

Landscape of Science Communication in the Video Content Creation Community



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Introduction

In order for science media to thrive in an environment where science misinformation is prevalent -- more than ever communicators need tools to be effective in reaching audiences. Researchers in science communication have developed best-practices approaches that can be extremely useful.

Connecting researchers in science communication and practitioners including science filmmakers can lead to research that is more applicable and impactful and relevant to the needs of producers, in addition to media content that is based on the latest best-practice evidence.

What is science communication research?

In this report, science communication research refers to the study of different elements of communication of science such as :

- The **source of information** (how does the host's personality affect behavior change? Is there a difference between how the audience trusts a female science Tik Tok producer or a male producer?),
- The **receiver of information** (who is the main audience of Instagram's science Reels? How can we encourage more diverse audiences to share their feedback with producers?),
- The **message** (what kind of message framing can elicit more action? How useful is fear to encourage donation?),
- The **channel** (What is the platform, e.g.YouTube, TikTok, Snapchat, that encourages most interaction with the host?) and
- The **impact** of the message (e.g., curiosity, donation, motivation to become a scientist).

However, to encourage and facilitate connection between research and practice, organizers of such initiatives should be aware of the status of science communication as it relates to the science filmmaking and content production community. This community includes broadcast, YouTube, social media and other producers who create content about science. So in this landscape analysis, we attempted to answer questions that address how we can facilitate such connections.

Methodology & sampling

Data Collection Measures and Analysis

We have used the mix-method design to collect the data for this analysis. Initially 19 interviews with US-based science video content producers were conducted. Each interview lasted about one hour. Interview content was recorded and transcribed.

The surveys were dominantly collected through a listserv from a major science filmmaking conference based in the US with 83 US-based content creators participating in the survey. Survey respondents are also mostly limited to science video producers across platforms such as YouTube, broadcast, social media, and subscription-based video platforms.

Reflections on the Design: Strengths and Limitations

This landscape analysis is the only mixed-method published landscape analysis examining the status of science communication in the science filmmaking community and it builds upon previous valuable work such as the 2020 Impact Media Report¹, through:

- **Deeper understanding of the community:** Collecting data on the demographics of the community's sample in addition to their goals, objectives and communication strategies
- **Multifaceted understanding of the community:** Complementing quantitative survey data with descriptions and elaborations from interviews
- **Practical understanding of an action plan:** Answering questions that can help with the design of a practical to connect science communication research with practice

However, this landscape analysis includes limitations such as:

- The community of respondents is US-based only
- Compared to the larger community of filmmakers, their project can benefit from a larger follow-up study
- The outcomes noted from this landscape are limited more towards documentary and science entertainment rather than science news and journal

Data collection

Survey (n = 83)

Interview (n = 19)

Time Period

2020-2021

Location

US-based producers

Qualtrics platform & Zoom

¹ Stogner (2020). The Impact media Report. Retrieved from:

<https://drive.google.com/file/d/1eyi2NLVZ8TAWHdmy00k43pVSxzSbndNu/view>

Executive Summary

The **sample** community of science media content producers is dominantly between the ages of 30-39, with higher education. The majority are white and female and produce on the YouTube platform, and identify as liberal.

Content creators generally have a positive **attitude** towards using science communication research and while in the past they mostly were exposed to the research around once a year, they would like to have exposure at least once a month.

Content creators identify the main **barriers** to using science communication research as inaccessibility of research and researchers, limited time to use this research, and not being aware that such research exists.

To receive information on the science of science communication, the top three **preferred modes of access** were socializing with researchers, watching SciComm-related videos, and using guidelines and toolkits.

Content creators' main **long-term goals** in production are to elicit behavior or attitude change in their audience, gain personal satisfaction, and in some cases, creators explicitly noted that their goal is NOT to change behavior.

Creators' main **short-term objectives**, as a direct outcome of audiences watching films, can be categorized into these categories: building empathy with their audience and showing care, helping the audiences see the relevance and importance of the topic, building trust with the audience, elicit different emotions about science such as joy, awe, and curiosity, , showing that a certain positive behavior is the norm, educating the audiences, helping audiences reach self-efficacy and equip them with the ability or attitude to make changes, and showing the process of science.

To reach these short-term objectives, creators use four main **tactics**: storytelling, the use of rhetoric such as metaphors, examples and removing jargon, use of beautiful and helpful visuals, and choosing tones such as conversational or serious.

Content creators mainly **measure their impact** through social media metrics and anecdotal evidence, and have very little information about the ethnicity of their audiences.

Demographics

What is the demographic profile of the sample content-creator community?

Demographics Summary:

The respondents were dominantly:

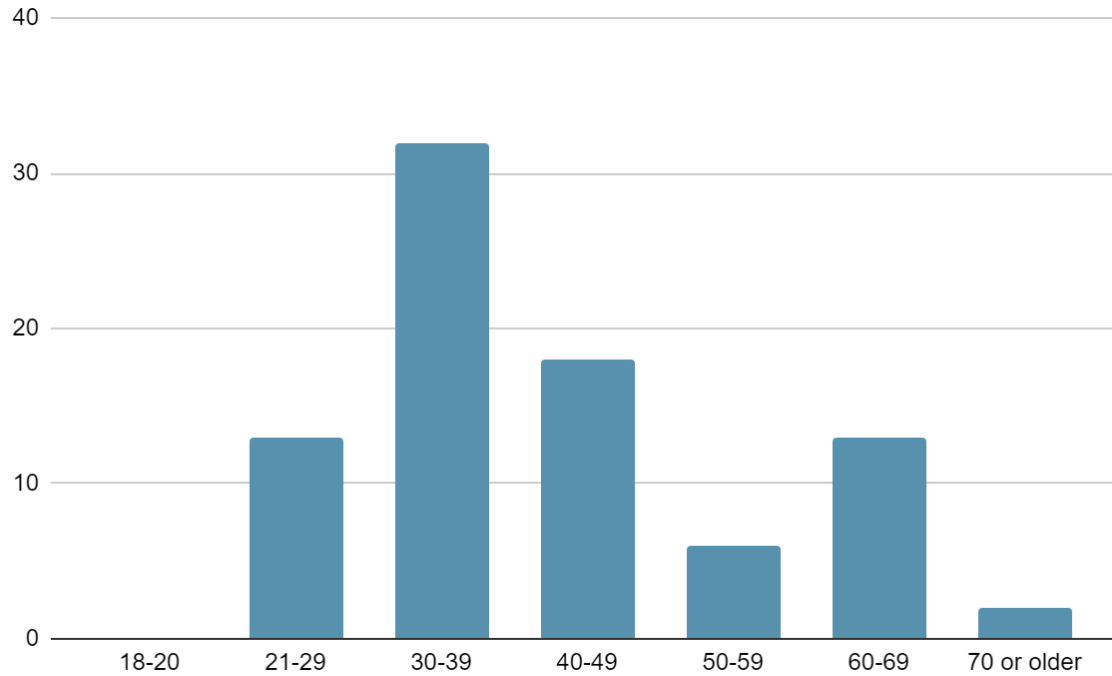
- Age range of 30-39 (38%)
- Have a Master's degree (50%)
- White (79.50%)
- Female (59%)
- On YouTube platform(29%)
- Liberal (69%)

Interviewees mostly self-identify themselves as:

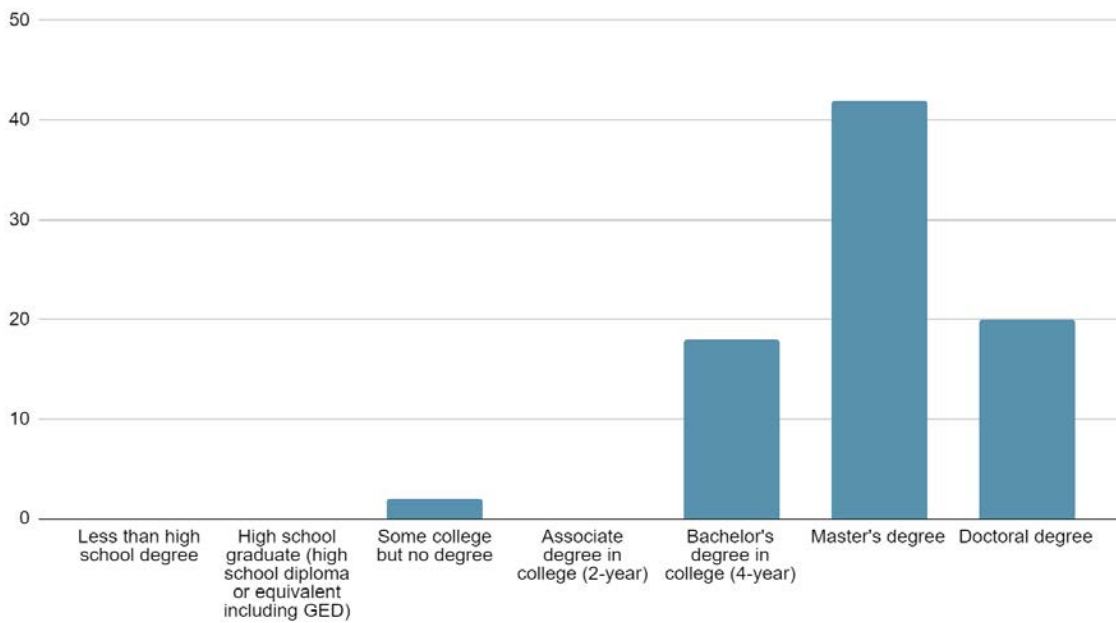
- Journalist
- Advocating journalist
- Advocating artist
- Science communicator/writer
- Filmmaker
- Executive producer/producer
- Science entertainer
- Educational ambassador
- YouTuber
- Network executive

Demographic survey responses:

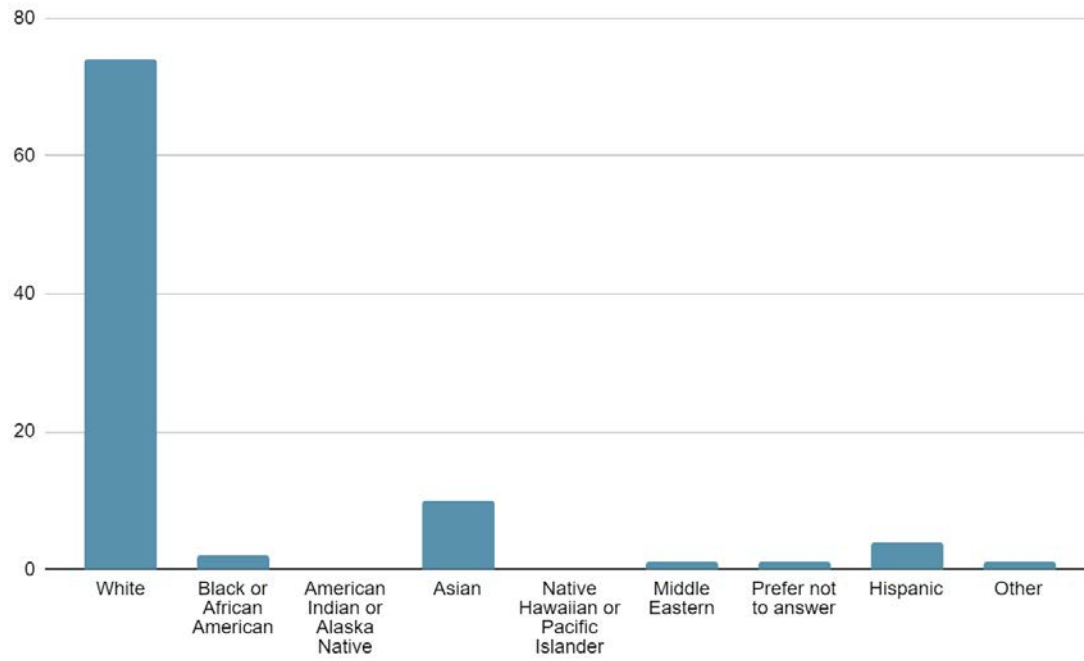
Age range



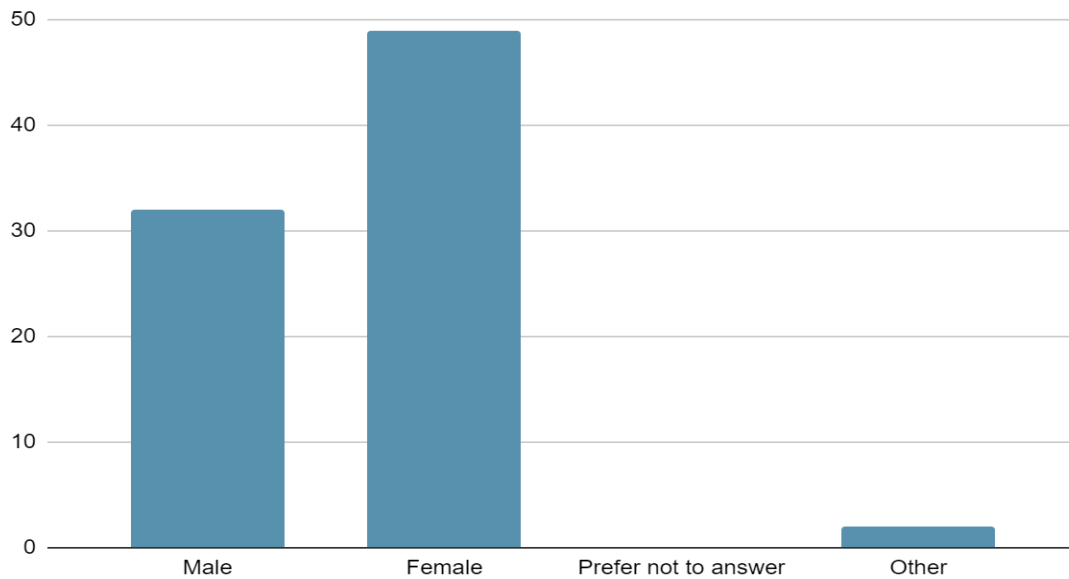
Highest level of school/education



Race

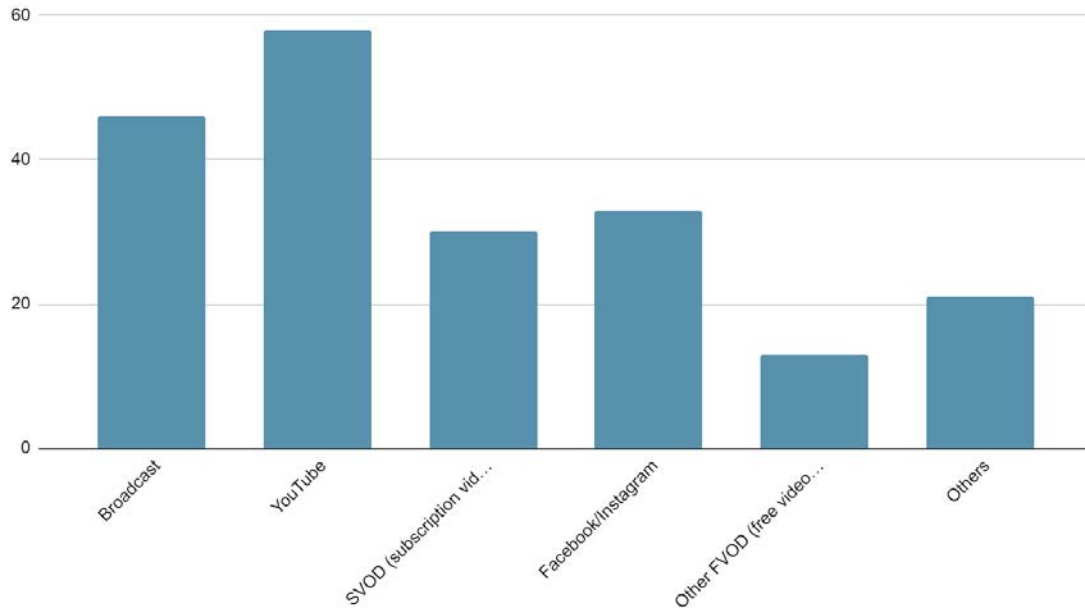


Sex

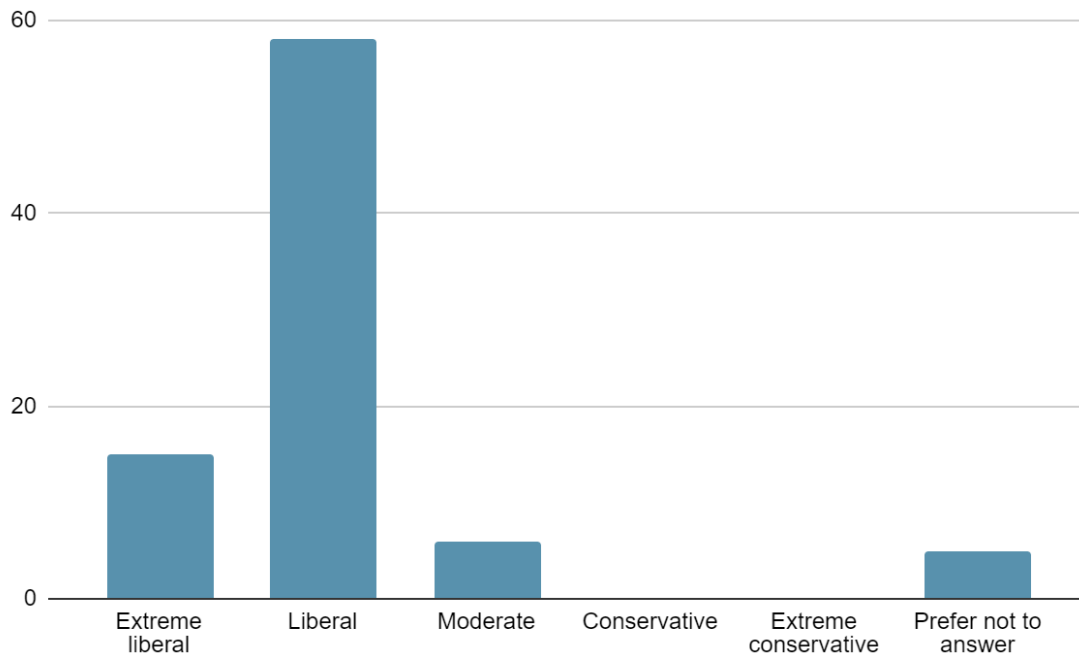


* Other includes non-binary, two-spirit presenting as female

Platforms



Political identity



Research-practice

What are the filmmakers' attitude towards research-practice connection? What barriers and opportunities do they perceive for such connections?

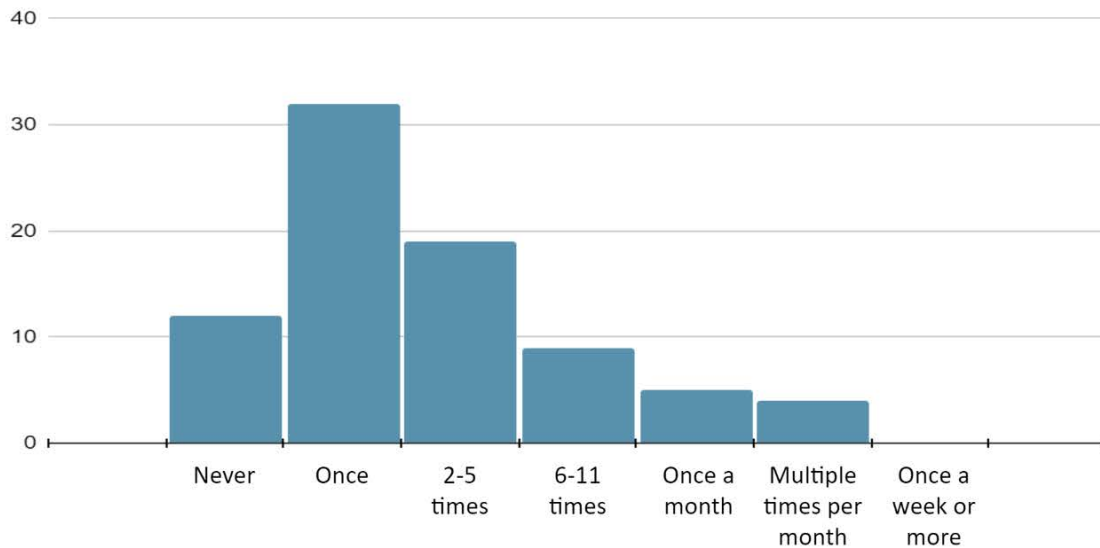
Research-practice Summary:

- Overall positive attitude towards SciComm research and researchers.
- Exposure to SciComm research or researchers 0-5 times during the past year.
- Interest in exposure to SciComm research is once a month.
- Main barriers to using SciComm research: inaccessibility of research and researchers, limited time, not being aware that such research exists.
- Main channels of interest to learn about SciComm research: Socializing with researchers, watching SciComm-related videos, using guidelines and toolkits.

Past behavior:

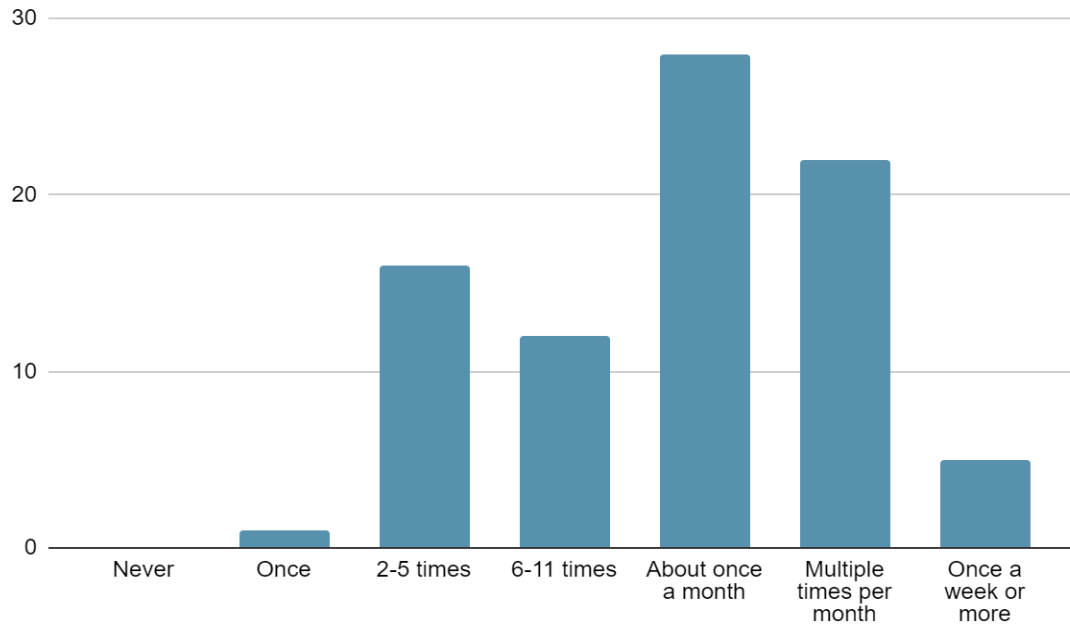
In the past 12 months how often have producers interacted with SciComm research/researchers?

Average of items: Conversations with social scientists, reading research and white papers, attending events like conferences or workshops, watching related videos.



Future intention to connect to SciComm research:

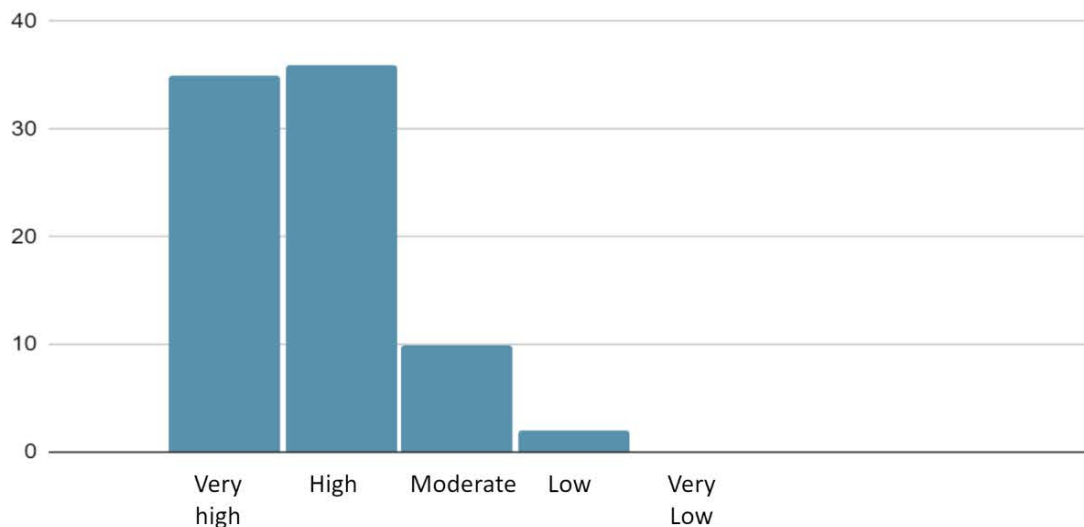
During the next 12 months, how often would you like to be exposed to science communication research?



Attitude towards engagement with research or researchers:

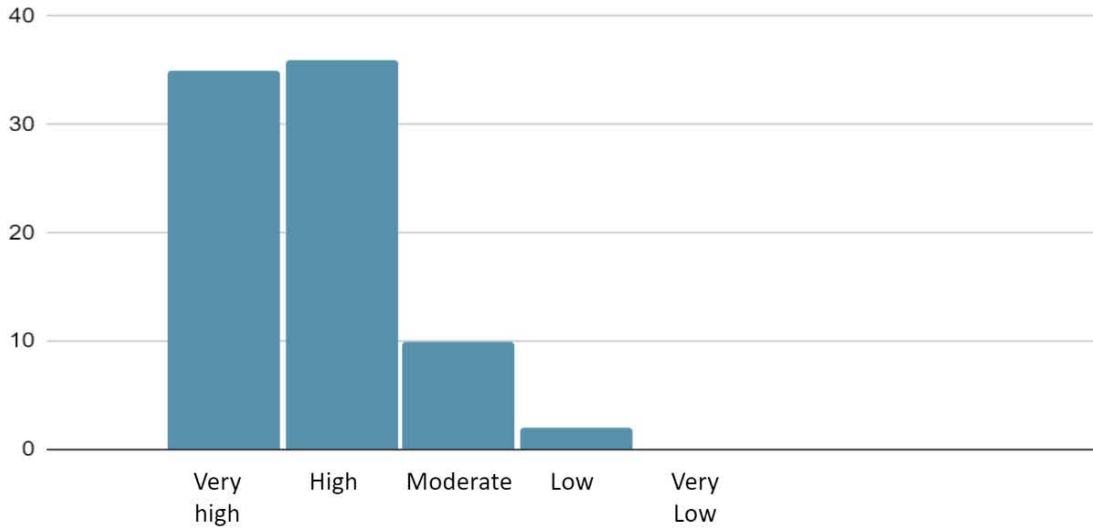
How would you rate your...

Average of items: Interest in SciComm research and researchers, evaluation of helpfulness and effectiveness of SciComm research to themselves and other filmmakers.



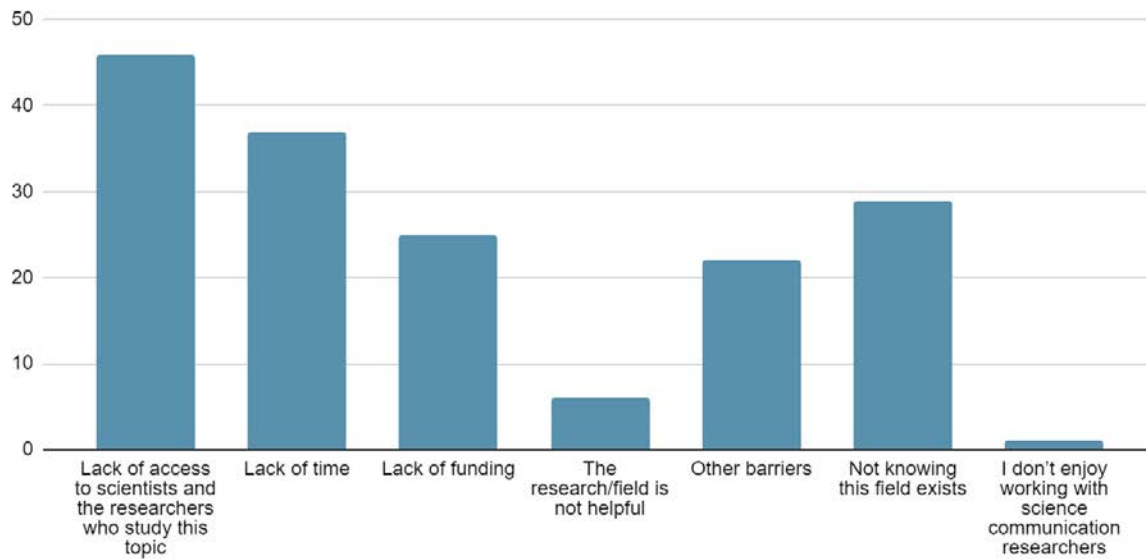
Norms and perception of others' interaction with SciComm

In the last year, how often do you think other science filmmakers have been exposed to science communication research?



Barriers²

What do you perceive as the most important barriers to using science communication research?



Examples from interviews:

“The field has its own jargon and other barriers to being accessible to reading.”

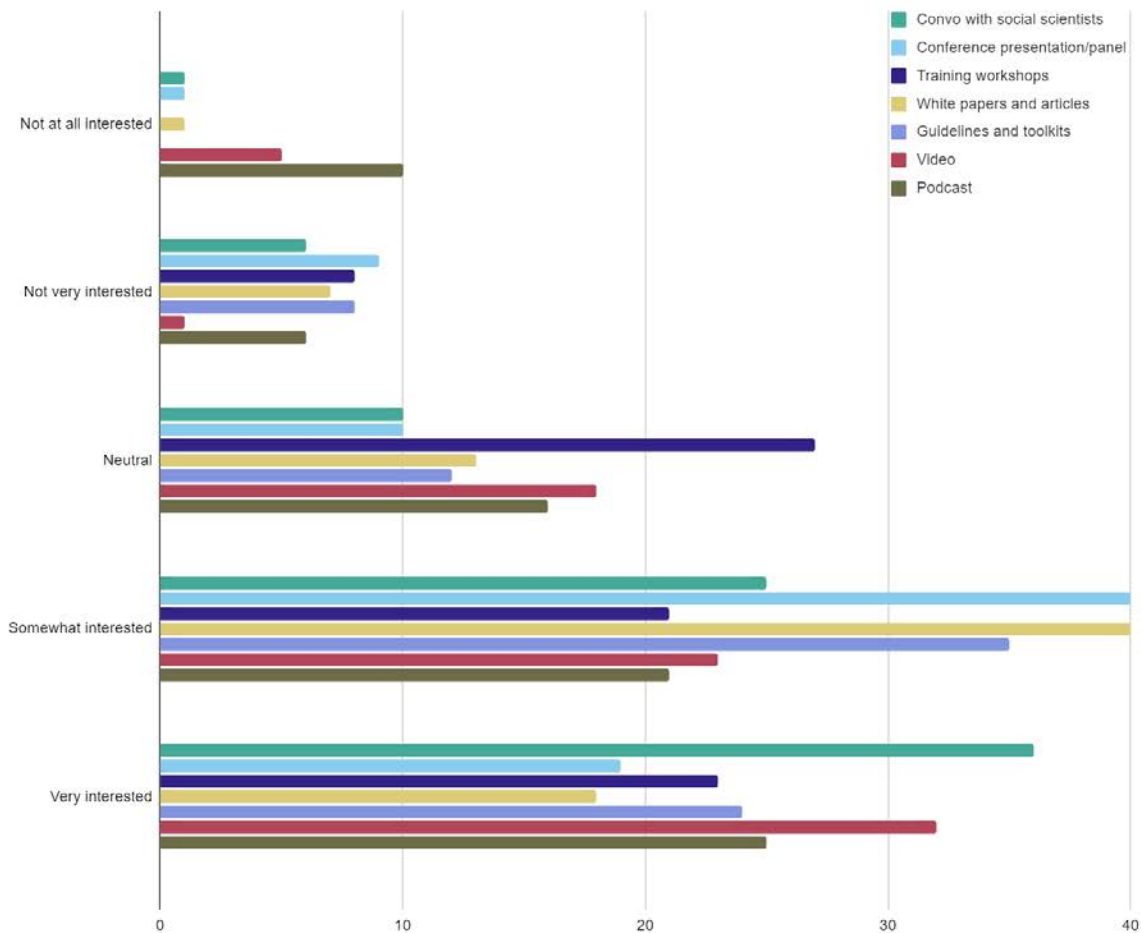
“Someone sent me a resource that I could reach out to, but I think that by the time I got it, I was well down the path toward completing that [show]...I didn't even have time to think I'm just racing.”

“It [Science communication research] is not a thing, been in this business 35 years, and I've never dealt with it. “

² Interview excerpts in the supplemental material section.

Opportunities³

If you were to receive information on the latest science communication research that can help with science filmmaking decisions, how would you prefer to receive it?



Examples from interviews:

“Most of my background in [SciComm] comes from my time doing the PhD. Besides my conversation with [SciComm expert] and [SciComm researcher], um, that that's probably largely what has influenced me.”

“I think you should watch other people's films...there's the technical end of what we do...like cameras and all that stuff. [So] do you watch the way the people tell stories?”

³ Interview excerpts in the supplemental material section.

Suggestions based on findings:

- Increasing awareness of the field of SciComm and sciComm researchers.
 - Translating SciComm research and making it accessible and practical for producers.
 - Producing videos and sharing examples of videos on SciComm best practices based on research findings.
 - Facilitating connection between SciComm researchers and producers and building community.
 - Consider integrating the identification of evidence-based SciComm strategies when developing production timeline
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Communication status quo

What are the producers' goals, objectives, and communication tactics?

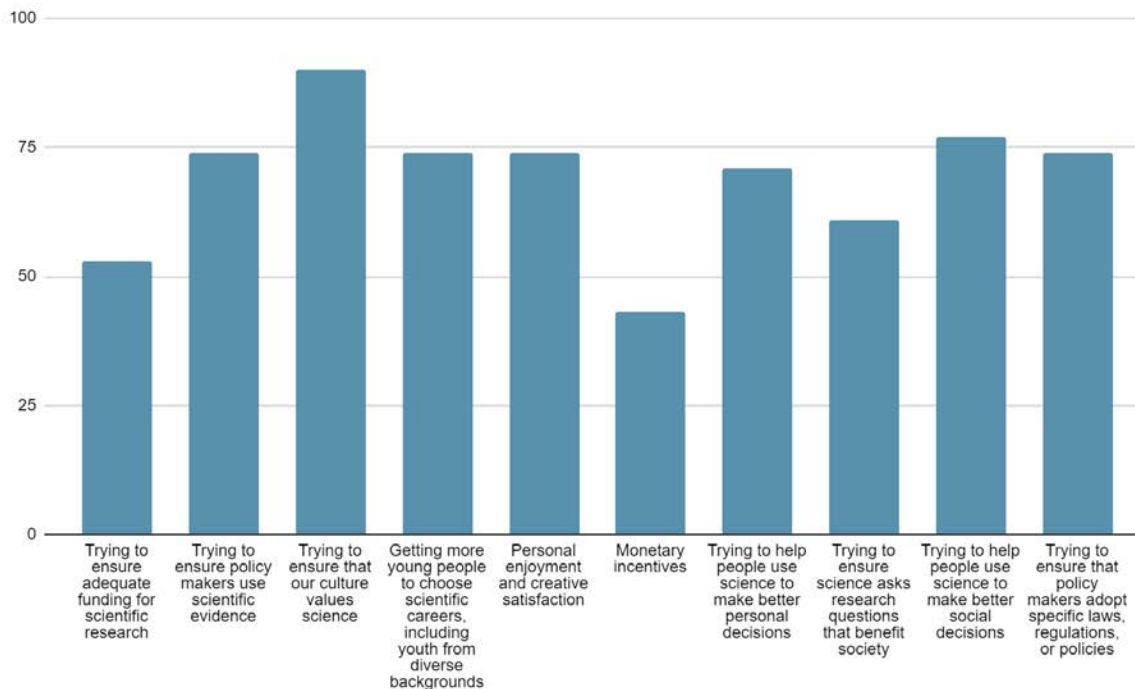
Communication status quo Summary:

- Main goals (long-term) are ensuring that our culture values science and helping people use science to make better decisions (behavior and attitude change).
- Main objectives (short-term) are eliciting positive emotions about science, showing the transparency of the scientific community, frame how others think about science, and improve knowledge.
- Main tactics (strategies to reach outcomes) are using storytelling, effective visuals, choosing appropriate tones.

Goals⁴

Long-term and final effects producers want to see in their audience. This impact can go beyond the effect of one piece of content.

Goals priorities based on survey data:



⁴ Interview excerpts in the supplemental material section.

Goals based on interview responses:

Changing behavior



Helping audiences make behavioral changes such as conservation efforts, voting for pro-science policies, staying healthy, etc.

Not changing behavior



In some cases, there is explicit rejection of behavior change goals. “We're not in the business of advocacy television, so we're not necessarily trying to overtly spur you into action.”

Changing attitude



Eliciting appreciation for science or an animal, or the importance of a certain topic. Usually accompanied with positive feelings “ I want people to feel this sort of awe or like, wow.”

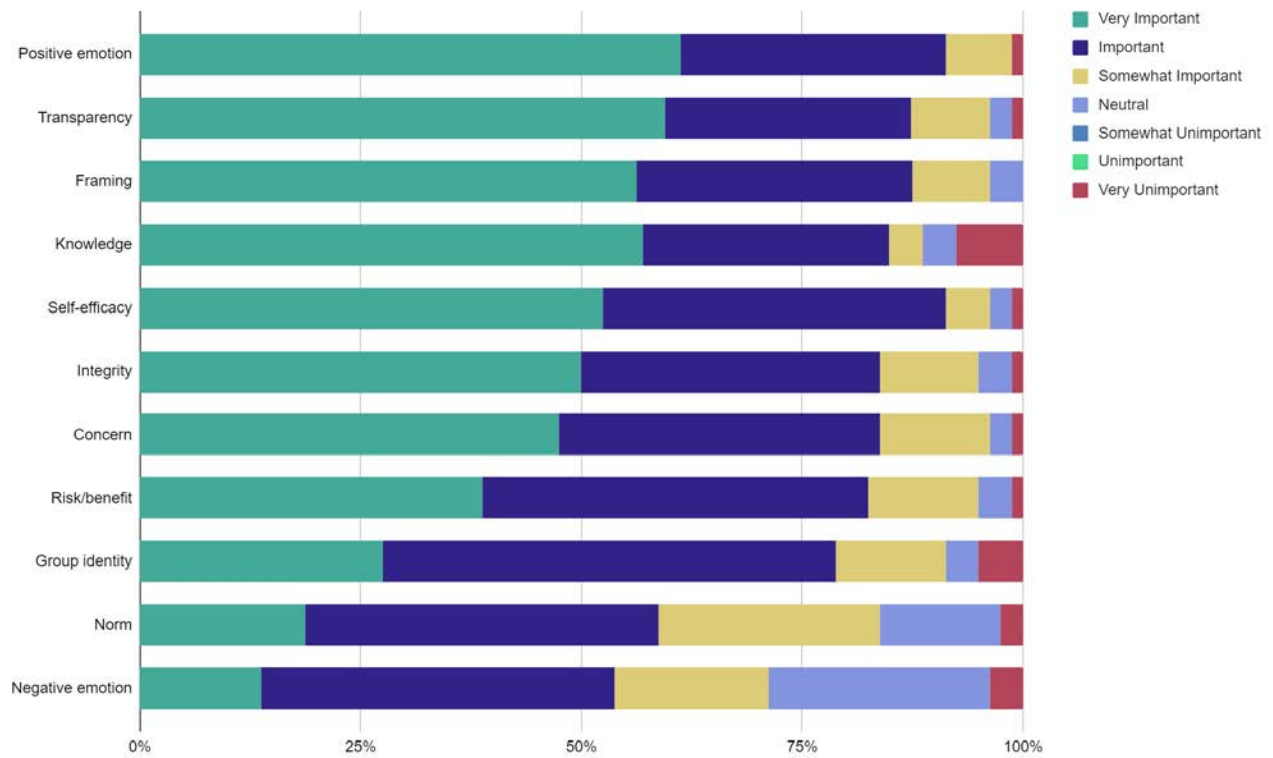
Personal satisfaction



“Deep down, I'm satisfying my own need to be like creative and express things. “

Objectives⁵

Intermediary outcomes that producers expect to get through their content. Objectives can lead to final goals.



⁵ More interview excerpts in the supplemental material section.

Objectives based on interviews responses:

Empathy & concern



Showing the audience that they are heard and not judged. Showing that science cares for individuals.

Relevance & Importance



Showing the audience why a topic is important and how it relates to their lives.

Emotions



Eliciting emotions such as hope, joy (entertainment), curiosity. Mostly negative emotions such as anger were avoided.

Education



Educating the audience with the caveat that “You can kill a film with too many facts.”

Scientific process



Showing the process of science. Mostly, only used if the process is visually interesting or “mysterious”.

Trust



Building trust in science/scientists/host/channel through different tactics such as vulnerability, transparency, showing competence, etc.

Self-efficacy



Showing the audience that they have the ability to make a change and remove barriers to action.

Norms



Showing that other people engage in the same positive behavior but this objective is rarely used.

Tactics⁶ Tactics and strategies used by producers to elicit specific outcomes.

Tactics based on interviews responses:

Storytelling



The most used tactics in production. Each element is used to meet an objective, e.g. characters are used to build empathy, challenges to elicit importance, and hooks to elicit surprise.

Rhetoric



Avoiding or explaining jargon. Using metaphors, and examples to facilitate the understanding of concepts.

Art & Visuals



Using beautiful, high quality visuals for aesthetics. Also, as a learning tool to complement the information such as an onscreen text map.

Tone



Using different tones based on context. Mostly serious in broadcast and conversational on YouTube.

⁶ Interview excerpts in the supplemental material section.

Examples of Goals/objectives that show discrepancy with evidence:

- SciComm research might identify many strategies to lead to behavior change. Since there is some defensiveness toward goals that imply change in behavior or advocacy, it's worth discussing what ethical persuasion looks like.
 - While educating is an important objective, the "deficit model" shows that providing facts on its own is not enough to change attitude or behavior.
 - Eliciting negative emotions is a low-priority objective, but if used in a proper context, this objective can lead to action.
 - Eliciting humor is disputed due to concerns over host credibility. Research shows in most instances humor does not affect credibility.
 - Trust-building is heavily through eliciting a sense of competence, i.e., getting the facts right. Other less used, more important tactics are showing care, transparency, vulnerability, & openness.
 - Norm-building is a low-priority objective, but if used properly, can be an effective way to elicit attitude and behavior change.
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Impact measurement

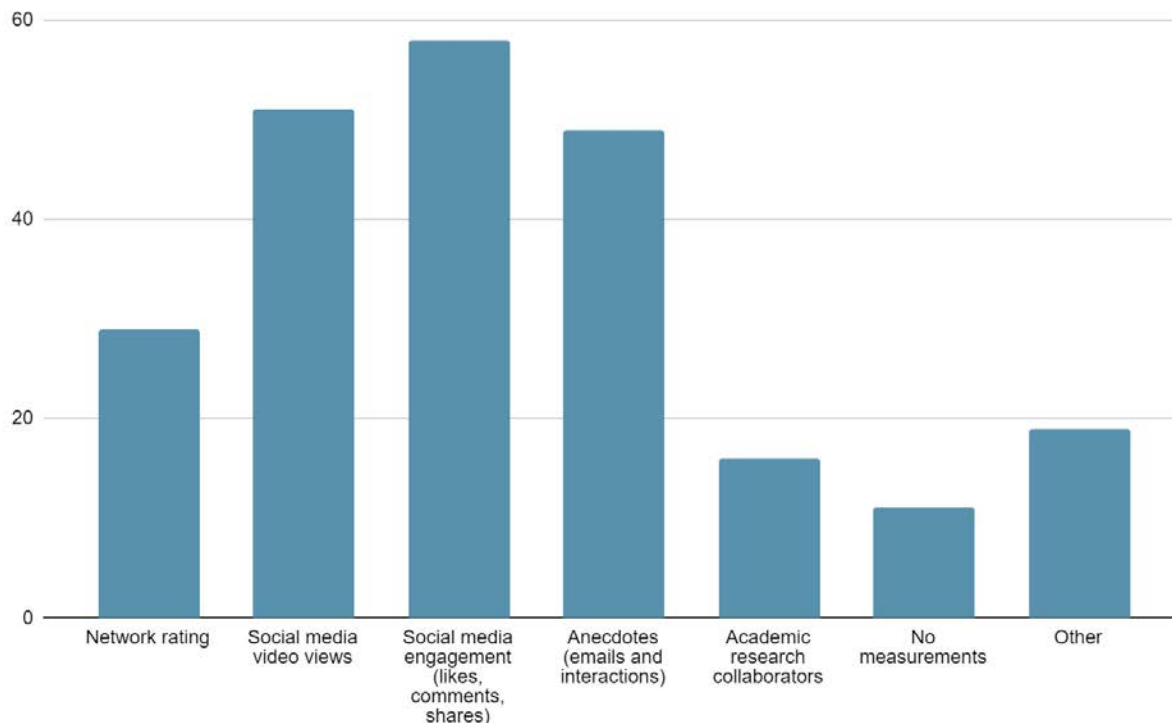
How do filmmakers measure their impact?

What is impact?

In this report media impact/effects are defined as “social or psychological responses occurring in individuals, dyads, small groups, organizations, or communities as a result of exposure to or processing of or otherwise acting on media messages. The changes caused by media can take place on several dimensions. The effects can be intended by the message source or unintended. The consequences can include not only changes, but also preservation of the status quo. If a certain social situation perpetuates because of media this is also considered a media effect. In addition, media effects can be both short-term and long-term.”⁷

When interviewees discuss impact measurement, in most instances it is focused on quantitative default data obtained through platforms and ratings, rather than specific strategies to measure pre-determined goals such as voting behavior, attitude towards science, or trust in a scientist.

How do you measure your impact?



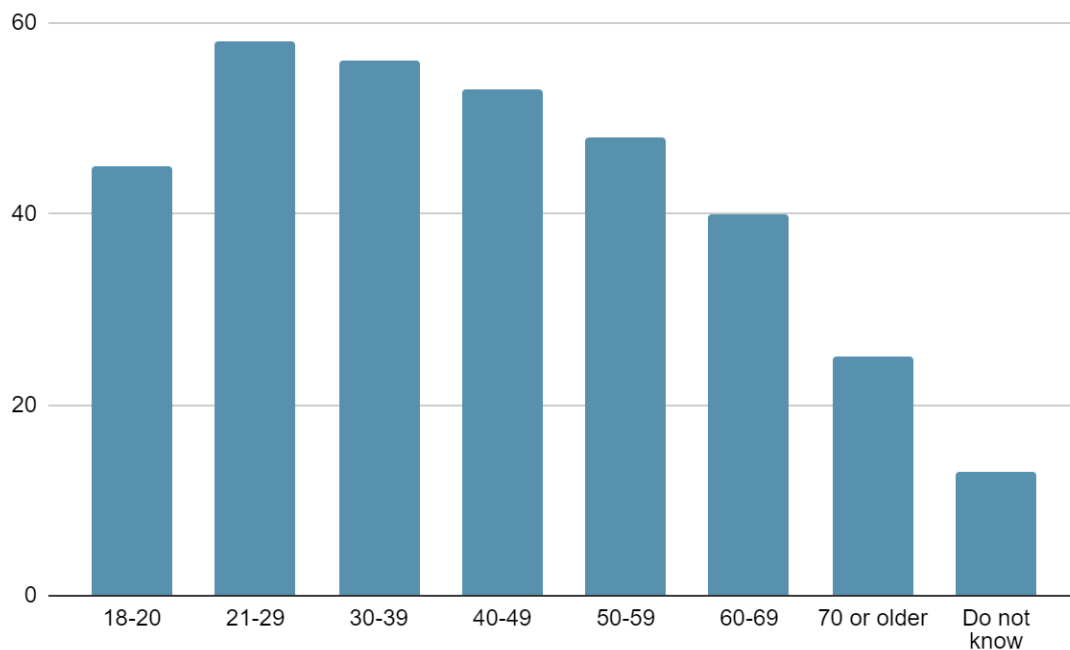
⁷ Yariv Tsfati (2017). Media Effects, Oxford Bibliography. Retrieved from: <https://www.oxfordbibliographies.com/view/document/obo-97801997568>

Suggestions based on findings:

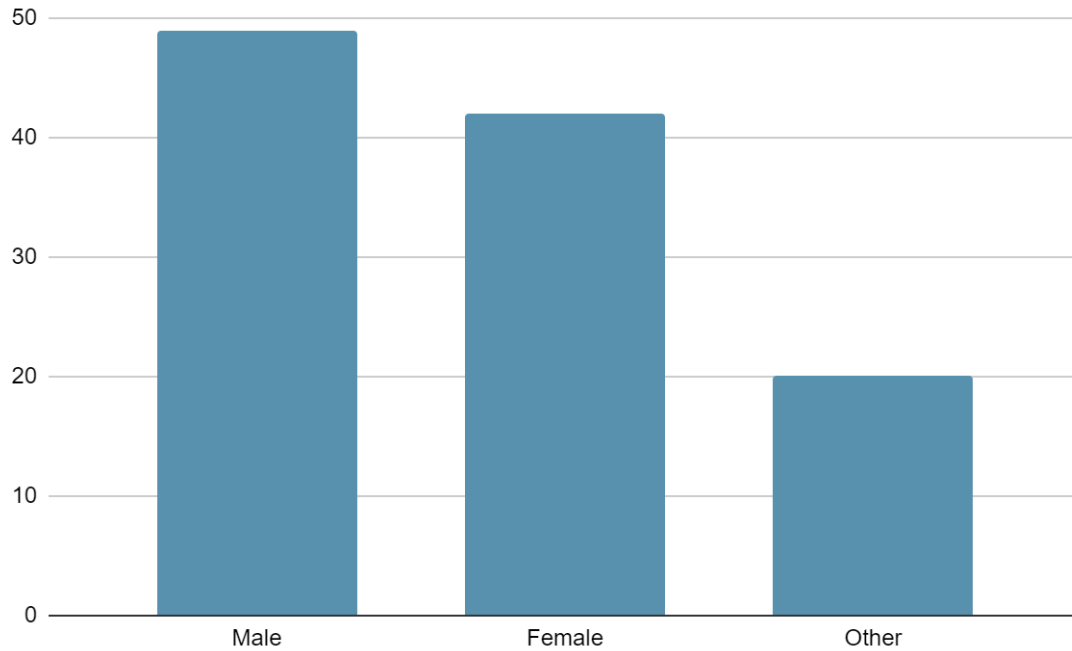
- **Social media metrics:** Developing impact measurement strategies that are easily integrated into social media posts (e.g., videos & links)
 - **Researchers:** Facilitating connection between researchers and practitioners during the production and evaluation stage
 - **Academic scales:** Adopting academic measurement scales to user-friendly tools that assess goals, objectives, and tactics mostly used by producers based on the findings
 - **Anecdotal evidence:** Formalizing the process of collecting anecdotal evidence for impact
 - **Outcomes:** Moving beyond default analytics and setting measurement goals and strategies that address specific outcomes such as trust or hope
-

Audience data:

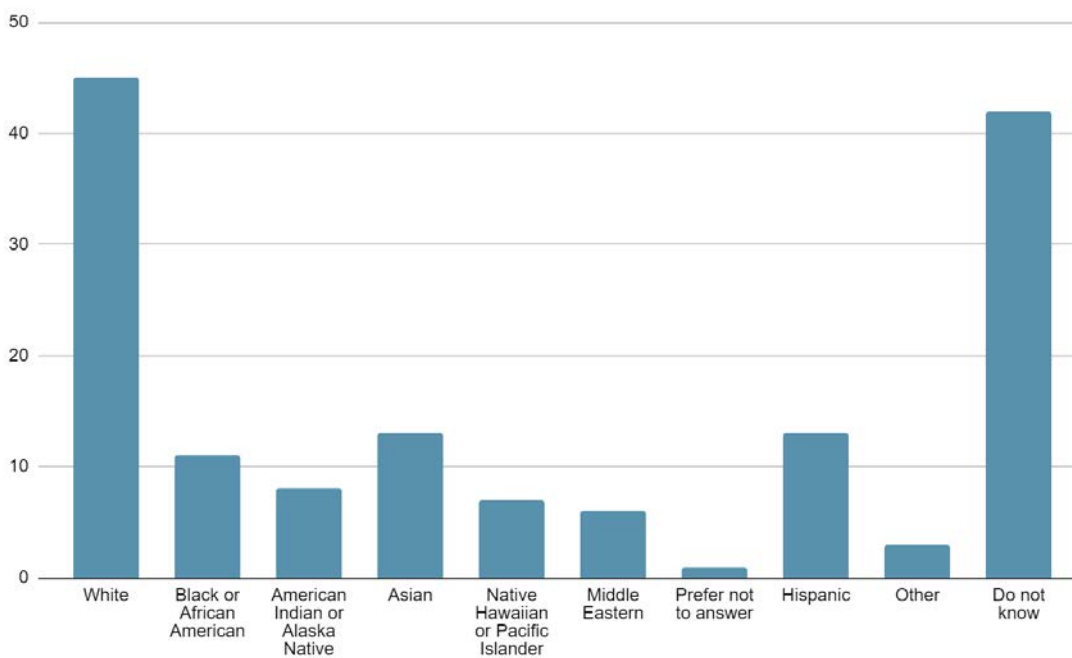
What is your current audience's age range?



Does your current audience tend to be leaning towards a certain gender?



What is your current audience's dominant ethnicity?



Suggestions based on audience distributions:

- Examining research to identify strategies to invite more diverse audiences
 - Identify measurement strategies to be able to learn about the ethnicity of the audiences
 - Examining research to identify strategies to invite more women as audiences
 - Examining research to identify strategies to invite younger audiences. Based on interviews, producers want younger audiences.
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Supplemental material

Selection of quotes from the interviews that make the previous points more concrete.

Barriers - Interview examples:

What do you perceive as the most important barriers to using science communication research?

Lack of access to research/researchers

Lack of access to the research and researcher:

*“The folks doing the academic research on effective science communication **aren't reaching and sharing insights with science filmmakers.**”*

*“Academic publishing **paywalls.**”*

Hard to understand the content:

*“**The field has its own jargon** and other barriers to being accessible to reading.”*

Content being irrelevant to practice:

*“The **research is often not practical for filmmakers.** It seems to be theoretical and geared towards other social scientists.”*

Lack of time

*“Someone sent me a resource that I could reach out to, but I think that by the time I got it, I was well down the path toward completing that. **And when I was on the covert project, I didn't even have time to think I'm just racing.**”*

*“Um, it's, it's challenging to wrap theory into something **when you're trying to bang out a video and half a week, you know?**”*

*“Not having an easy way to access findings in a succinct way. **I want the quick takeaways** that can help me in my work, but I don't have time to go through the literature”*

Not knowing this field exists

*“It is not a thing, been in this business 35 years, and **I've never dealt with it.** Don't know anyone who has, so in television seems not to show up. I may be, you know, there may be people I don't know, but I've never, uh, never occurred to me to do that. Never been an opportunity.”*

*“I would say for me it's more **lack of knowing that that resource is there.** Like if I had known that I*

could call somebody who would know more about this than me and they could tell me this would be a good way to display it, if I had known that I probably would have done it, but I didn't know that. And I haven't known that. So that's probably part of it just access to that resource. Um, my first thought is like the Hollywood science exchange. Yeah. It's just like, if that resource is there, people will use it. Um, and so they, they do, but not everybody obviously. And so that's probably, for me, at least the biggest barrier that I would see on the other side of that barrier. ”

Lack of funding & accountability



“Meetings are happening less and less because of money, I used to go to AAAS all the time when I was new in the field, cause it was my foothold in science and, media, but I don't often [go] if it's not in my town or nearby, I'll go now if it's in DC or, you know, once in a while”

“The caveat there is whether it is a grant that's paying for the film or not. With NSF, yes, there are those science communications people attached to the grant. And also we have to [...]actually show who's going to see it and why and where, and what's the reach going to be? What's the impact going to be? We have to think about those outcomes and impacts.”

Attitude towards researchers



“And then you come to the room and you bring the filmmakers into the room, you know, that's the part of it that I find really sort of upsetting is the idea that we're [researchers] going to tell you, we can, we're smart so we can figure this out faster or better than you can. [...] I know you're very smart, bro.[...]You know, and I think that's where, you know, a little bit of humility and a real desire to cooperate, It makes a difference.”

Integration challenge



“That's hard. Um, I mean, I think there were certain films where that would be very interesting to try [using science communication research]. Um, but I think perhaps they should be more involved with the actual producers of the film with their scripting and stuff rather than at the network level.”

Defensiveness to the concept of behavior change



Some producers perceive using science communication research to inform their practice as leading to behavior change in audience, and they are defensive to that goal:

“ I have never gone in trying to change people's behavior. I mean, as a scientific problem, how do you get people to act is an interesting scientific problem. You know? Um, yeah, that's interesting, but I've just never, I've never done a show where that was, I mean, part of the show.”

Strategy vs. Art



Some producers see research as a barrier to artistic freedom and decision-making:

“Storytellers hate compromising their vision. So, many creative storytelling decisions are less about communication and more about entertainment/artistry.”

Opportunities - Interview examples:

If you were to receive information on the latest science communication research that can help with science filmmaking decisions, how would you prefer to receive it?

Socializing and conversations



*“I mean, most of my background in that[science communication research] comes from my time doing the PhD. Um, so besides that, and besides **my conversation** with [SciComm-centric producer name] and [SciComm researcher name], um, that that's probably largely what has influenced me.”*

*“I think **it's building communities**. I don't know what platforms are really the most effective, but I think it's probably platforms or moments or engagements or spaces, however defined,[...]I think **to talk about**, this is what I'm trying to do, and this is how I think you could help me, and let those two things form whatever they form[...]But even **just sort of starting the conversation about what's the shortcoming**, say I'm a professional psychologist. Why am I in this room?*

What is it that I am doing that I really feel that other people could understand and benefit from? And then how does that resonate with you, Mr. Filmmaker, in terms of what you, whatever it is. But I think that it's the conversation that hopefully it begins to lead to, these are the kinds of ways in which we can collaborate.”

Video examples



*“ I think you should watch other people's films, you know? I mean there's the technical end of what we do, you know? You know about like cameras and all that stuff. **Do you watch the way the people tell stories?** Like somebody like just said, like a camera. That's how you gotta look at this Netflix show about babies. It looks interesting.”*

*“I would say that **most of our information that we use comes from other successful YouTubers**, you know, so people who have found some tools that help and that might be YouTube specific or that might be in the aid of communicating. But I don't really know, you know, I'm not sure if those are like, evidence-based necessarily, it's more word of mouth.”*

Conferences, workshops and events



*“Let me start with where I encountered it [SciComm] first, like some of those things are[...] as a scientist in life science field and in graduate school, **I'm sure I received a presentation at some point on science communication** early in the years. And, you know, received it in every science communication presentation or workshop, like the Day's Edge **fellows** thing. Um, you know, I'm sure I received it a hundred times after that. And I think that, you know, most of those things, many of those things became, just guiding, operating ideas to work by. You know, generally with a lot of that information, it's mostly like ethereal in the back of my mind when I'm making things about like how to structure these things or things to be aware of.”*

Academic and white papers



*“ **Richard Mayor's whole body of research around media, it think definitely guides my thinking a lot.** And you think about things like, you know, contiguity principles or like reducing extraneous loads and all that sort of stuff. Like, I think all of that is really useful to bring, uh, to video video making.”*

Goals - Interview examples:

Long-term and final effects producers want to see in their audience. This impact can go beyond the effect of one piece of content.

Behavior Change



To help change behavior such as voting or conservation:

*“[...] but in order **to equip people to go into, um, public policy or voting scenarios** where they're better informed about an issue, or they can that information to reflect upon their leaders or an issue to see how well they align with, um, you know, what we know to be true science.”*

Or helping others communicate science:

*“Uh, obviously you want something like this to reach a scale and have the video almost **serve as the viewer's information unit that if they feel unequipped to defend the issue that they care about** because of a lack of knowledge or experience, or, or ability to translate, you know, use their own language, this can serve actually as the communication unit for them to spread around because it's inherently shareable things.”*

And inspire future generations to choose science careers:

*“You know, seeing people that look different on TV, doing important jobs, interesting jobs that are...I can't tell you how important that is, it's always been that way for me, like I have a daughter, like every, **we just need to see different people on TV doing those jobs, and then we will have more people in those jobs.**”*

And elicit participation in science for “everyone”:

*“There ought to be much more of an aggressive, urgent action to make sure marginalized communities know about this science, marginalized communities know about this work and are participants in this work. So if people aren't just coming in and picking up data and information on pollution in my neighborhood or traffic in my neighborhood, **but finding ways to engage people, to make sure that they understand that they can be participants.** And this work is not beyond their understanding and it's not beyond their lives. It turns out it's important.”*

Not behavior change



Avoiding to use behavior change as a goal:

*“We're not in the business of advocacy television, **so we're not necessarily trying to overtly spur you into action.** Um, we just hope that you will have learned something and take something away from watching the film that will, you will feel is relevant to you.. [...] It's not that we don't want to. It's just that we're not, **we're not engaging you the viewer in the terms of, you're going to watch this film and we're going to persuade you to do something. We engage the viewer with, We're going to tell you an amazing story about something that you don't know about yet, and we hope you find it entertaining and interesting. What you choose to do with that knowledge is up to you.** But sit down and let me tell you a story. [...] I mean, the difference is that when all of you is sit down to watch our shows, they're not choosing to, they're not going to an advocacy website, for example, wildlife conservation trust, where they're choosing to go in and learn more about a conservation topic that they know at the end is going to ask them for money. And it's going to ask them to engage in surveys and whatever, our view has come to us because they want to be entertained. **Now we hope with conservation that when they choose to sit down and watch an elephant film, they walk away from that thinking, Oh my gosh, we have to save the elephants because they're amazing.** And look at all these horrible things that are happening to them.”*

This decision might be an editorial and organizational limit:

*“So **some of this is editorial limitations** based on like working with [organization name]. We do not advocate and try to take editorial positions. Um, so like our calls to action are rarely go do a thing. It is consider a thing, It is learned about a thing and just think about how thing it impacts you, but, uh, we rarely, if ever put a specific call to, like, I can tell you to go vote for something, or, we try to respect the independence and intelligence of the audience to feel like they're making that decision for themselves. That's the bigger level, but also sort of just editorially limited for making like direct appeals in that way. We don't, it's just, isn't part of our kind of our policies.”*

Attitude change



*“ **I want people to feel this sort of awe or like, wow.** You know, when I think about topics that I want to take on, it's normally when I get this feeling of like, Whoa, that's amazing that I want to make that video. If I'm not amazed by it, then I don't want to make a video about it. Typically, so, I guess to share this sort of appreciation, love, and joy and passion that I have for these topics with, uh, like minded audience,”*

Personal satisfaction



*"I'm pretty self serving with what I do, people thank me a lot for like making the videos and stuff. Um, and that's always like, feels good, but like **deep down, I'm satisfying my own need to be like creative and express things.** And one of the core ways that I experienced satisfaction is when I've produced something that I feel like shows a phenomenon or shows the beauty of science or, you know, illustrate something or, um, tackles a concept that just hasn't been tackled in that way with that kind of clarity or with that kind of, um, storytelling before. So **there's a deep, personal satisfaction, which I think if I'm honest is like the core of what I do and why I do it.** Um, but I guess there's sort of bigger implications beyond that, which is, I guess a couple of things."*

Notes on goals

For many the goals are dependent on the project:

"Every film is different. With [Film name] I really hope people would understand this is a treatable brain disorder, and there's evidence-based therapies that we see right now."

At times, there is no control over goals due to working with a company or client:

"You know, that that's the downside of being a filmmaker. You have no control, all you can do is, is make something and say, here you go and hope for the best."

In some cases in for-profit format, the goals are determined by profitability:

"If we're doing something which is hardcore cosmology, then the barriers for entry are a little bit higher as are the expectations that it's a purely entertaining topic, lower. If it's popular science stuff, then obviously it needs to have a pop appeal. [network name] will describe itself as a mission driven company, but at the bottom of the bottom line is, you know, we're publicly traded. We have shareholders and there are expectations of profitability."

Objectives - Interview examples:

Intermediary outcomes that producers expect to get through their content. Objectives can lead to final goals.

Empathy and Concern



Through building mutual grounds, listening to the audience, showing kindness and treating them as equals, and avoiding attacks:

*"I think it's like **finding common ground.** I think it's **including enough in your film that, you know, all kinds of people are going to relate** to even people that may not have the same perspective that you do as a filmmaker. So I think it's not ostracizing people. I think it's sort of welcoming everyone into the subject matter at hand, um, so that people aren't feeling defensive."*

*"You just **don't talk down to them,** but you've never talked down to anybody. I mean, that'd be rude,*

you know, *listen, cause I don't, I really truly don't think I know more than anybody else, you know?*"

And through online interactions:

*"Certainly in digital age we do a lot of outreach through, you know, all the social media platforms and stuff to **engage with our audiences that way, um, on a personal level.**"*

However, depending on circumstances, producers might perceive levels of showing care to be different:

*"**I don't think it's [showing care] valuable in all science communication.** I mean, I value it more now that I'm independent because every new subscriber means a lot to me. And so when I first started doing [Channel name], I'd come from TV. **TV, doesn't really value them professionally,** but they aren't like out there literally being like, thank you so much for showing up and watching this documentary that costs \$700 million, whatever...doesn't actually cost that much. But you know what I'm saying? It's just like this million dollar television show isn't thanking their viewers. Um, and so it's like, it depends kind of what your goal is. **I value all of my viewers now, even more so.** And I did when I worked at [Channel name] when it was small and as we got bigger, it was harder to value individuals."*

Importance and relevance



*"I think the, the first few minutes of, of my films pretty much every single time is, is **showing not only that here's this interesting thing, but this is how it's relevant to you.** You know, that's, that's the number one thing I do in every show is to show how this relates."*

*"If I'm trying to communicate to native Hawaiian audiences, I'll have native Hawaiians speak some of these messages, and I've been really fortunate to have some incredible collaborators who are characters in these films that **can deliver these messages really compelling ways.** And so, you know, in that way, because I've had that access to those characters and those spokespeople, um, people appropriate people to carry those messages and I spend a lot of time on my end, trying to become the best interviewer that I can, um, to be able to, you know, elicit, um, you know, very **genuine, heartfelt responses from people who actually really care about these things.**"*

However, interesting might beat relevant in some circumstances:

*"I mean, it's sort of the goal is finding things that they'll find interesting. It's not like PBS where we tackle social issues that we think are applicable to certain people. Um, science affects everyone. You know, you don't have to believe the world is round. It's going to be every bit as round, uh, whether or not you believe in it. Um, so there, **the focus is on finding things that are interesting, not necessarily things that are directly applicable.** Obviously we try and make things as relatable as possible, particularly for some of the more difficult topics"*

Eliciting emotions



This outcome, in the interviews, is frequently framed as the producer's goal.

Eliciting emotions like hope, joy, awe, fear, etc.

*"**I want people to feel this sort of awe or like, wow.** You know, when I think about topics that I want to*

take on, it's normally when I get this feeling of like, Whoa, that's amazing that I want to make that video..”

“I think you're more invested in that if you're, **if you're genuinely interested in something and genuinely genuinely curious about something**, I mean, sure. You can recycle because you are told it's a good thing to do and just do that. But I think if **you learn more about the process of who would impact, where the recycling goes, if you get more invested in it, then you're kind of more likely to do it and to stick with it and maybe even tell other people about it** then if you're just kind of following the rules.”

For some it depends on the persona of the organizations and emotions they want to avoid:

“**It really depends on that's probably on brand** [...]. We've got a little bit older viewership. People look [network name] for something they can trust and that's completely authentic. **So we do a little less jokingness because the more jokes you make, the less authentic, it feels it might be more pop.**”

“I have to make an argument for humor, before, **I have to fight for humor a lot.**”

“So we tried to make it [an episode] as lighthearted and conversational as we could. And the only way to do that is with two people, if it was just me monologuing, then that's, that's like a recipe to be unfortunate. **And if I was angry while I did it now, you're like really unfortunate.**”

Education



This outcome, in the interviews, is frequently framed as the producer's goal.

“It's my core belief that when we, uh, know the real truth about reality, **when we know the actual way the world is working and the actual way things are rather than how they, or how we'd like them to be, then we make better decisions about our future and we live better happier lives.**”

However there is debate on how often should education be the focus:

“**You can kill a film with too many facts. You can kill a film with too much information.**”

One interviewee describes the push and pull of the effectiveness of information-provision as a immune response analogy to external threats:

“It's good to have an immune response to foreign bodies and stuff. And you want to have a certain sort of proportionate response, to go and root out those things and get rid of them. And I think for very small movements or things that people might be confused about, that [providing information] can work, you know, a pushback that's pretty clear and well resourced.

And then they get to some of these things that are really kind of like almost polemical or things that people are super passionate about or like they've just made up their minds, flat earth or vaccines are bad or whatever. And there, it's almost like then I do worry about things like the backfire effect. That's where I worry.

Like if the immune response may be worse or may inflame things to a worst degree and kind of letting it lay[...] sometimes it's actually best not to fight back or not to really go strongly into the case because you are just inflaming the situation. That's kinda how I think about it.”

Norms



Some producers use themselves as the host to set norms:

*“I lean more on “you Trust me” I'm saying **this is normal and cool**. I do it. You know, I'm your every man who you can reflect some part of you on you, trust me. So I do it that makes it normal because we're friends. So you have another friend that says this is an okay thing to believe or do. So that gives you a little bit of psychological buffer to take it on yourself.”*

However some are not familiar with norm-setting (many people are doing x, so you should do it too) and some are very defensive to the idea especially as it reflects the fear of advocacy:

*“I mean, **it's important, but that's not something that guides my work**. Uh, I am in general, **not an advocate**. I mean that, that's not what I do, you know, I mean, there's a big difference, like being a journalist or being an advocate. I'm not an advocate. I mean there's all sorts of stuff I care about. But you know, I mean, **I that's a dangerous place for somebody who's a journalist.**”*

Scientific process



Some producers place high priority in showing the scientific process:

*“It's **hugely important depending on the story, depending on the network**. But I think pulling back that curtain, allowing people to see that this is how things are done, this is what people are doing. It takes the mystery away. It's no longer a black box. You know, that here's the answer, the world's getting warmer. It's this is people working very hard to show us how it is and how it's changing and why it's changing. “*

But at times the importance of this outcome depends:

*“ I guess [showing the scientific process is] moderately important. **I think they have their place**. And this is just being honest about like, you know, when you're putting together an entertaining film, I think **some scientists have like real jobs that seem very cool and they're visual they're action packed or look really neat or have a big mystery behind them**. And I think in those cases, yes, **I think in other cases, um, it can often feel a little like inside baseball or people might kind of suddenly lose interest**. So I, I guess I would say it's less important. When I have the opportunity to, then I think it's great, cause it does get people more aware of what does go on behind the scenes and how cool scientists are. But I think if it doesn't lend itself to the story, it could almost backfire. Cause it just seems you'd lose viewers.”*

Trust



Showing competence by presenting credibility and getting the facts right:

*“ So for whatever we're talking about, I think it is important to establish credibility of whoever's, whoever the video's about. I think you do that by sort of **showing you can put their name and their like title on the screen**”*

However, some producers struggle with showing competence due to stereotyping:

*“It's a tough one to do because **being a woman in a male dominant field on the internet, people are like, what I don't want to trust you.** [...] [once] I was like, we're going to talk about [topic], before you jumped down my throat, **I have degrees in this.** And then took pictures of me with my diplomas. And some people were like, that's really funny and campy that you did that because you're making it clear that you're not just some girl on the internet talking. And then for every one of those was a person that was like, wow, this was the most off-putting thing ever. And I'm like, there's literally no way you're going to win.”*

Showing honesty and vulnerability:

*“To make sure that **the characters are not infallible, that they have flaws, that they had to struggle to get where they are.** Um, I think that makes them, **I don't know if that's, I have no idea actually that's helpful** for kids and I couldn't really tell you why I do that... [building trust] Um, mostly with, with the like authentic voice theme. And then with, if I, if I have the option with like **vulnerability and humor.**”*

Showing openness and fairness

*“Um, and then I think it's also being a balanced, **a balanced storyteller too.** Um, you know, always sticking to the facts. And of course you always have kind of your end goal of what you want the takeaway to be. But at the same time, I think it is important to prove to audiences that like you've done your research. **You do know that there's both sides and you've kind of, you've shown both sides.**”*

Showing authenticity and humanity:

*“I can't engage with every single thing, but **I try to do that by being conversational and kind of, you know, sharing my life curated,** but sharing my life on social media, be it Twitter or Instagram, um, and doing, you know, videos of me, I have a video of me getting my tattoo and it's kind of like sharing the more personal side. So they feel more of a connection to the person, not just the presentation a little bit. I think that also actually might fall under getting my audience to trust me too. Is that like, **I want them to see me as a person, not just a talking head.**”*

Self-efficacy



Helping the audience feel the self-efficacy (being equipped and having the ability to make changes) is important to some producers, but for some, brings up the fear of being perceived as doing advocacy:

*“Um, Sort of important. It's kind of, I think not something that I can put super evidence or emphasis on as a [science history-based] channel, um, because **it is more the education for education's sake, not like a, let's talk how to change the national conversation** about race relations or something. Um, so it's like I said earlier, **I just try to kind of make it so that you learn a little something, inspired, maybe think differently, maybe thinking broadly.** Um, but it is important for me to kind of **give my audience that spark to kind of move forward. And I hope they do good with that as opposed to not.**”*

Tactics- Interview examples:

Tactics and strategies used by producers to elicit specific outcomes.

Storytelling



*“I think about framing, it's always good **to have a story that people are going to be compelled to follow**. And so within it, you sort of learn about maybe the sort of drier subject of climate change, like obviously a hugely important subject, but **I think you're more engaged if you're kind of following the story of climate change through an individual.**”*

Using each story elements such as the “hook”:

*“**But I'm pretty obsessed with the hook of a story** for the first few seconds of the story. I am really, I'm really obsessed with getting right. **I think surprise is something I like to use**”*

“Conflict” and “consequences”:

*“So in terms of films that engage in science, I think if I had a style it starts with really trying to, um, focus on human story where **what I'm trying to talk about or explain, uh, has consequences for that person or that person's community**. So I'm always trying to, I think it's important to have stories where there are stakes and the stakes are pretty obvious in terms of people's lives.”*

Character's (human and non-human):

*“I feel even when I'm reading an article and especially when I'm watching a TV show, that people are really not that interested in animals, they're not, we can't relate to them, **but what we can relate to are human beings and interesting human beings and good looking human beings** and all the rest. “*

*“We introduce characters. So like **if you're dealing with molecules and cells or like amoebas or something, Oh, you gotta make them characters** then [...] So we put a face on the cell, like the cell does something to something else, you know, a germ does something to somebody, something else. So, um, a lot of anthropomorphizing in order to, to invent these narratives so that people can see action and follow through with that.”*

Character's relatability:

*“Well, **you want a younger people to feel like they can relate to the scientists**. Um, early on at [network], [individual name] would say no ties and jackets, if you can avoid it because it's too formal. And so always trying to get them to, for people to feel that they're accessible, [...] So that's part of our mandate too, is to figure out how to make it something you're interested in and not intimidated by.”*

Character's diversity and representativeness:

*“It can help **to have a person with [that] condition involved** in the video. Um, because then it's not just me, like standing up there saying like, this is autism. [But] it is also an autistic person saying, **this is***

*what my experience as an autistic person has been. And this is how I feel about these things. It was also really **helpful in terms of like getting a sensitivity check** on our writing and making sure that we were using appropriate language.”*

A challenge that arises in storytelling is finding a balance between the science content and focus on character:

*“It's that **balance of wanting to teach them stuff versus wanting them to feel something, and connect**. So it's a balance that I find everywhere. It's probably the hardest thing that I think science communicators do in the edit suite is finding that balance because I think the filmmakers fall in love with their characters, um, and maybe sometimes sacrifice some information and story because you just want to be with them. Um, and versus, you know, if it's just the facts, then they can look it up online, you know, or they can read about it. So it's a really tough, tough balance.”*

*“My point has always been, **these videos are not about me**. Like I never say my name. I don't reference myself typically in most of this stuff, or even in the description, it's like, this is a video about ideas and I'm here to talk to you about those ideas and I hope you like them and I think that people come to me primarily because of the ideas and secondarily, because of what I do.”*

Rhetoric



*“Um, our goal is to have the, give the audience ways of learning about something that, um, engage them. And if it's going to engage them, it's going to have some level of entertainment. So we're always **looking for like analogies, you know, think about it like this, something that's very familiar and then you go, okay, I get it. So that's entertaining an accessible word.**”*

Art and visuals



For aesthetic, engagement:

*“I think, um, a few things that I always try to do in every **film that I do is for it to just visually look really beautiful**. I think that goes a long way. I think if you look at planet earth and people are just attracted to amazing shots and beautiful cinematography, and if you hire a great camera man, and, you know, put the money into like making it look great, [...] But I think that really goes a long way. And **people thinking like I'm watching something quality, I'm watching something that people really invested in. People think this is an important story** because they, they spent a lot of time on the ground. They found the best camera equipment. So I think that right there just kind of like raises it to a level that kind of demands attention in a way. **And it's just fun to look at and fun to make.**”*

And as a cognitive learning tool:

*“Uh, always put text on screen for complicated terminology and say it and show it at the same time because **when you use those two channels, people are more likely to remember**, you know, stuff like that.*

Tone



Heavily depends on the topic, the audience, and the institution:

*“Honestly, again, **it depends on the topic**. Um, for something like a cosmology show, it will tend to be pretty, pretty voice of God straight ahead. Whereas some of the popular science stuff, we might try to work in more humor,”*

*“I’m able to have a **lighter tone because I’m doing it for a young audience now, whereas before I was doing the cable shows and you know, they were like tone it down, make it more serious, make it more dramatic**, make it, you know, make the music more kind of, uh, over the top, you know, for an older audience.”*

Impact measurement

How do filmmakers measure their impact?

Social media



Many use social media metrics such as likes, shares, and YouTube analytics (quantitative data) to measure the impact:

*“I don’t know how much you’ve been able to see the backend of YouTube, but **YouTube gives you really good analytics**, about where they’re coming to, what your most viewed videos are. Who’s watching them, what country and how long they’re sticking around, which I think is a very interesting metric. [...]Um, and it’s interesting to see how many people kind of drop, where people drop off. ”*

And some also read comment and qualitative data:

*“ **I try and read the comments** and I get angry sometimes and I get offended sometimes, but I also have a lot thicker skin than I did 10 years ago I think that’s just part of the process is realizing that people will disagree with you. When you put your thoughts in a public forum, you can’t expect everyone to agree with you. And if you do, you can’t put your thoughts in a public forum.”*

Anecdotal evidence



*“What’s really great, fundamentally what really gets me excited is **when [I] keep running into people and saying, Oh, you made that film. I teach that**, I’ve been teaching for five years. Oh, you made that film. You put that series. Oh, that Series is so important to us now that you can not get through the curriculum for public health without having to see the series that’s happened to me, numbers of times I’ve had a couple of, that’s the thing I’m striving for because that’s where you can begin to influence and impact change[...]. Not just because it’s hopefully good, but because nobody’s done anything like it since, and that’s also a problem too.”*

Ratings



For broadcasting, ratings seems to be of high value:

*“Uh, **only one way that matters and that's called ratings.**”*

*“we get ratings. So you see what the ratings are. We see **how many people streamed it. We see how many people bought DVDs.**”*

Research



Other than academic research some use independent companies:

*“You have to pay for those and they're not cheap. So we have a certain amount of money each year. **That's dedicated for research** and properties that are either big, well, typically big and expensive. We'll get more of those resources devoted. [...] So normally a rough cut comes in and if we thought about it enough ahead of time, **we given ourselves a few weeks to do a focus group** on it, and we'll get detailed feedback from people in the demographic about what's working. What's not working what the talent does. Uh, you might get a minute by minute graph of to let you know where the sort of laws are in your editorial. Um, it really depends. I'll be honest. I'm not a big focus group person.”*

Awards



*“Well, in terms of reach, we get the ratings, which we all study very closely. Um, **in terms of evaluating the caliber of the film**, we certainly enter a lot of the, um, international film festivals, which are all peer reviewed. And that, you know, it means a lot when, when films get voted as award winners, by other people in the business that tells us we're doing a good job. “*

External change



In the interviews rarely impact is seen as goal-based in terms of change in attitude or behavior:

*“[seeing that a] **Legislation/regulations [has been] passed.**”*

Finishing this report which is a way for us to know ourselves and our communities, with a poem by Ibn-e Yamin(mid-14th century):

آنکس که بداند و بداند که بداند
 اسب شرف از گنبد گردون بجهاند
 آنکس که بداند و نداند که بداند
 با کوزه ی آب است ولی تشنه بماند
 آنکس که نداند و بداند که نداند
 لنگان خرک خویش به مقصد برساند
 آنکس که نداند و نداند که نداند
 در جهل مرکب ابدالدهر بماند

One who knows and knows that they know...
 Their horse of wisdom will reach the skies.
 One who knows, but doesn't know that they know...
 They are fast asleep, so you should wake them up!
 One who doesn't know, but knows that they don't know...
 Their limping mule will eventually get them home.
 One who doesn't know and doesn't know that they don't know...
 They will be eternally lost in their hopeless oblivion!