Assessing Scientists' Willingness to Engage in Science Communication

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"Not only is it important to ask questions and find the answers, as a scientist I felt obligated to communicate with the world what we were learning."

—Stephen Hawking

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About ScienceCounts

ScienceCounts is a 501(c)(3) organization supporting science's essential contributions to job creation, economic growth, improved health care, national security, energy independence, environmental sustainability, and enhanced quality of life for all Americans.

About the Alda Center

The **Alan Alda Center for Communicating Science at Stony Brook University** empowers scientists and healthcare professionals to communicate complex topics in clear, vivid, and engaging ways, leading to improved understanding by the public, media, colleagues, elected officials, and others outside of their own discipline.

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Research Team

- **Todd Newman, PhD,** Assistant Professor, Department of Life Sciences Communication, University of Wisconsin, Madison
- **Christopher Volpe, PhD,** Executive Director, ScienceCounts
- **Laura Lindenfeld, PhD,** Director, Alan Alda Center for Communicating Science; Interim Dean, School of Journalism, Stony Brook University
- **John Besley, PhD,** Ellis N. Brandt Professor, College of Communication Arts and Sciences, Michigan State University
- **Anthony Dudo, PhD,** Associate Professor, Stan Richards School of Advertising & Public Relations, University of Texas, Austin
- **Nicole Leavey, PhD,** Postdoctoral Research Associate, Alan Alda Center for Communicating Science, Stony Brook University

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The purpose of this study was to assess U.S. scientists' and STEM professionals' perspectives on science communication, public engagement, and baseline attitudes regarding science and its interface with society.

Questions that motivated this study:

- HOW willing are scientists to take part in public engagement?
- WHAT goals do scientists have for engagement?
- WHAT kind of help do scientists want in communicating science effectively, and from whom?
- WHAT scientific research institutions do scientists most trust to be non-political?
- WHAT are views about basic research funding and the implications of possible cuts?
- HOW do scientists describe their personal connections to science?

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National Online Survey

An online survey was administered to two separate groups of U.S. scientists and STEM professionals in the fall of 2018:

AAU Sample

- Representative, random sample of U.S. STEM faculty from member universities of the Association of American Universities (AAU)
- Administered September and October 2018
- *N* = 516
- ±4% at the 95% confidence level

Society Sample

- Illustrative sample of U.S. members of 27 professional STEM societies
- Administered October through December 2018
- *N* = 3,619

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Section I: Science Communication and Engagement

Section I of the survey explores scientists' and STEM professionals':

- Willingness to take part in public engagement
- Goals for and beliefs in the impacts of engagement
- Preferred science communication tactics and training

The mean responses from scientists in seven key demographic subgroups are presented on pages 8 to 14: politically liberal (LIB), politically conservative (CONS), employed by a college or university (UNIV), employed by a non-governmental organization (NGO), employed by a corporation (CORP), a graduate student (STUDENT), or a full professor/senior scientist (SENIOR).

In all cases, a higher numerical value corresponds to a higher level of agreement or urgency. Blue shading highlights the top responses.

Willingness to Engage

Scientists' willingness to engage in various outreach activities in the next 12 months. (Scale 1-7)

	LIB	CONS	UNIV	NGO	CORP	STUDENT	SENIOR
Face-to-face engagement where you discuss science with adults who are not scientists (e.g., giving a public talk or doing a demonstration)	5.7	5.0	5.7	5.4	4.8	5.8	5.7
Direct interaction with government policy makers (e.g., meeting with elected officials, government officials, lobbyists, etc.)	5.3	4.5	5.3	5.0	4.7	5.0	5.4
Interviews with a journalist or other media professional (e.g., from a newspaper, television, online news, documentary film, etc.)	5.0	4.3	5.1	4.5	4.0	4.8	5.2
Online engagement through websites, blogs and/or social networks (e.g. Facebook, Twitter) aimed at communicating about science with adults who are not scientists	4.7	4.1	4.5	5.0	4.1	5.3	4.4
Protest, direct advocacy, or demonstrations about science-related policy (e.g., March for Science, climate change march, petitions, etc.)	4.5	2.2	4.4	4.2	3.0	4.6	4.1

Society sample only.

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Goals

Scientists' goals for science communication. (Scale 1-100)

	LIB	CONS	UNIV	NGO	CORP	STUDENT	SENIOR
Ensuring policy makers use scientific evidence	90	84	89	89	90	88	90
Ensuring our culture values science	86	77	85	84	85	82	87
Ensuring adequate funding for scientific research	80	73	80	80	77	78	82
Helping people use science to make better personal decisions	78	79	78	79	74	76	77
Getting more young people to choose scientific careers	78	76	77	76	78	76	79
Fulfilling a duty to society	72	69	73	71	65	72	74
Strengthening my own professional reputation	37	44	38	42	35	43	32

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Beliefs

Scientists' level of agreement with questions about science communication. (Scale 1-7)

	LIB	CONS	UNIV	NGO	CORP	STUDENT	SENIOR
This type of public engagement activity can make a difference in society	5.9	5.3	5.9	5.9	5.7	6.0	5.8
My colleagues would respect someone who participates in this type of activity	5.1	4.9	5.0	5.3	5.2	5.2	5.0
Participating in this type of public engagement activity would help my career	4.6	4.5	4.2	4.6	4.1	5.0	4.0
I am skilled at this type of public engagement activity	4.2	4.0	4.6	4.6	4.4	4.5	4.7
My colleagues participate in this type of activity regularly	3.9	4.0	3.8	4.3	3.9	4.0	3.9
My colleagues expect that most scientists will contribute to this type of activity	3.7	4.0	3.6	4.0	3.9	3.7	3.8
Participating in this type of public engagement activity would hurt my career	2.3	2.6	2.4	2.3	2.3	2.3	2.4

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Communication Tactics

Communication tactics that scientists are comfortable to use. (Scale 1-7)

	LIB	CONS	UNIV	NGO	CORP	STUDENT	SENIOR
Speak in a way that helps connect with an audience	6.3	5.7	6.2	6.2	5.7	5.7	6.3
Tell first person stories in a way that helps connect with an audience	5.8	5.2	5.8	5.7	5.2	5.2	5.7
To talk about science in terms of hope	5.6	5.0	5.6	5.6	5.2	5.0	5.6
To have professional communicators help create a high-quality presentation	5.3	4.8	5.2	5.5	5.0	4.8	5.0
To talk about the role that a desire to help their community or society plays in shaping their research	5.4	4.8	5.4	5.3	4.9	4.8	5.2

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Communication Tactics

Communication tactics that scientists are less comfortable to use. (Scale 1-7)

	LIB	CONS	UNIV	NGO	CORP	STUDENT	SENIOR
To commit time to making sure that non-scientists feel like they are being listened to by the social community	5.3	4.8	5.3	5.4	4.8	4.8	5.2
To try to organize a group of scientists to work together to send decision-makers a common message	4.8	3.9	4.7	4.8	4.4	3.9	4.7
To publicly question the credibility of those who disagree with a scientific consensus	4.2	3.1	4.1	3.9	4.2	3.1	4.2
To commit to spending about 10% of their project budget to support communication efforts	4.1	3.5	4.1	4.2	3.9	3.5	3.8
To try to get people angry about a science topic	2.3	1.7	2.3	2.2	2.2	1.7	2.1

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Science Communication Training

Scientists' willingness to participate in various types of communication training. (Scale 1-100)

	LIB	CONS	UNIV	NGO	CORP	STUDENT	SENIOR
In-person workshop with people outside of your organization, but in your field	75	66	77	74	65	80	74
In-person workshop with people in your organization that work with you directly	71	64	74	72	60	79	70
In-person workshop with people outside of your organization and across different fields	70	61	71	71	60	75	68
In-person workshop with people at your organization that you may not work with directly	69	60	72	68	59	77	67
Online webinars	58	59	59	64	60	61	58

Society sample only.

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Sources of Support

The organization that scientists believe should provide assistance with public engagement activities. (Scale 1-5)

	LIB	CONS	UNIV	NGO	CORP	STUDENT	SENIOR
Professional/Academic Society	4.3	4.0	4.4	4.3	4.2	4.4	4.3
Government Science Agencies (NSF, NIH, NASA, etc.)	4.1	3.7	4.1	4.2	3.9	4.2	4.0
Your Employer	3.9	3.4	3.9	4.0	3.3	3.8	3.9
Philanthropic Organizations	3.9	3.6	3.8	3.9	3.6	3.9	3.9

Society sample only.

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Section I: Summary

Goals

Analysis demonstrated that scientists and STEM professionals hold many of the same goals and opinions regarding science communication.

Willingness

Most are willing to engage in science communication and agree on communication goals, beliefs, and tactics.

Training

They are open to receiving communication training, and look to professional societies to lead in offering such programs.

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Section II: Baseline Attitudes

Section II of the survey explores scientists' and STEM professionals':

- Trust in various institutions to conduct scientific research with no political or ideological agenda;
- Awareness of government's leading role in funding basic scientific research;
- Use of words to describe how they feel about science.

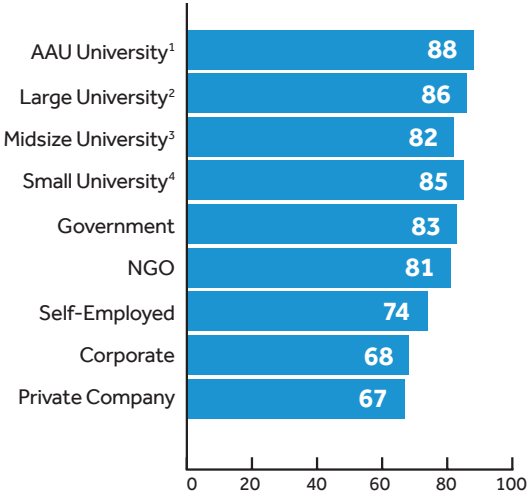
Relationships between baseline attitudes and respondents' political ideology, career level, employer sector, and field of study were explored.

Text under each figure indicate which data sample was used.

Knowledge of Funding

Percent of scientists aware of government's leading role in funding basic research as a function of employer, field of study, and personal ideology.

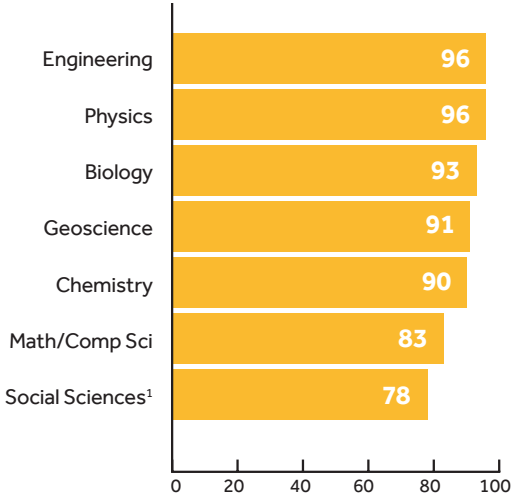
BY EMPLOYER



Both AAU and society samples.

[1] Sixty leading research universities in the US
[2] A college or university with more than 35,000 students
[3] A college or university with 5,000 to 35, 000 students
[4] A college or university with fewer than 5,000 students

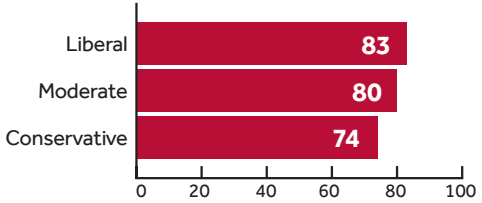
BY FIELD



AAU sample only.

[1] Anthropology, Archaeology, Economics, Geography, Linguistics, Political Science, Psychology, Public Policy, Sociology, Urban Planning

BY IDEOLOGY



Society sample only.

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Differing Views on Consequences

Scientists and the public differ on the area of society that would suffer most if the U.S. loses global leadership in STEM.

	PUBLIC	AAU	SOCIETY
NATIONAL DEFENSE	**12%**	**4%**	**5%**
HEALTHCARE AND MEDICINE	**31%**	**21%**	**29%**
EDUCATION	**8%**	**19%**	**16%**
ECONOMY	**10%**	**28%**	**22%**
ENVIRONMENT	**10%**	**25%**	**23%**
SPACE EXPLORATION	**14%**	**3%**	**5%**
NONE OF THESE	**14%**	**1%**	**1%**

Data for U.S. public from national Raising Voices for Science Benchmark Survey, ScienceCounts, 2016 (N = 2,021).

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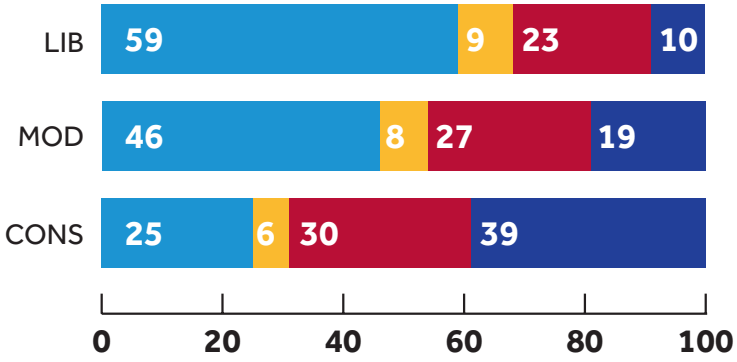
Institutional Trust by Ideology

Americans' trust in institutions to conduct non-political scientific research is closely tied to their personal ideology (ScienceCounts, 2016). Liberal Americans trust academia more; conservatives trust the private sector more.

Scientists follow a similar trend.

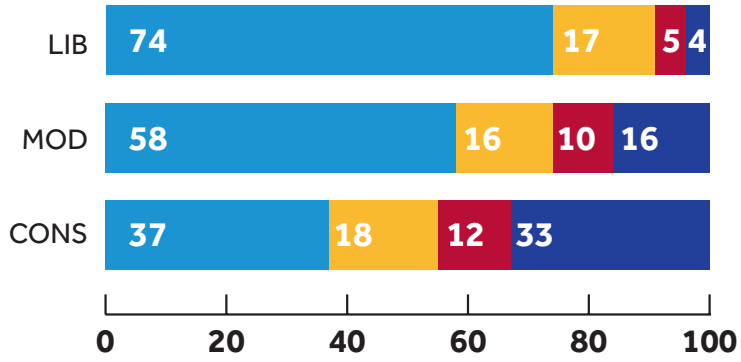
BY IDEOLOGY

AMERICANS WITH BACHELOR'S DEGREES



Raising Voices Benchmark Survey, 2016

SCIENTISTS/STEM PROFESSIONALS



Society sample only.

Academia Government Philanthropy Industry

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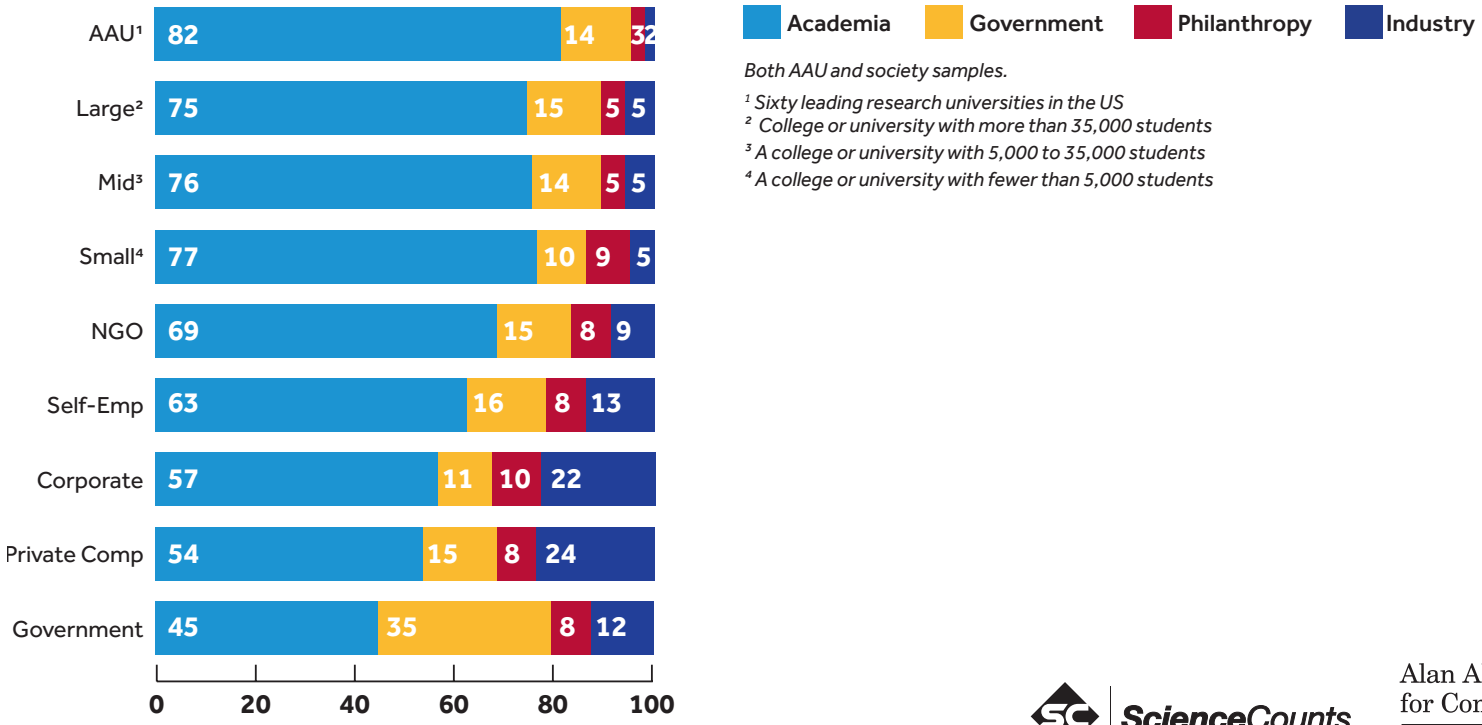
Institutional Trust by Employer

Scientists generally trust academia most to conduct non-political scientific research. However, the prevalence of trust in academia varies with where they work.

BY EMPLOYER

SCIENTISTS/STEM PROFESSIONALS



Both AAU and society samples.

¹ Sixty leading research universities in the US
² College or university with more than 35,000 students
³ A college or university with 5,000 to 35,000 students
⁴ A college or university with fewer than 5,000 students

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How Scientists Feel about Science

Below are the words AAU and society scientists use to describe how they feel about science. "Hope" and "Joy and Excitement" are the most frequent responses. Responses from a similar study of the most engaged members of the public (Raising Voices for Science Digital Test Campaign, ScienceCounts, 2018) are included for comparison.

	AAU	SOCIETY	ENGAGED PUBLIC
JOY AND EXCITEMENT	43%	38%	6%
HOPE	37%	35%	63%
FEAR AND CAUTION	0%	0%	9%
BOREDOM AND INDIFFERENCE	1%	1%	3%
CURIOSITY AND INTEREST	8%	14%	-%
EVIDENCE, KNOWLEDGE, TRUTH	2%	4%	-%
DISCOVERY AND WONDER	1%	3%	-%
OTHER	8%	6%	18%

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Process-Minded or Payoff-Minded

The words scientists use to describe their feelings about their work may provide clues to the subtle differences in which they connect to science on a personal level.

For instance, scientists expressing "joy and excitement" may be more motivated by the day-to-day undertaking of conducting research, hence could be said to be more process-minded.

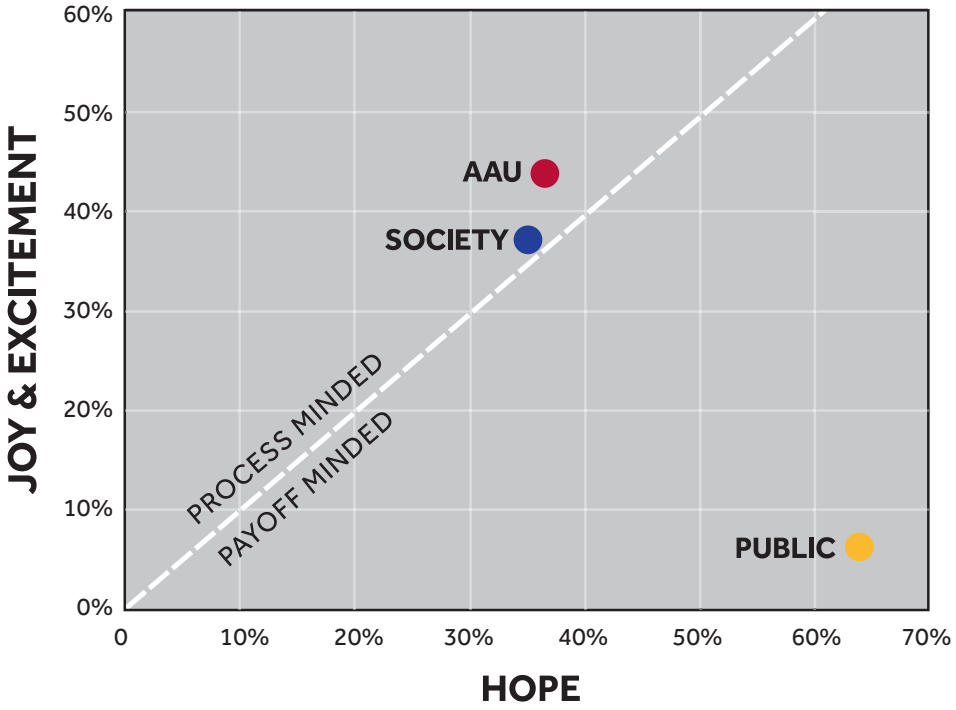
Joy and Excitement → **Emotional Reward in the Present** → **Process-Minded**

In contrast, scientists expressing "hope" may be more motivated by the eventual outcome of their research, and could be said to be payoff-minded.

Hope → **Emotional Reward in the Future** → **Payoff-Minded**

A Process/Payoff Map

A process/payoff map is created using "joy and excitement" and "hope" percentages as coordinates. AAU and society samples have similar positions, but differ markedly from the most science-engaged public.



AAU and society samples with public data from ScienceCounts (2018)

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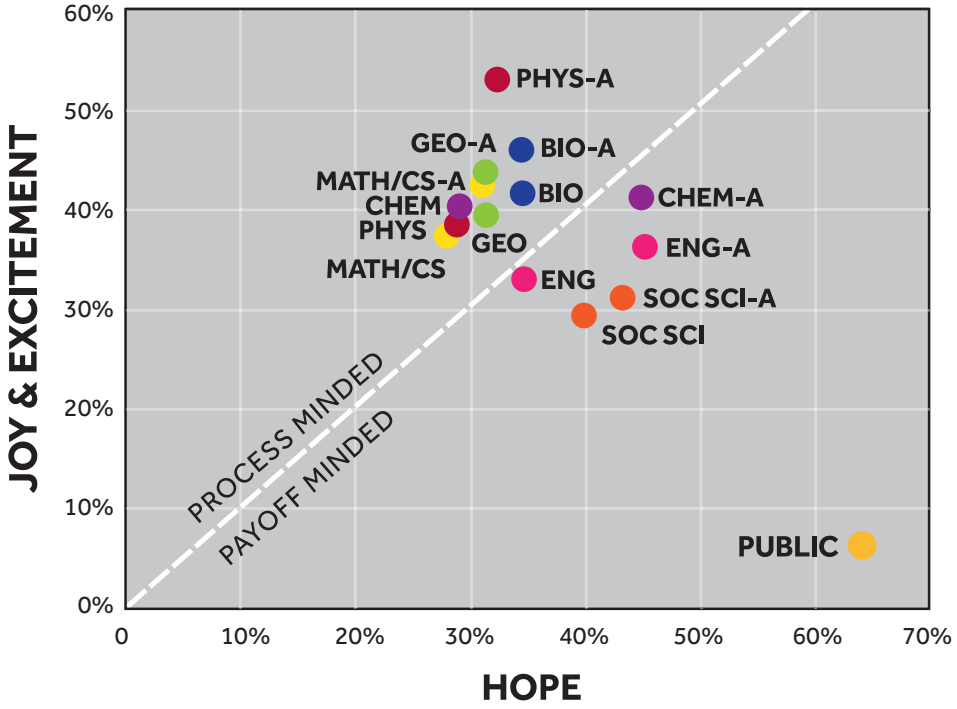
A Process/Payoff Map

Breaking out scientists by their field of study reveals an interesting pattern where natural scientists—especially physicists—are more process-minded, while engineers and social scientists are more payoff-minded.



AAU scientists are represented by -A
Society scientists data use field name only
Public data from ScienceCounts (2018)

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A Final Thought about Process or Payoff

Subsequent analysis indicates a possible connection between whether scientists are process-minded or payoff-minded and their views of science communication.

- Process-minded (joy and excitement) scientists express a slightly higher willingness to engage and to embrace communication tactics that help connect with their audience.
- In contrast, payoff-minded (hope) scientists, not surprisingly, are more comfortable with communicating the value of science in terms of hope.

Additional research is recommended to further explore whether scientists indeed fall into two camps—the process-minded vs. the payoff-minded—and how such fundamentally different views of science, if real, impact scientists' attitudes and approaches to science communication and public engagement.

Part II: Baseline Attitudes Summary

Trust in Institutions

All demographic subgroups most trust academia to conduct science with no political or ideological agenda; the degree of trust varies with personal ideology and employment sector.

Funding Knowledge

More than four out of five scientists are aware of government's leading role in funding basic research, however, awareness among private-sector and social scientists is weaker.

Process-Minded or Payoff-Minded

Natural scientists may be more process-oriented and express feelings of joy and excitement toward science, while social scientists and engineers may be more payoff-minded and express feelings of hope toward science, like the public.

These differing mindsets may affect how scientists approach science communication.

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Key Takeaways

What's Similar

Regardless of personal ideology, career level, employment sector, or field of study, scientists widely agree that:

- Public engagement makes a difference by ensuring science-based policy-making, fosters a culture that values science, and ensures federal funding for science.
- Using first-person stories and hopeful themes in a face-to-face setting is the preferred form of public engagement.
- More help is needed, especially if professional/academic societies would bring scientists together across different organizations in similar fields in in-person workshops.

Key Takeaways

What's Different

On some other issues, scientists' perspectives vary. For instance:

- Although awareness of government's leading role in funding basic science among scientists is high (85%), 1 in 3 privately employed scientists and 1 in 4 academic social scientists at leading research universities remain unaware.
- While scientists view academia as doing the best job in conducting research with no political or ideological agenda, scientists who are liberal are twice as likely to trust academia as conservatives, like the public.
- Scientists express their personal connections to science in two different ways, those expressing "joy and excitement," i.e. the process-minded, and those expressing "hope," i.e. the payoff-minded. These differences may affect how scientists view and participate in science communication.

Methodology

AAU Sample

A randomized sample of academic scientists was created from 60 US-based research universities of the Association of American Universities (AAU). Three research assistants gathered email addresses from online sources for faculty and researchers from eight (out of 25) randomly selected departments per university: chemistry, computer and information science and engineering, engineering, geosciences, life sciences, materials research, mathematical sciences, physics and astronomy, psychology, and social sciences. From the 14,374 email addresses collected, three criteria – university type (public or private), field of study, and career level – were used to construct a representative subsample for the survey.

The survey sample included 6,935 email addresses of which 71 emails returned as undeliverable. After five emails, sent between September 2018 and October 2018, 772 scientists responded to the survey for a response rate of 11%. Of these, 516 completed 50% or more of the survey. The average time to complete the survey was about 20 minutes.

Society Sample

Twenty-seven professional and academic societies distributed a survey link to their members using emails, social media posts, and newsletters. Five reminders were sent to participating organizations between October 2018 and December 2018. Approximately 5,000 scientists and STEM professionals responded to the survey. Of these, 3,619 were US-based individuals who completed at least 50% of the survey. The average time to complete the survey was about 20 minutes.

Where possible, AAU sample data are used to make representative assessments about U.S. scientists. Society sample data are principally used to explore correlations between demographic and attitudinal variables within a wide array of scientist subgroups – i.e. scientists assorted by personal ideology, career level, employment sector, and field of study. Of note, where the AAU and society sample data do overlap, there is good agreement between the two.

Acknowledgements

We are grateful to the scientists and STEM professionals who participated in the survey. We'd also like to thank the American Association of Universities member institutions that participated in the study, and the professional and academic societies that helped distribute the survey to their membership:

- American Anthropological Association
- American Association for Dental Research
- American Astronomical Society
- American Chemical Society
- American Educational Research Association
- American Geophysical Union
- American Institute for Medical and Biological Engineering
- American Mathematical Society
- American Society of Human Genetics
- American Meteorological Society
- American Physical Society
- American Physiological Society
- American Psychological Association
- American Society for Microbiology
- American Society of Plant Biologists
- Arctic Research Consortium of the United States
- Genetics Society of America
- Geological Society of America
- Linguistic Society of America
- Population Association of America
- Sigma Xi
- Society for Developmental Biology
- Society for Psychophysiological Research
- Society for Research in Child Development
- SPIE – The International Society for Optics and Photonics
- The Oceanography Society
- The Optical Society
- United States Pharmacopeia

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This study was made possible with the generous support of

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For more information, contact aldacenter@stonybrook.edu

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