oh, you're just saying that because of your politics." So it's tough. I write a lot about how to get more people on board with trusting science. And it seems to me you guys did a really good job with this. So I guess the first question I have is, was there ever an adult—I mean, I think with kids it's easier—who had made their mind up about a myth and whose mind you were able to change?

Adam Savage: Oh, whose mind we were able to change?

Holden Thorp: Yeah, I want to know if there's a climate denier who, if they watched a *MythBusters* about climate change, would go, "Okay, I get it now."

Adam Savage: Yeah. Man, first of all, that's a question I haven't had, which is in and of itself after 20 years of talking about this show, totally amazing. Second of all, I have so many examples of people refusing to change their minds. One of the most vitriolic arguments we settled early on in the show was a myth called airplane on a conveyor belt. The question is: If an airplane is attempting to take off on a runway, and the runway is in fact a conveyor belt running in the opposite direction to the plane and matching its speed, can the airplane take off? And the answer is always, always, and forever: The airplane can take off because the question has a bit of fakery involved in its phrasing. When the question says that the runway is a conveyor belt running in the reverse direction of the airplane, most people's minds immediately think that that plane isn't moving forward as it's trying to take off because the runway is matching its speed, but the airplane's medium is not the ground—it's the air.

The only reason an airplane has wheels is to keep the propeller from hitting the ground. So a car would remain stationary, but a plane will always move forward no matter how fast that runway is operating in reverse. And we took a half mile of tarp on an actual runway, got an ultralight plane, put it on the tarp, ran a pickup truck in the opposite direction, and the pilot of that plane did not think his own plane was going to take off. And he was as surprised as anybody when it did. We knew it would. Let me just say that my ease of explanation of that story took weeks of arguing between me and Jamie and our crew and our producers and writers. There were so many discussions to get to the meat of why people had that mental disconnect. And when that episode aired, we went and looked at the forums and the general response was, "Still disagree because we didn't agree before with the results, and we don't agree now, even though they've proved it. They must have gotten something wrong." Literally just like that.

So people's reluctance to change their views on something is incredibly rigid. I laid some of the blame in late-stage capitalism earlier in this interview, and I lay more of it here because as soon as you can question someone's integrity, as soon as you're wondering what the financial incentives are for the results they've been giving, if there are financial incentives, that's problematic and that needs to be addressed. So to me, full transparency is the most important aspect of science. We only stand on the shoulders of giants because they tell us what they did. And when we put stuff behind paywalls or we have crazy financial incentives for being the first or being the newest or coming up with something different, we end up with a situation where every result can be challenged for some reason or another.

Holden Thorp: The most common reason that people would say not to trust us is because we always do what will get us more money for our research. But of course, these experiments are not cheap to do. It's not free. But the thing that I think we have a hard time getting across is that science is set up to be self-correcting.

Adam Savage: I had the most beautiful epiphany about science when looking at a 3D rendering of our current universe model and realizing it's not a model of the universe. It is simply an amalgam of all the current data we have to tell ourselves a story. And there could be these completely fundamental ways in which it is wrong, and we can still go and discover those things. But yeah, the biggest difficulty is when you come to a different result, it often means people think, "Well, science got it wrong." Science is always getting it certain degrees of wrong. It's not like we get things right and then sometimes it's wrong. We're just getting less and less wrong as we go.

Holden Thorp: Do you have any advice on how we can get that across to people better?

Adam Savage: I think a lot about science communication because it is the linking tissue in everything that I do. For me, the secret sauce is always to make it personal. It's always to find that intersection with my emotionality about the things that I'm talking about that makes them interesting. I find the structure of science surpassingly beautiful. I find the structure of figuring out how wrong we are to be a great frame to approach the world. Unfortunately, that frame can easily be weaponized for nefarious purposes. My favorite science communicators in the world are Carl Sagan and Richard Feynman, both of whom radically personalized their science communication. They really made it emotional.

I love this. [Physicist] Murray Gell-Mann said, "How to solve a problem scientifically is to write down some hypotheses and test them, unless you're Dick Feynman. Then you sit down with a piece of paper and think really hard, and then you write down the answer." Feynman worked really hard to communicate how he visualized and understood things. That spoke to me as a young reader.

Sagan still inspires me. I don't think anyone listens to Sagan read the *Pale Blue Dot* and comes back questioning Sagan's integrity for finding the right answer. And I think that emotionality is one of the ways he earns our respect and our trust. Now, not everyone is an emotional science communicator, and there's a lot of ego in science communication. And frankly, as someone who is in the public eye and who worked really hard to ferret stuff out on my own, I have problems when other people's science communication is all about their ego.

Holden Thorp: I think there's a temptation to go on TV and say, "I've got the answer." But, of course, we never have the answer. All we have is the answer that we have right now, and it's very hard for people to go on TV and say, "Here's what we know right now, but I might have to change it." And journalists don't like that because they want things that are crisp. So how do we get through that?

Adam Savage: Totally. I remember reading that when Oppenheimer was running the Manhattan Project, he was cognizant of the power in his position. If he expressed an opinion, it would be assumed to be correct. So he said very little because he understood how damaging he could be if he was wrong.

Holden Thorp: I write a lot about how we've somehow got to get this across to people because we'll never get all 4 million, or whatever it is, scientists to be communicators like Dick Feynman or Carl Sagan or Adam Savage. So the only solution is to do a better job of telling people how science actually works. How can we do that?

Adam Savage: I am always suspicious of statements like "This is the best career" or "This is the most pure art form." None of that is true. There is no best career. There's no best job. Everyone finds their own way and their own method to transcendence and enlightenment. But as I have traveled around the world in the past 20 years meeting and talking to scientists, talking to them about their work, getting to experience them on a level that I never imagined, what I've come to see is that I don't think I have met a working scientist that didn't love their job, that didn't love the process of their job, and who wasn't deeply connected to both the granular work of their day-to-day and how it fits into the big picture. And when you spend a lot of time around people whose joy comes from gathering that data and interpreting it and processing it and working with others, it's very infectious.

I feel like there's still a story to be told that covers that joy. The BBC did a beautiful telling of Alan Turing's story with Derek Jacobi back in the 1980s. And although I love Benedict Cumberbatch, *The Imitation Game* was a terrible depiction of the scientist that Turing was. It didn't bring out the joy and the passion. That's a story that I think is continually worth telling. And you're right, replicating other people's results isn't sexy, but it is deeply beautiful and joyful. And I find that those are the stories that I want to continue telling. So those are the stories that I seek out, that joy at discovery that exists in every working scientist.

Holden Thorp: Let's say you and I had as much money as we needed to make one more episode of *MythBusters* or one episode of *Tested*. And we're going to test the myth that says humans didn't cause climate change. Okay, we're going to bust it, of course. But would it work? How would we do it? If we have a plan, I bet I could get us the money to do it.

Adam Savage: The issue is that science communication at its core is about creating drama by giving people scale. There is drama in the scale of an atom versus a stratosphere. And when you wrap your head around the scale of somebody else's research, it's an endorphin rush. Getting how things fit together is a deeply pleasurable experience. We talked about doing climate change stories a bunch, and the issue we had was that we knew—and it's the same reason we didn't do the Twin Towers collapse—that you're only ever testing it at a small scale. And thus, there has to be a point at the end of the narrative in which you're saying, "Our model is accurate, trust us on that." You can build a narrative about how accurate your model is going to be, but climate change denial has foundations in cigarette cancer denial and leaded gasoline denial. The same mechanisms, the same people, and often the same institutions are ginning that stuff up.

One of the things that is brilliant about climate change denial is that it always brings it back to the individual and says, "How much pollution are you personally responsible for? Come on, it's not much." And it reduces everybody to their own engine of their own pleasure principle. And so we think, "I can't possibly imagine how turning on my car can cause hurricanes in Jakarta." And getting people to understand that scale is really hard. It is really complex to help people understand how many, many small actions yield big results. So I don't have a direct answer to that, sadly, because I'm always about building the biggest possible model you can to demonstrate that you have satisfied the conditions to the greatest possible degree.

Holden Thorp: Okay. Well, if you ever come up with something, let me know. I'll get us some money to do it.

Adam Savage: I totally will.

Holden Thorp: One last fun question. If there's one myth you could have tested that you didn't, what would it be?

Adam Savage: Oh, I've got it. It's actually one I had to give up in the last season. I had this beautiful little 15-minute story, and we had a tanker car implosion that went so cattywampus that we ended up with 20 minutes of extra material. As a producer, I had to give up one of my stories. This story was a Native American hunting myth. If you wanted to hunt ducks, Native Americans had a technique where they would go to a pond where ducks congregated and float pumpkins on the pond for a few weeks, and the ducks would get familiar with pumpkins floating around. Then the hunter, when he wanted to eat duck, would put a pumpkin on his head and cut two eye holes out of it and swim out to the ducks, and they would ignore him because he was a pumpkin.

I talked to a friend of mine who's a hunter, and he said, "Oh, it totally works." He said he's done it with grass. And, he said, you can go up to a duck and pull it underwater, and the one next to it won't even notice. Now we weren't going to do that on the show, but I did go far enough to actually build a pumpkin camera platform that I could steer through the water so that we could film this. And we had a duck pond to shoot on and everything. It's one I've always wanted to test, but sadly, when our episode for the tanker implosion went too long, I had to give it up. So if we were going to do another episode, that would be the first one I would do.

Then I have this whole other one in my head about stirring, because when I go to a coffee shop and they give me a cup of coffee and I put sugar in it and they give me one of those tiny little straws that's about a millimeter in diameter, I think, "This isn't stirring. This is barely more than Brownian motion." Then I grab five of those sticks and I have this question in my head: What do we consider the threshold of stirring? I would test wooden sticks, spoons, and a bunch of different objects, and work with sugar in liquids to come up with a threshold for stirring.

There's one last thing that I'm interested in related to stirring sugar into my coffee. I notice every morning as I stir sugar into my coffee that the sugar of course thickens the water as it dissolves into it. And I can hear the tone of my spoon hitting the cup getting lower as the resonant frequency of the water changes. And I've been always fascinated by that relationship as well.

Holden Thorp: Yeah, I think those are cool experiments and worth doing in a general chemistry class also. So if you ever do those, let me know.

Adam Savage: I will.

Holden Thorp: Well, Adam, thank you for everything you've done for so many people and I guess especially for giving me a son who's a scientist, just like his old man. I really appreciate that.

Adam Savage: My pleasure, man. Thank you.

> **EDITOR'S BLOG**
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> Thoughts on things going on in *Science* and science from the Editor-in-Chief H. Holden Thorp and invited guests.