

To see our slides on your phone, iPad, etc. ...

To get the slides dumped to your Google Drive ...

To answer questions during the workshop ...

- open a browser
- log in to a **gmail** account
- go to joinpd.com
- enter code in upper right corner
- **turn off your device's sound**

Broader Impacts through Social, Behavioral, and Economic Sciences Research

Jane Zavisca, University of Arizona

Cecile McKee, University of Arizona

Alan Tomkins, National Science Foundation

Which of the following best describes your **main** role?

- A. STEM scientist who does basic research with BI
- B. Professional who designs or implements BI activities
- C. Research development/grant professional
- D. Other



Students choose an option

I am a social, behavioral, or economic scientist.

Agree



Disagree



Students, drag the icon!



Pear Deck Interactive Slide
Do not remove this bar

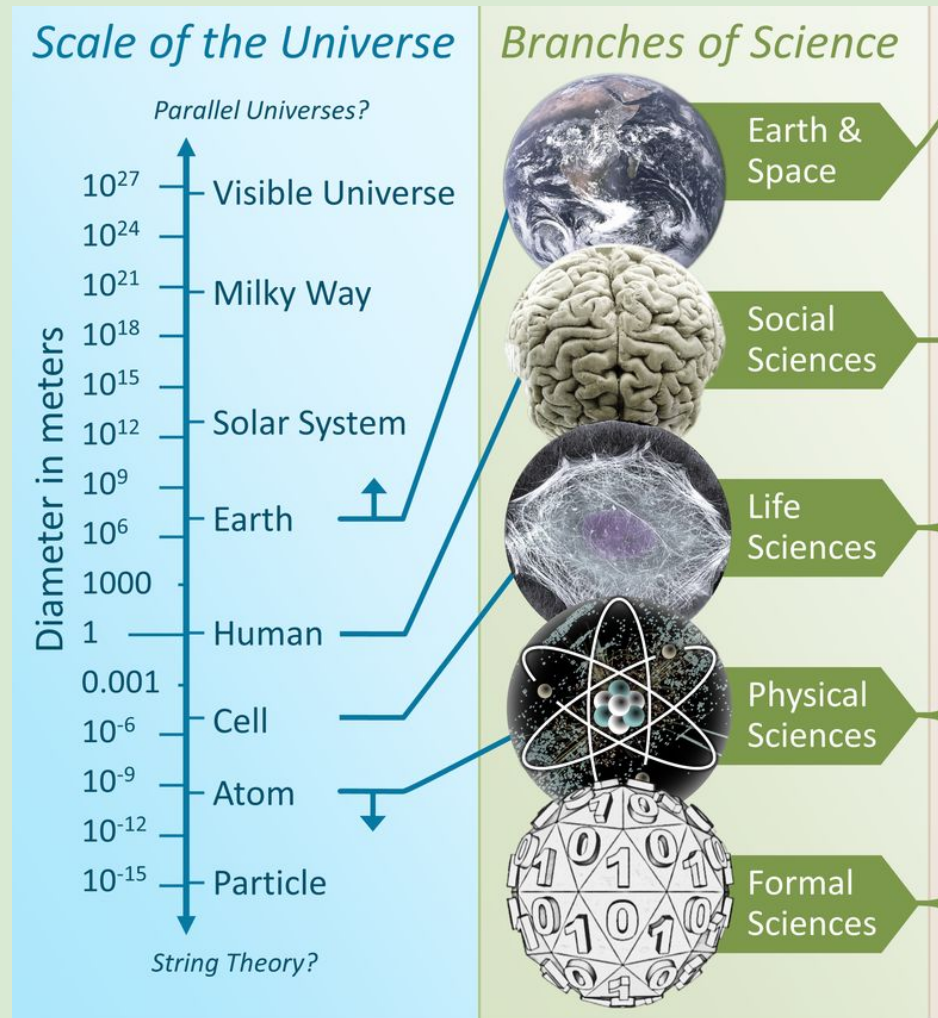
What are you hoping to learn in this workshop?



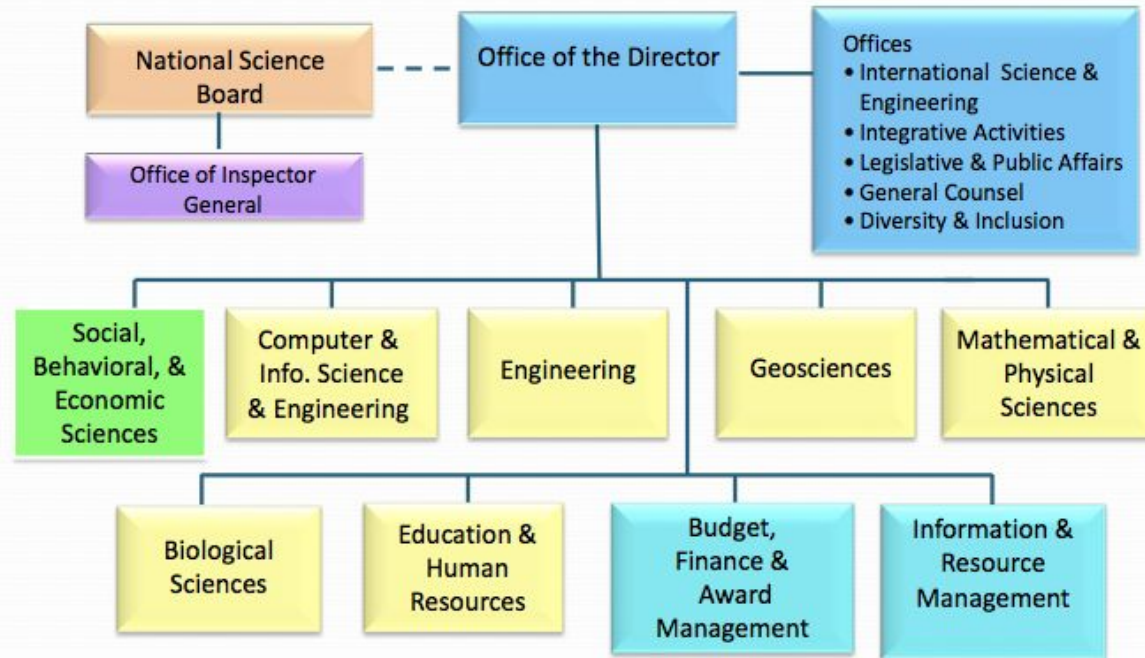
Students, write your response!

What is science?

What is science?



National Science Foundation



What are the SBE Sciences?

Definition: Focus on human behavior and social organizations, and how social, economic, political, cultural, and environmental forces affect people's lives and how people shape those forces.

Method: Develop and employ rigorous methods to discover fundamental principles of human behavior at all levels, from neurons to neighborhoods, and across space and time.

Impact: Help us to understand patterns of stability, change, conflict, and cooperation that can be applied to promote the progress of science and advance the nation's health, prosperity, welfare and national defense.

Source: <https://www.nsf.gov/sbe/about.jsp>

SBE Handouts

- [Overview flyer](#)
- Factsheets on impact of SBE Research
 - [Research on Cognition and Behavior](#)
 - [Research on Human Behavior in Time and Space](#)
 - [Research on Cooperation and Conflict](#)

Other useful resources:

- [*The Value of Social, Behavioral, and Economic Sciences to National Priorities. Consensus Study Report for NSF by the National Academies. 2017.*](#)
- [SBE on NSF's Blog](#)
- [NSF's BI resources website](#)

NSF's Broader Impacts

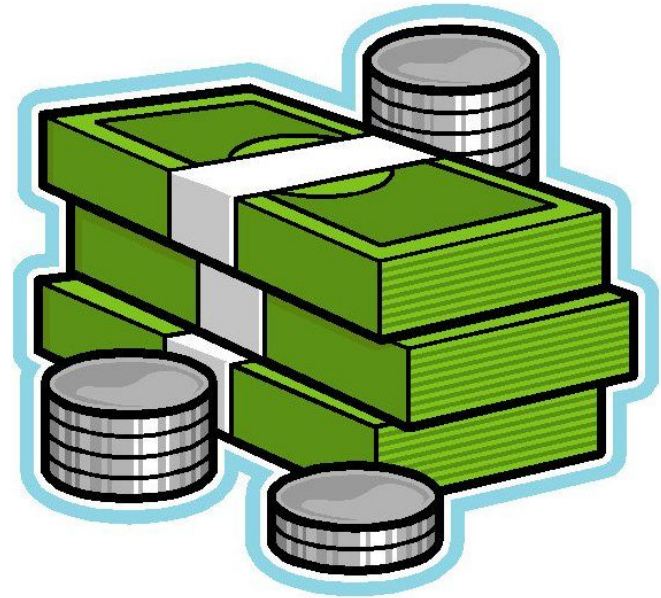
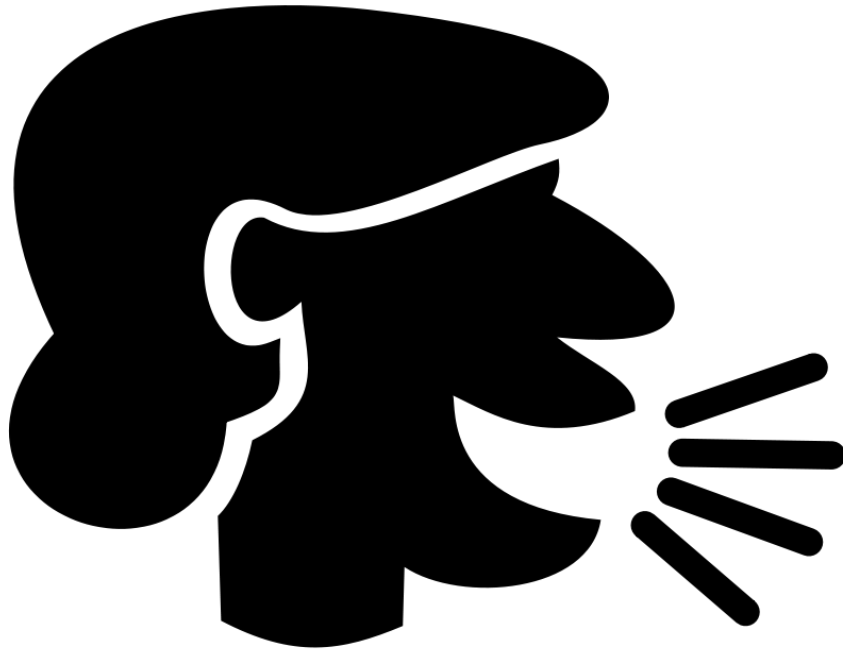
Project's **potential to benefit society** and contribute to the achievement of **specific, desired societal outcomes**

- Advance discovery and understanding while promoting teaching, training, and learning
- Broaden dissemination to enhance scientific and technological understanding
- Broaden participation of under-represented groups
- Enhance infrastructure for research and education
- Other societal benefits

Examples of thin BI descriptions

1. The project will recruit participation from women, minorities, and undergraduates.
2. Data from the research will be incorporated into a course and disseminated in seminars.
3. Results will have implications for policy audiences.

Put your money where your mouth is.



SBE contributions to BI

- **Fundamental:** SBE basic research has inherent BI
- **Handmaiden:** SBE “does” BI for other sciences
- **Integrated:** SBE contributes to both basic research and BI with other sciences

SBE basic research has inherent BI

- Developmental Science (DS in SBE)
- Documenting Endangered Languages (DEL in SBE)
- Improving Undergraduate STEM Education (IUSE in EHR)

Sleep and abstraction

Rebecca Gómez - psychologist

DS: experiments showing how sleep relates to infants' learning

PI Gómez in lab



Sleep and abstraction

sleep-dependent memories
consolidate over multiple
learning experiences

PI talks with parent groups in
schools and museums about the
value of naps

polysomnographic recording



Pai languages & ethnobotany

Carrie Cannon - ethnobotanist

DEL: protocols for documenting
and disseminating traditional
indigenous knowledge encoded
in Pai languages



Pai languages & ethnobotany

biologists, ethnobotanists,
linguists, elders, and other
experts from Pai communities

5 - Arizona, 1 - Mexico

Hualapai Ethnobotany Project

students and staff collect and
share plant knowledge

PI Cannon & agave



Pai languages & ethnobotany

Where is the cure to **diabetes**?

“Ask the prickly pear, or the mesquite bean pod ... maybe they will tell you.”

This is the answer you may hear from elder instructors of the Hualapai Ethnobotany Youth Project.



Poverty Project

Brian Mayer - sociologist

IUSE: develop and run
immersive methodological
experience for social
science undergraduates

student learning
evaluated

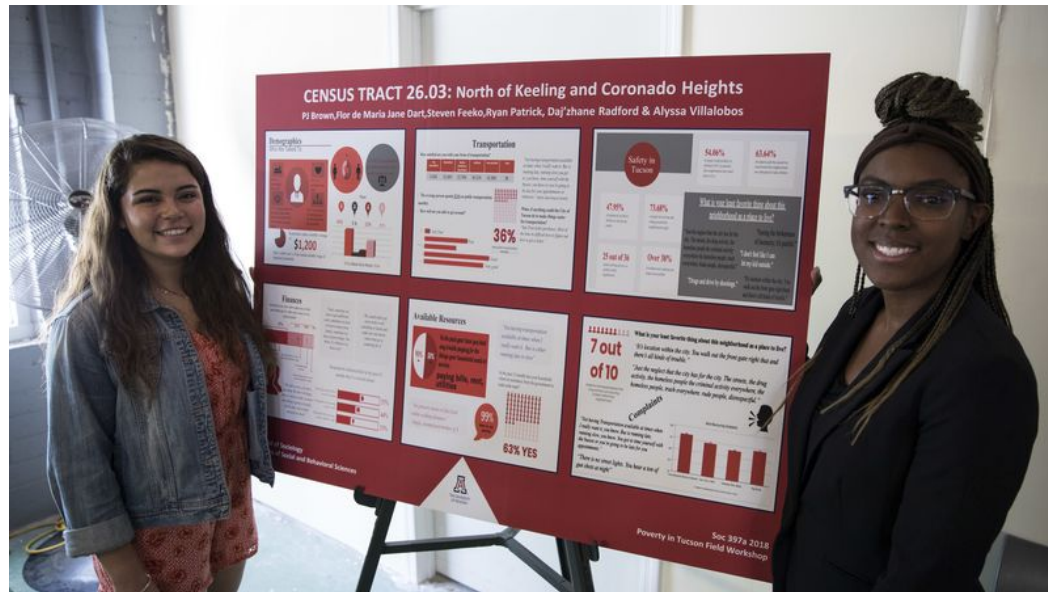
PI Mayer & undergraduates



Poverty Project

workshop students
interview households in
high-poverty tracts

analyses shared with
local government and
non-profit organizations



Poverty Project

anyone serving poor neighborhoods

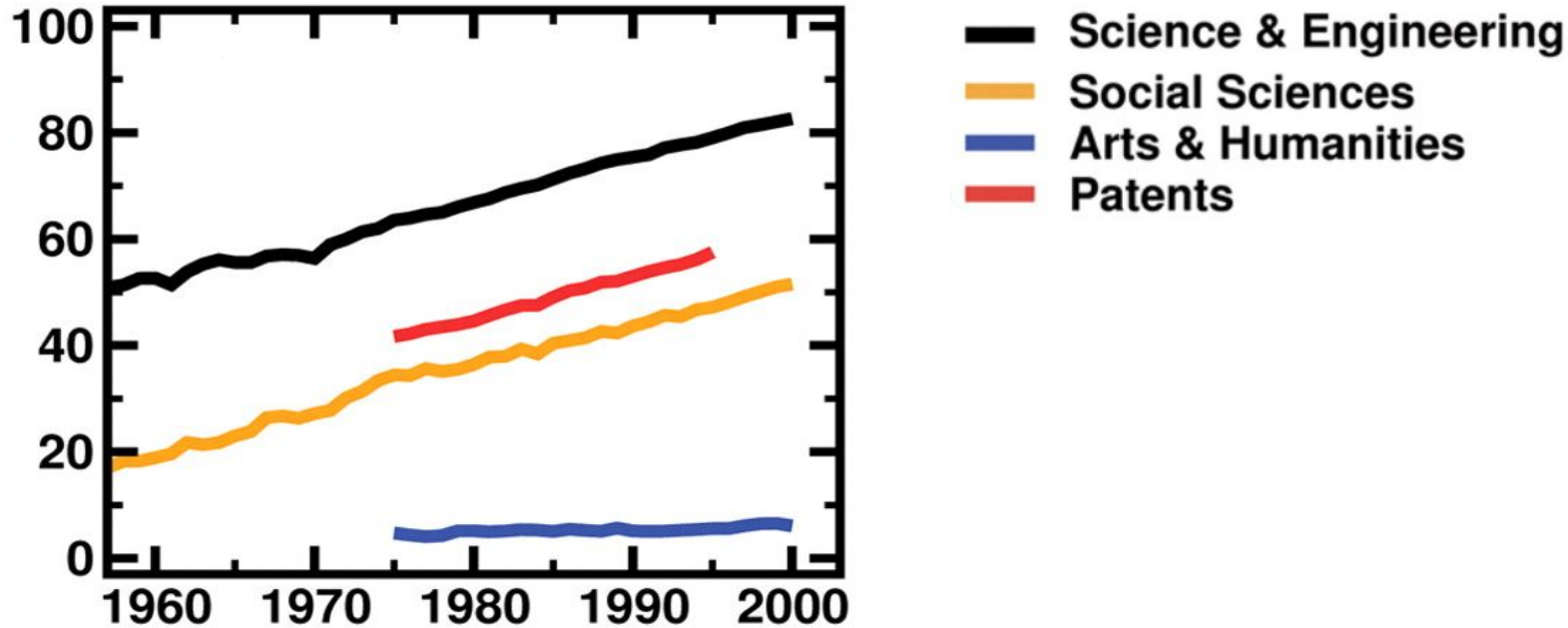
- police
- fire fighters
- food bank
- Habitat for Humanity



SBE contributions to BI

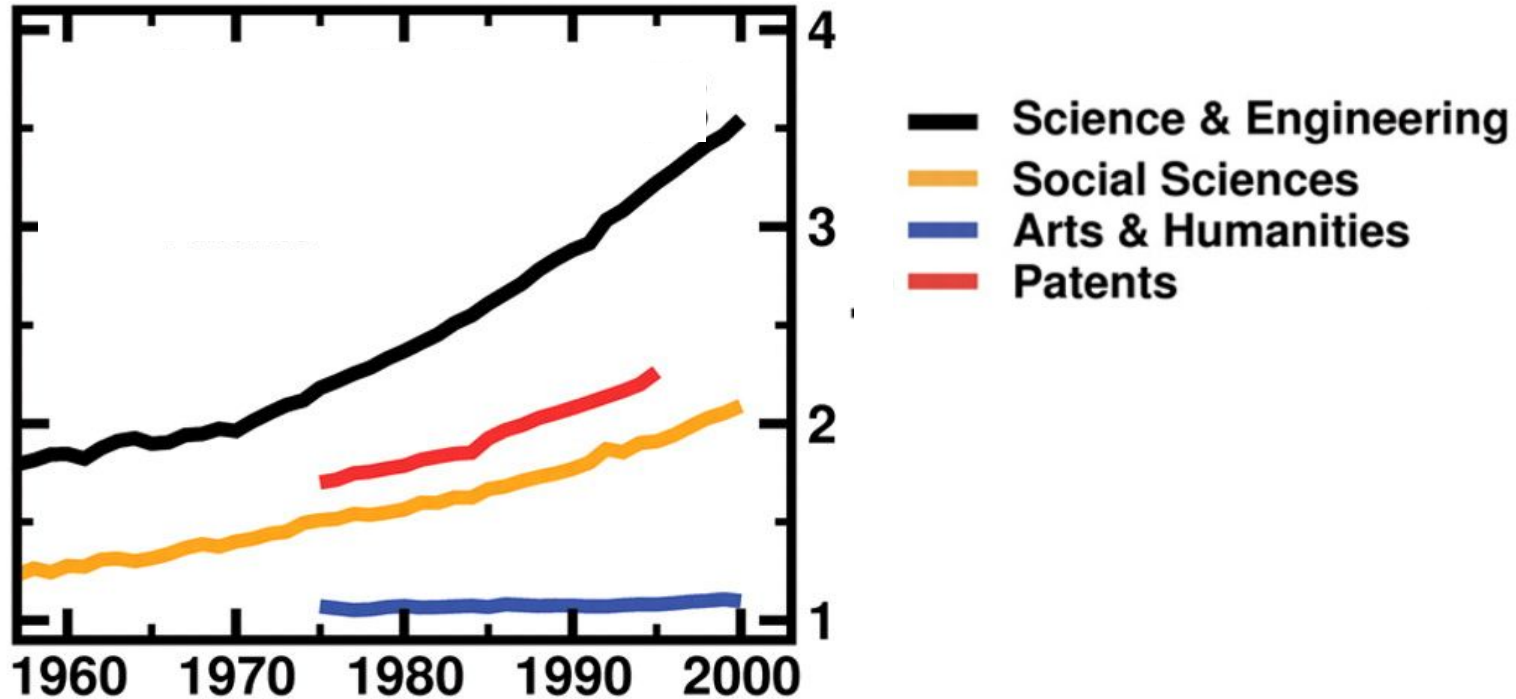
- **Fundamental:** SBE basic research has inherent BI
- **Handmaiden:** SBE “does” BI for other sciences
- **Integrated:** SBE contributes to both basic research and BI with other sciences

Percent of articles and patents written in teams



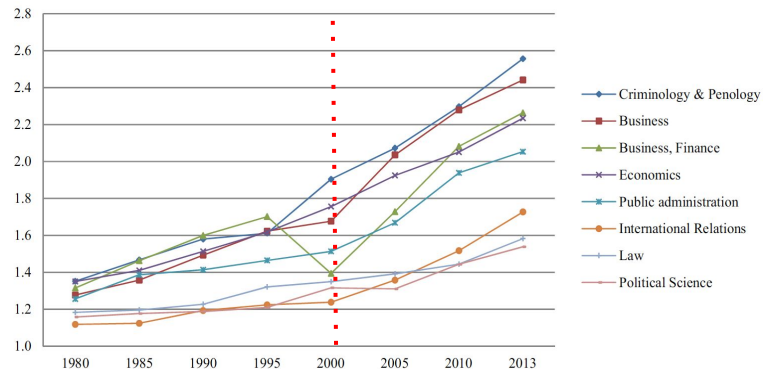
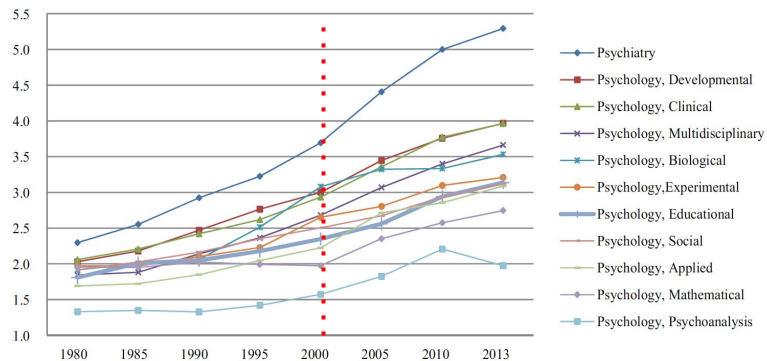
Source: [Wuchty et al. \(2007\)](#). "The Increasing Dominance of Teams in Production of Knowledge." *Science* 316 (5827).

Mean team size of papers and patents

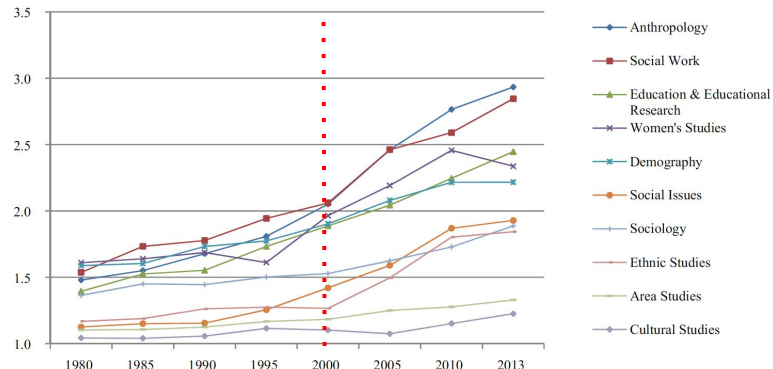


Source: [Wuchty et al. \(2007\)](#). "The Increasing Dominance of Teams in Production of Knowledge." [Science 316 \(5827\)](#).

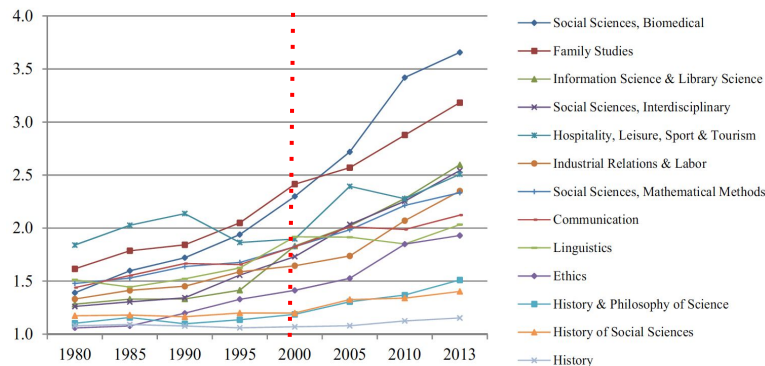
Mean number of authors per article, 1980-2013



Psychology



Political science, business, law



Source: D. Henriksen (2016). "The Rise in Co-authorship in the Social Sciences (1980-2013)," *Scientometrics* 107: 455-76.

Other STEM fields are increasingly recognizing SBE sciences

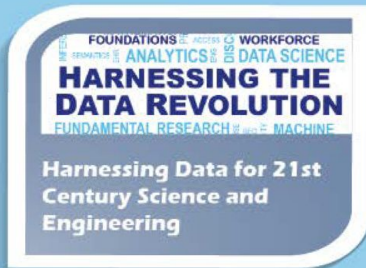
- Complex scientific problems require complex teams
- NSF incentives collaboration with SBE



Looking Ahead: Ten Big Ideas



Navigating the New Arctic

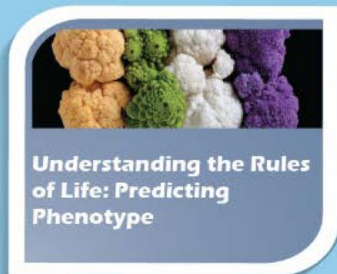


Harnessing Data for 21st Century Science and Engineering

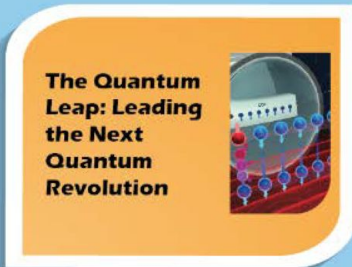


Work at the Human-Technology Frontier: Shaping the Future

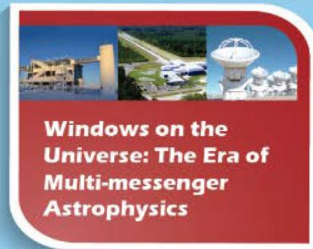
RESEARCH IDEAS



Understanding the Rules of Life: Predicting Phenotype



The Quantum Leap: Leading the Next Quantum Revolution



Windows on the Universe: The Era of Multi-messenger Astrophysics

PROCESS IDEAS



Growing Convergent Research at NSF



NSF-INCLUDES: Enhancing Science and Engineering through Diversity



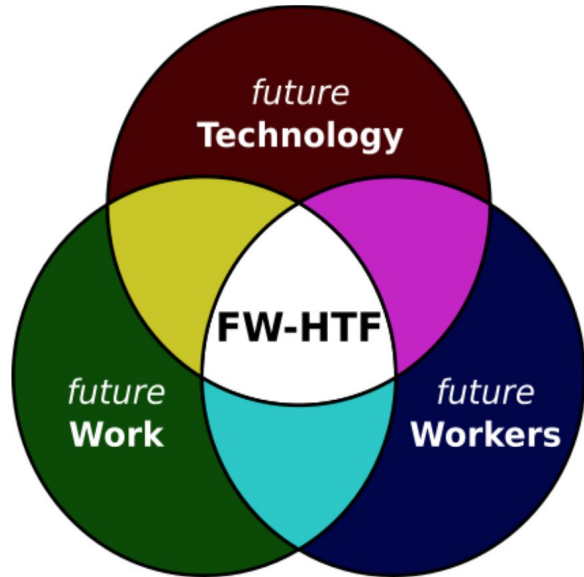
Mid-scale Research Infrastructure



NSF 2050: Seeding Innovation

Exercise: Enhance the BI in “Convergent Research”

The FW-HTF Program



Convergent research integrating future work, future technology, and future workers.

- **Future Workers:** Address the worker as an individual or in teams, including education & training
- **Future Technology:** Engineering & computer science technologies that will develop the human-technology partnership in future workspaces, including offices, classrooms, warehouses, farms, & factories
- **Future Work:** Considers a societal, economic, professional, occupational, industrial, or national context

The FW-HTF program occupies the intersection of these elements



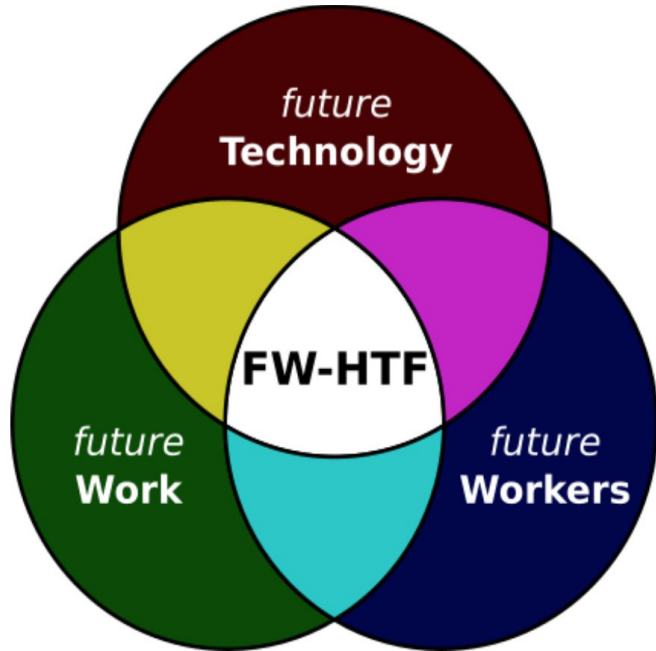
Workshopping an example

- Abstract from an actual award
- SBE did not co-fund this
- The team is four engineers and one economist.

A. Read and discuss an award abstract.

1. Evaluate the project's inclusion of SBE perspectives (e.g., E = economic sciences).
2. Brainstorm on ways to enhance other SBE perspectives (e.g., S = social, B = behavioral).
3. Prepare to share some ideas with the whole group.

The FW-HTF Program



Convergent research integrating future work, future technology, and future workers.

- **Future Workers:** Address the worker as an individual or in teams, including education & training
- **Future Technology:** Engineering & computer science technologies that will develop the human-technology partnership in future workspaces, including offices, classrooms, warehouses, farms, & factories
- **Future Work:** Considers a societal, economic, professional, occupational, industrial, or national context

The FW-HTF program occupies the intersection of these elements



B. Focus on the two BI sentences in the abstract.

1. How might these two activities be expanded or detailed?
As you make suggestions, consider SBE sciences.
2. What other types of BI activities might enhance the project?
3. Prepare to share some ideas with the whole group.

C. What could **you** do in your current role to help these PIs?

Example: Building respectful & robust collaboration

- What **not** to do
- What to do

Example: Building respectful and robust collaboration

Note: This fictional scenario is loosely based on our actual experiences in helping build teams.

Background: A team of cellular biologists, biophysicists, and computer scientists studies how molecules bind to one another in living cells. They have funding from the BIO directorate. Their BI approach emphasizes interdisciplinary training and mentoring of students, including URMs.

They are proposing to extend this work through NSF's new program on the "Rules of Life: Forecasting and Emergence in Living Systems." The RFP requires that research must include directorates beyond BIO.

The team's composition easily links to CISE as well as BIO. They think their chances will be even better if they can link to SBE as well.

The PI knows an anthropologist who studies the science of team science. He thinks she might be able to improve their interdisciplinary training and mentoring plan.

Mistakes were made

- Contacted anthropologist 10 days before the deadline
- Asked her to write in a workshop on interdisciplinary mentoring, and to make sure it synchronized with already-developed evaluation plan.
- Sent her project summary but not full proposal or budget.
- Told her to keep her section to half a page and < \$25k.
- When she asked to meet the PI, he referred her to the external evaluator (who had already been contracted).

What's your main take-away from this workshop?



Students, write your response!

Our goals for workshop

1. Understand SBE as sciences that inherently advance BI.
2. Think nimbly about SBE collaboration, from general project design to specific BI plans.
3. Respectful and robust collaboration takes time and money.