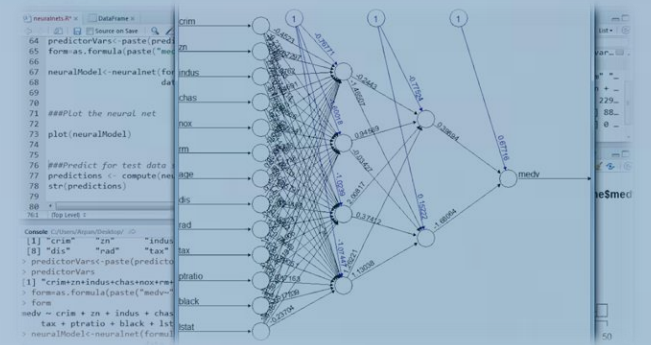Your Life. Our Work. SBE

SBE Goals

- ✓ **Advance** science

- ✓ **Grow** the economy

- ✓ **Enhance** safety & security

- ✓ **Improve** quality of life

SBE is…

- Behavioral and Cognitive Sciences

- Social and Economic Sciences

- Office of Multidisciplinary Activities

- NCSES

NCSES

- Is a federal statistical agency.

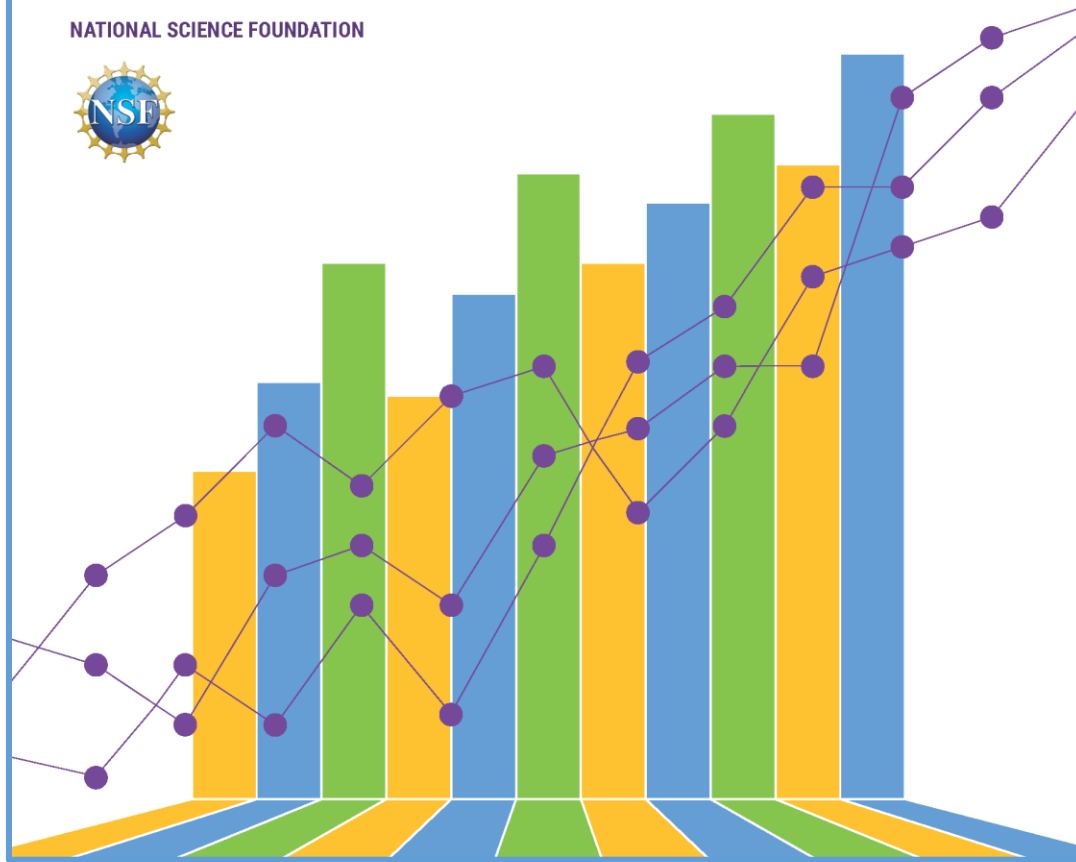- Provides essential information for America's science & engineering enterprise.
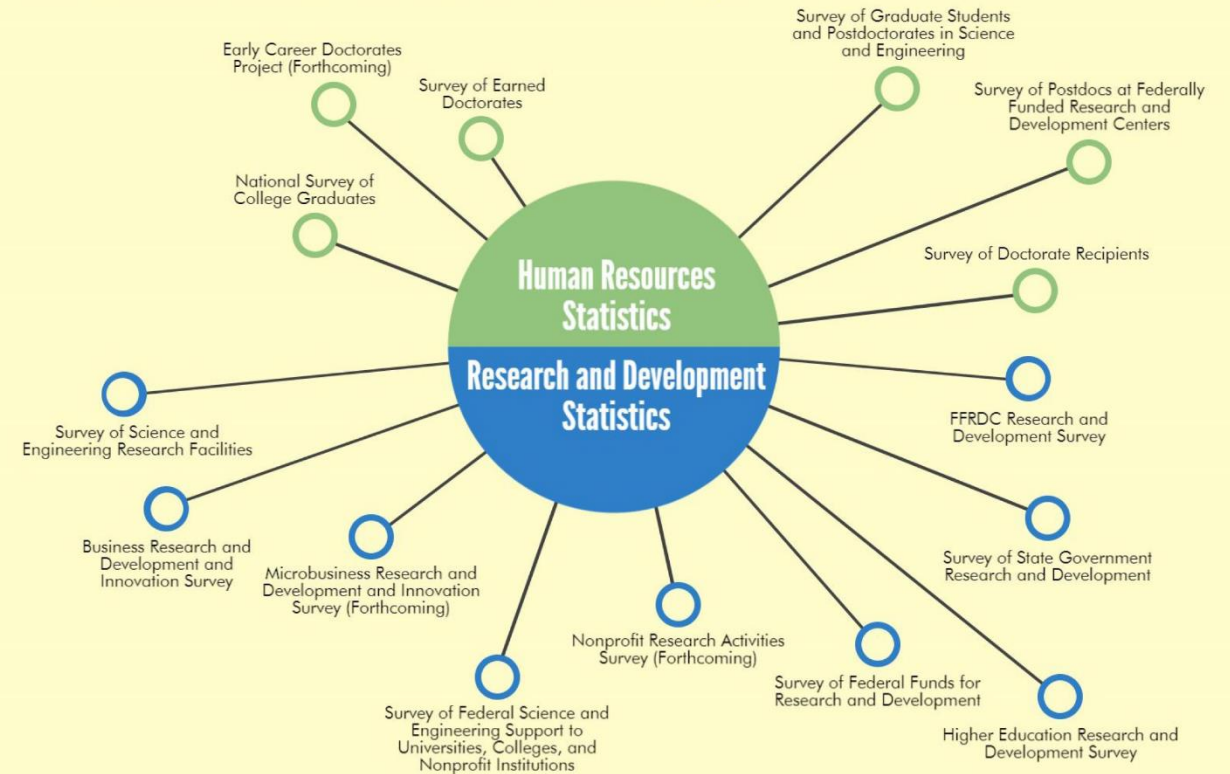
A History of Innovation & Impact

SBE 2018 Nobel Laureates

William Nordhaus
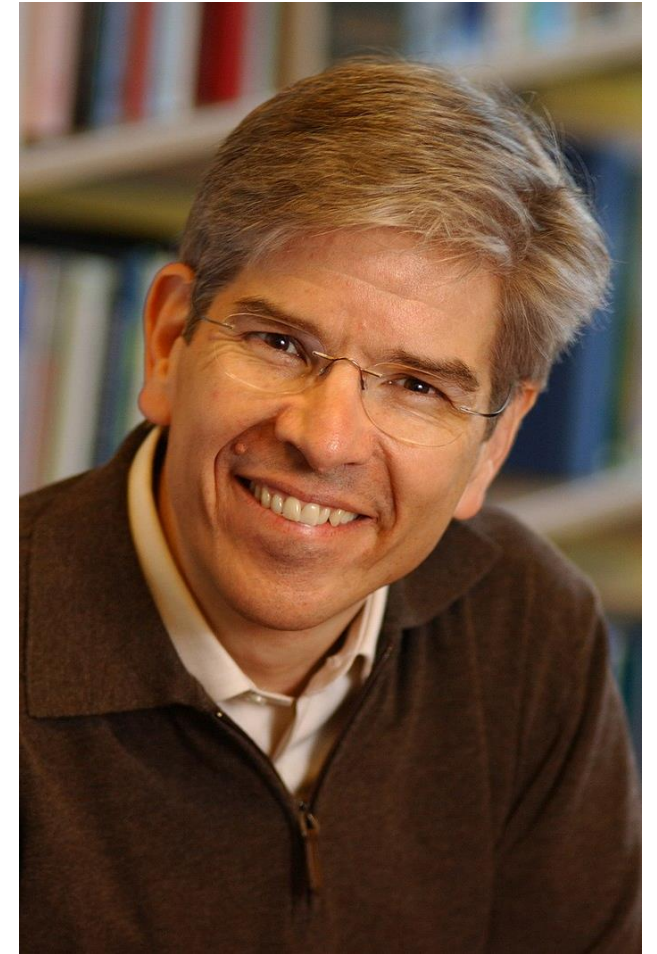
Paul Romer

NSF's Nobel Winning Streak

- **SBE has funded 45 of the last 50 Economics Nobel winners.**

- **SBE supported all *before they won their prize*.**

Nobel, MacArthur, Medal of Science winners since 2009
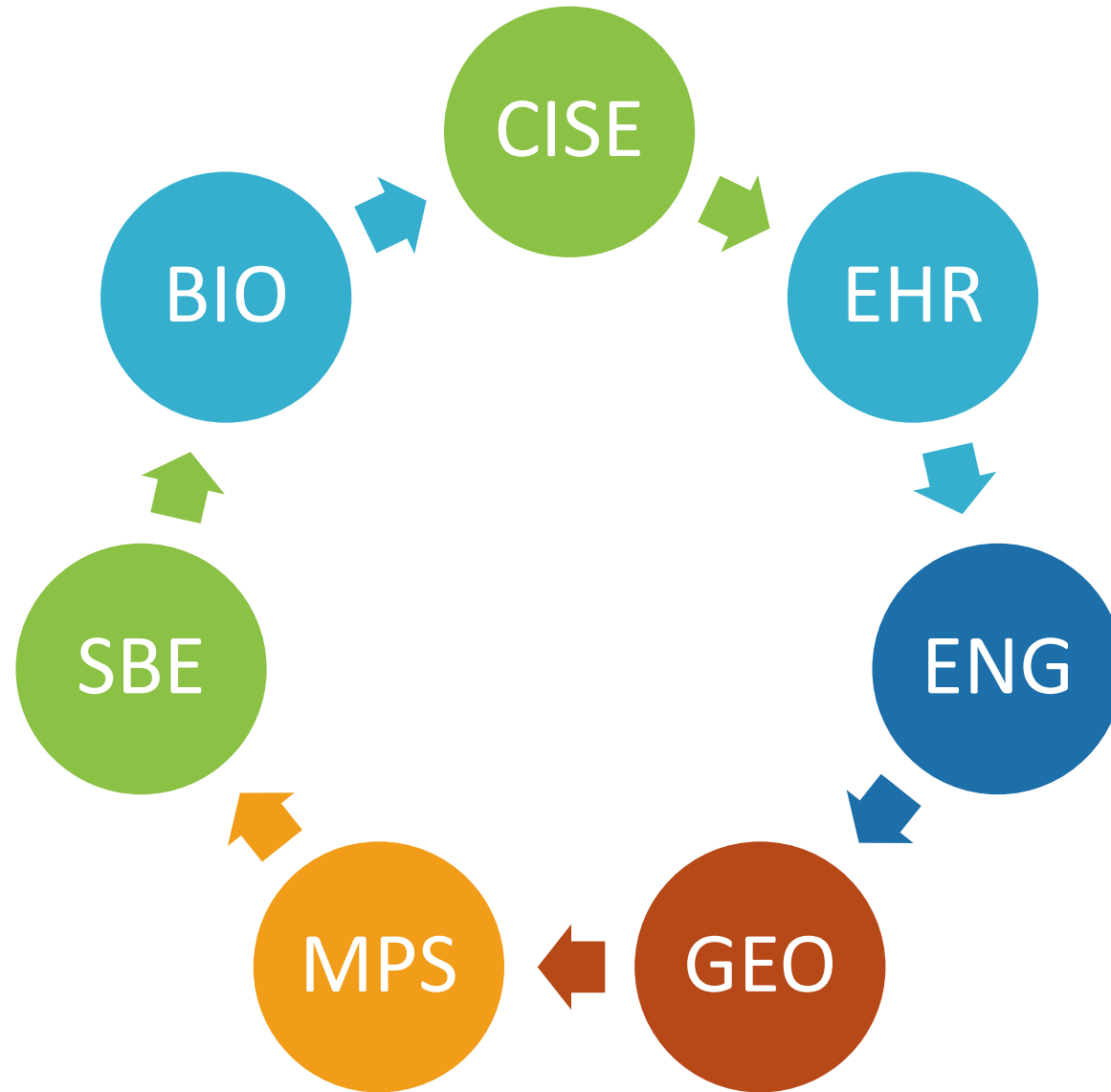
Saving Lives

- More than 100,000 Americans are waiting for a kidney transplant.

- Friends and family want to donate, but are incompatible.

- PIs used game theory to develop match-making algorithms.

LIVING DONOR KIDNEY EXCHANGE

Match

Does Not Match
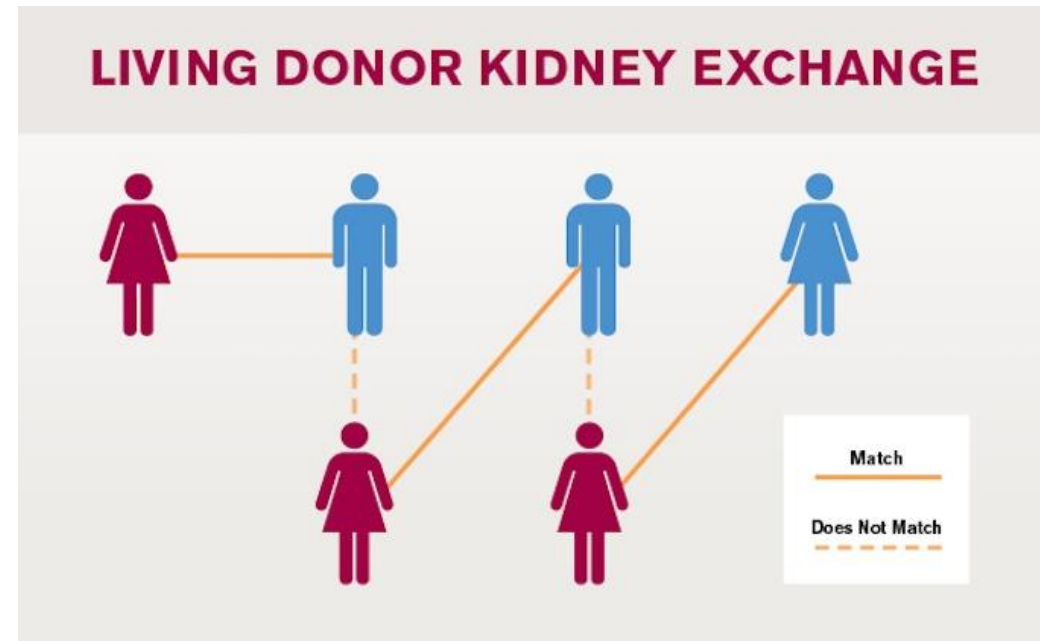
Roth, Sönmez & Ünver/ Economics

Amy and Fielding Daniel
Source: National Academy of Sciences

"We're very blessed…that this algorithm by this economist. I cannot explain enough how it gives you back your life, you know, celebrating grand-babies being born, celebrating children getting married, celebrating how lucky, how blessed you are that life is just normal.
- Amy Daniel

Spectrum Allocation

- Communication and commerce depend on the radio spectrum.

- Governments control the spectrum. Private firms seek its use.

- How to maximize taxpayer returns?

Quiz

- **What way of allocating the spectrum most benefits the US taxpayer?**

A. Ask government experts to evaluate bids and business plans.

B. Hold a single public auction of spectrum.

C. Hold numerous public auctions.

D. **Something else.**

Quiz

- **What way of allocating the spectrum most benefits the US taxpayer?**

A. Ask government experts to evaluate bids and business plans.

B. Hold a single public auction of spectrum.

C. Hold numerous public auctions.

D. **Something else.**

Milgrom & Wilson/Economics

- Researchers proposed multiple unit, multiple round, sealed bid auctions.

- These auctions induce higher bids.

- This application of auction theory generated $114B for the US taxpayer.
  - Out of thin air.

Status Quo Bias & Retirement Income
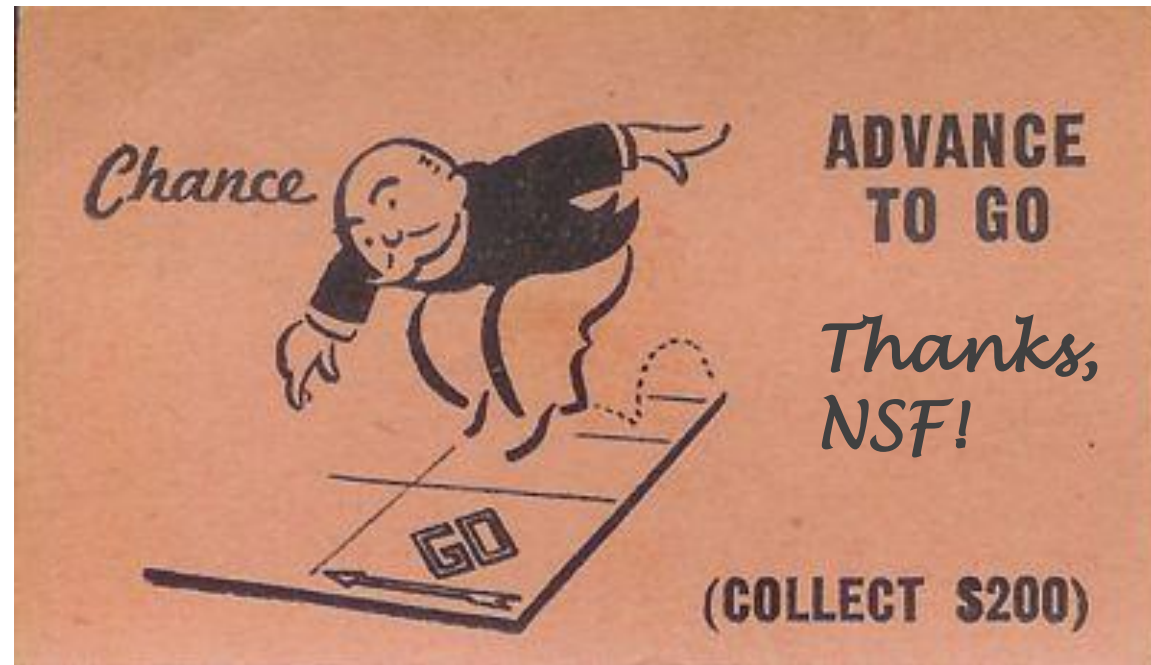
SBE & National Security

Can we stop terror networks before they start?

Photo Credit: VOA.gov

Atran & Ginges/ Cultural Anthropology & Decision, Risk and Management Sciences

Challenge
- Why do people join terror organizations?

Finding
- Fighters perceive their spiritual strength to be more important than material strength.

Impact
- DOD more effectively *disrupts terrorist recruitment*.

"Decision Science is a potential game changer." – Admiral John Richardson

Only NSF…

The Decision Scientist: Kennedy School Professor Jennifer Lerner is teaching the military how to harness the science of judgment and decision making

By Michael Blanding
Photo by Raychel Casey
Spring 2019
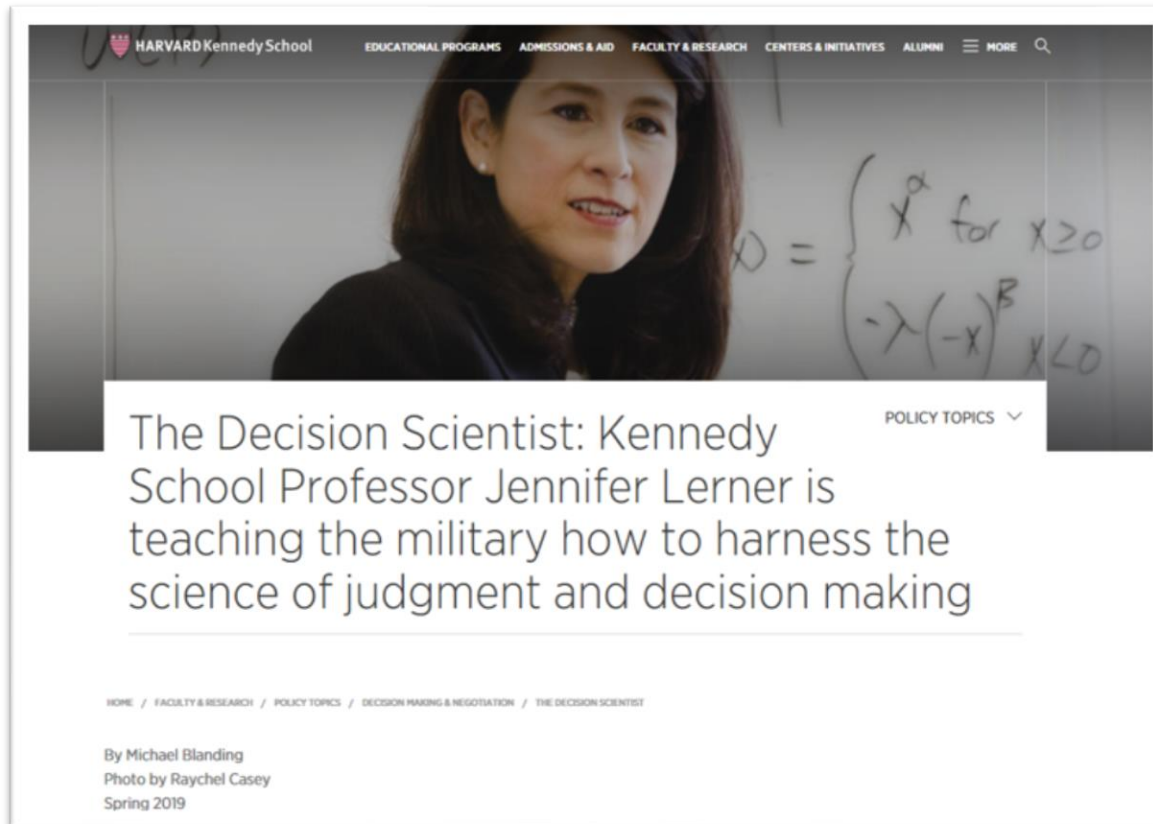
Lerner/Decision, Risk and Management Sciences & Social Psychology

- "I would not have made it through grad school without an NSF fellowship….

- …I needed the intellectual independence it gave me. …

- ….I would not be where I am today were it not for NSF."

SBE & Safety

Can We Predict Crime Before it Happens?

Brantingham/ Human and Social Dynamics

Challenge

- How do economic, social, and geographic variables influence criminal opportunities?

Design

- Integrated model predicts crime locations.

Findings

- Police used the model to reduce crime by much larger amounts than officers who used standard methods.

Captain Dominic Choi, LAPD

- "It's a very focused approach to crime fighting and we can do it with fewer officers in a more efficient and meaningful way. I would say it's pretty amazing."

Strategic communication
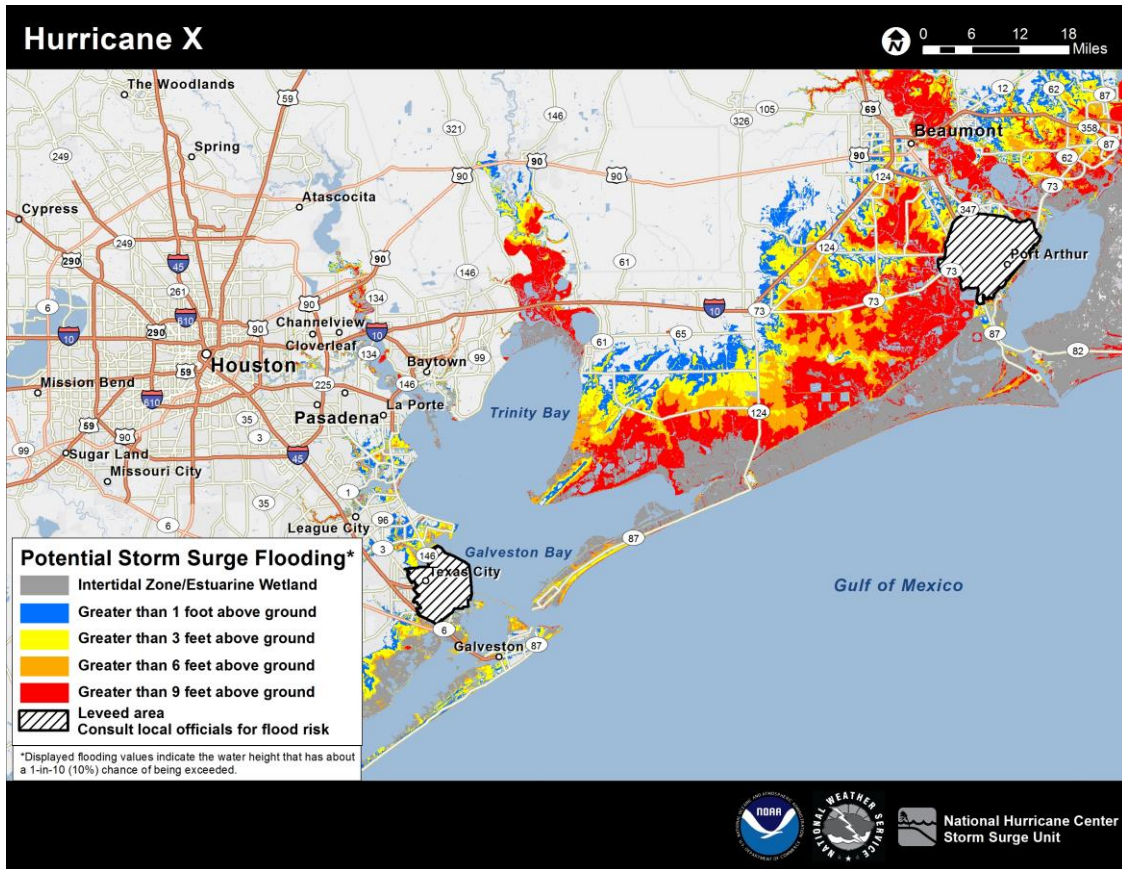
Challenge
- How do people process information when disaster strikes?

Finding
- Researchers learned how risk perceptions diverge from reality.

Implication
- New maps help people understand threats to life.

Lazo, Rhome, Morrow, Feyen, Bostrom, Demuth & Mors/ Decision, Risk and Management Sciences

SBE: Brains & Babies

Neural Basis of Miscalculation
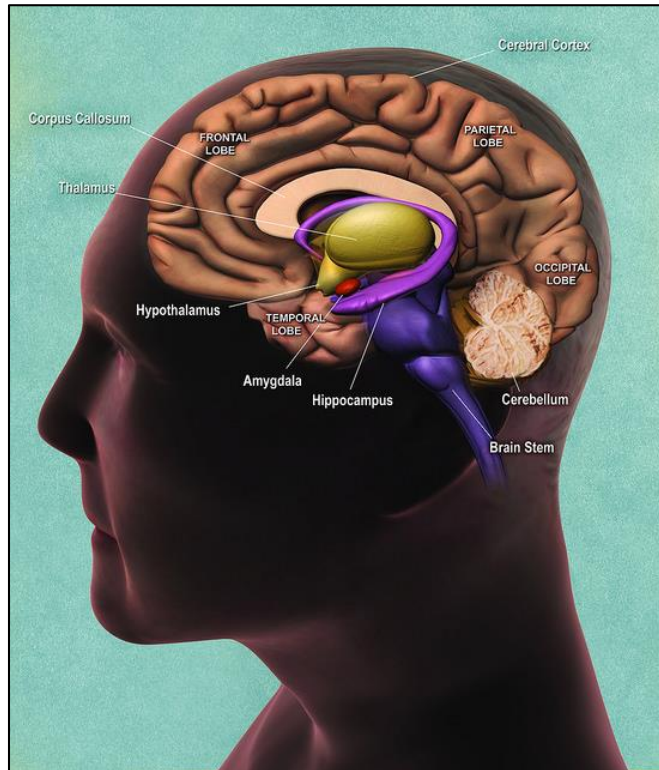
Rutishauser/ Cognitive Neuroscience

Challenge

- How do sets of neurons affect memory formation?

Findings

- Some neurons code familiarity.
- Other neurons code confidence, not familiarity.

Implication

- New options for treating memory disorders.

Empowering Child Development

Galloway/ Developmental Sciences

Challenge
- How does mobility affect development?

Finding
- Improved mobility increases many cognitive abilities.

Impacts
- The researcher designed easy-to-build devices to help kids move.
- Over 8000 "cars" distributed.

"With the help of a local high-school robotics team and open-source plans from Go Baby Go!, we built Cillian a car designed specifically with his disabilities in mind….He is making real cognitive gains."

– Krissy Jackson, mother of Cillian, Farmington, Minnesota

SBE: Increasing Opportunity

SBE by the Numbers. FY19 est

~$270M → ~1,000 awards → ~400 institutions

Building Strategic Capacity

- Human Networks and Data Science

- Strengthening American Infrastructure

- Security and Preparedness

- Science of Learning and Augmented Intelligence

- Ethical and Responsible Research

[Ralph Bunche Summer Institutes](#)

- 370 Students (1996-2017)

- 76 SBE PhDs to Date

- 34 more in SBE PhD programs

- 120 more completed SBE masters programs

- 52 others in/finished law/professional school

Class of 2018 RBSI Scholars

Veterans in STEM

"The experience really opened a window into what research actually entails and allowed me to consider graduate school, something I had not given a thought to before that."

"The program really pushed me towards pursuing a research profession."

• – Ivan Castro, Project Manager, Syracuse University's REU Site
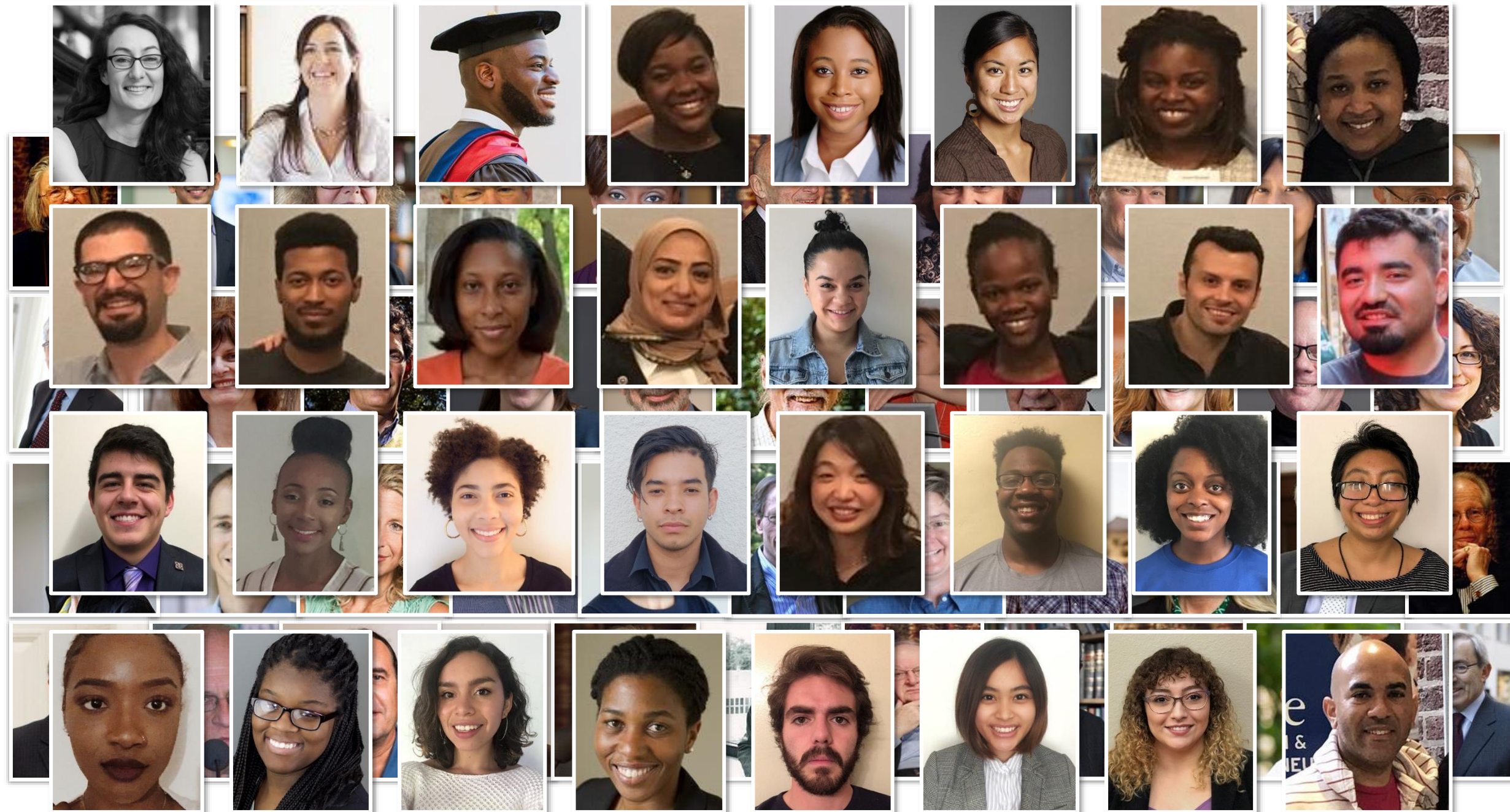
SBE Goals

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Thank you for your support

Thank you for your support

Supplementary Slides

- SBE By the Numbers
- Detailed versions of Atran/Ginges example.
- Additional examples.

SBE by the numbers

$270 M — FY 2019 Enacted Budget Estimate

4,300 proposals

22,400 Proposal reviews

20% Research Grant Funding rate

1,000 awards

4,800 people supported

400 Institutions supported

1,550 senior researchers

470 other professionals

180 postdoctoral associates

1,420 graduate students

1,180 undergraduate students

Disrupt Terror Networks

Photo Credit: VOA.gov

Atran & Ginges/ Decision, Risk
and Management Sciences;
Cultural Anthropology

Research Design
- Investigators interviewed violent extremists and those fighting against them

Findings
- Fighters, regardless of their allegiance, were committed to non-negotiable sacred values.
- Fighters perceived the spiritual strength of their group to be superior to their foes' and more important than material strength.

Implications/Impact
- Interventions that include moral and spiritual motivations are more effective than economic interventions alone.
- DOD and others use these insights to *disrupt terrorist recruitment* and retention.

Google: A Basic Science Success Story

2018
Google, now part of the tech conglomerate Alphabet, has $136 billion in revenue and employs over 98,000.

Foundational research in economics and sociology became the backbone for Google's PageRank algorithm and their successful ad auctions. In addition, NSF supported Google's founders and other leaders at key moments in their early careers, which allowed their expertise and the company to grow.

2004
Google goes public, with a value of $23 billion.

1998
Page and Brin co-found Google.

2007
Varian becomes Google's chief economist.

1974
Sociologist Michael Schwartz and colleagues study influence among members of social networks. Their work is credited in the original PageRank patent.

1980s-1990s
Economist Hal Varian leads trailblazing research on the economics of information goods.

1993-1994
Sergey Brin awarded a Graduate Research Fellowship. Brin and Larry Page, both graduate students in computer science, collaborate on the Stanford Digital Library Initiative, where they create the PageRank algorithm.

1961
Economist William Vickrey develops the Vickrey auction, which forms the basis of Google's Adwords algorithm for selling ads.

1950s-1970s
Economist Wassily Leontief develops input-output analysis, a forerunner to Google's PageRank algorithm. Leontief won the Nobel Prize in Economics in 1973.

1976
Computer scientists Gabriel Pinski and Francis Narin use linear algebra to rank the influence of physics journals. Their thesis, "A journal is influential if it is cited by other influential journals," is applied to PageRank for Web pages.

April 24, 2019

52

Predicting International Conflict

Credit: *iStock Photo*

Cranmer/ Methodology, Measurement, and Statistics

Research Design

- Researchers used complex network data to develop a predictive model of international conflict.

Findings

- When applied historically this model is 47% better at predicting conflicts than the standard model used.

- Trade and the strength of governmental organizations are more important variables in limiting conflict than the type of governments involved.

Implications

- Trade plays a powerful role in reducing conflict.

Responding to disasters

Browne/ Cultural
Anthropology

Design
- Researcher interviewed extended cultural family networks, including immediate & extended family and close friends, in the aftermath of Hurricane Katrina

Finding
- Cultural family networks that relocate together experience better outcomes.

Implication
- FEMA uses this research to improve training and strategy.

Disrupting Online Drug Networks

Dana Haynie/
Sociology and Secure and Trustworthy
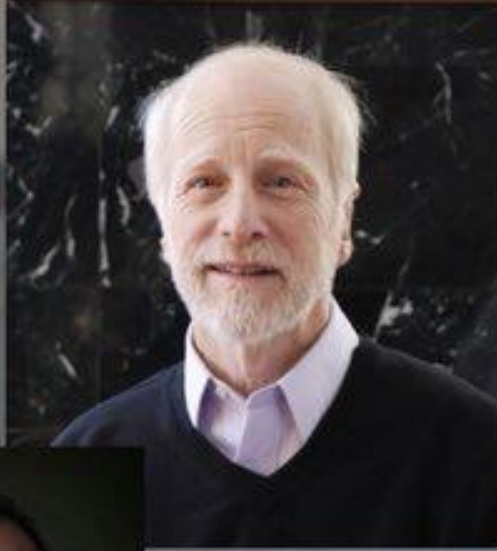Cyberspace

Research Design
- Researchers collect network data to detect buyer and seller behavioral patterns.

Findings
- Reputations are central to illicit marketplaces.

Implications
- Tracking and targeting high-reputation sellers to effectively disrupt illicit networks.

CONGRATULATIONS TO 2018 WINNER:

MAHZARIN BANAJI
ANTHONY GREENWALD
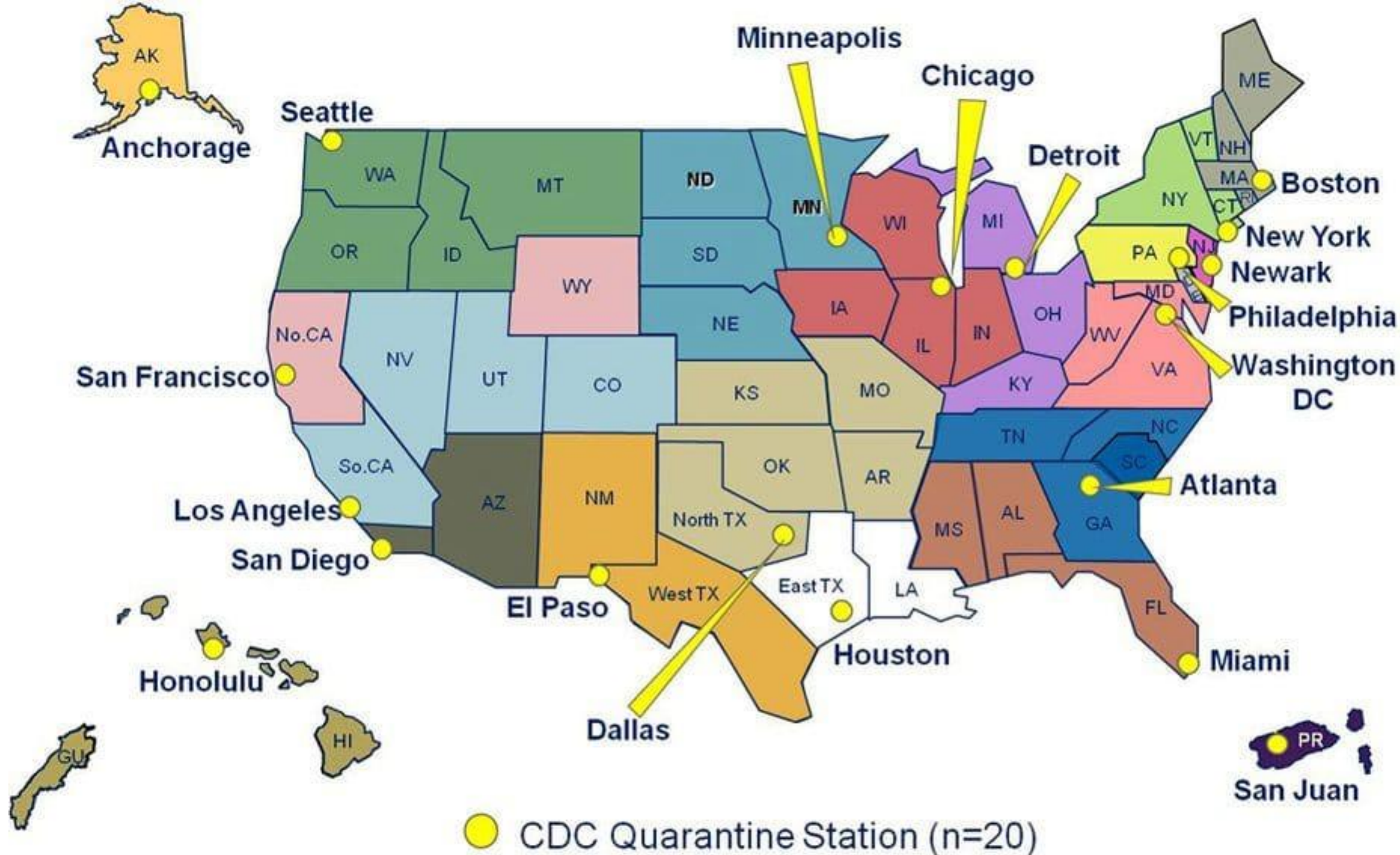**BRIAN NOSEK**

Implicit Bias, Explicit Science

THE GOLDEN GOOSE AWARD

Implicit Cognition to Save Lives

- The Self-Injury-IAT (SI-IAT) reveals potentially damaging thoughts without relying on self-report.

- Now tested at multiple times and in multiple countries.

- SI-IAT helps clinicians prevent loss of life.

Ebola in the USA

CDC Quarantine Station (n=20)

Ebola Transmission

Credit: CDC

Mariane Ferme/ Cultural
Anthropology

Background

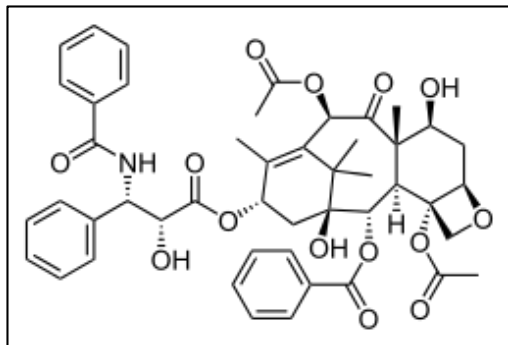•Examining relations between land rights and civil wars.

Findings

•In some countries, how people are buried affect land rights.

•Researchers noticed a correspondence between land policies and the spread of Ebola.

Implications/Impact

•To stop Ebola, avoid contact with the dead.

Better drugs faster?

SBE Research Accelerates Drug Discovery

Garrison W. Cottrell/ Science of Learning

Design

- Combine nuclear magnetic resonance spectroscopy w/AI to assess the uniqueness of new natural compounds

Findings

- Process streamlines discovery of the chemical structure of new compounds.

Implications

- Since a majority of all approved drugs are natural products or related to them,
- the "SMART" tool accelerates natural product drug discovery efforts.

HELPING CILLIAN MOVE, PLAY, AND LEARN

Photo Credit: *Krissy Jackson*

My son Cillian is two years old. For the first few months of his life, things seemed pretty normal. My husband and I don't have a lot of experience with babies. He is our first child, and he seemed to be doing okay.

Then, gradually we started to realize that he wasn't developing like he was "supposed to," that he was missing milestones like rolling over and crawling.

It wasn't until Cillian was four months old and hospitalized with Respiratory Syncytial Virus that we were told by the hospital's pediatric physical therapist that he might have physical issues. It began with torticollis, which is a twist in the way he held his head, but after seeing a physical therapist, we realized that there were more abnormalities than we had originally believed.

The weight of it builds over time. By the time he was 8 months old, Cillian was seeing specialists for tests and therapy every week or more. Blood tests, urine tests, MRIs, genetic tests, spinal tap. And you kind of put everything in your life on hold as you look for answers.

We finally learned that Cillian had a rare genetic disorder when he was 11 months old, but even that didn't really give us answers because the disorder affects different kids differently. Compared to kids with his specific disorder, he is significantly delayed in physical milestones.

My husband and I don't know how Cillian will develop, but what I do know is that we want more than anything to make Cillian's life as bright as possible.

As isolating as it has been for me as a mother, I know it was even more isolating for Cillian. As a baby, he was supposed to be crawling around, grabbing things, and looking at them. But he was always stuck in one place or dependent on us to move him around.

I started to wonder if some of his delays might actually be caused by the fact that he couldn't move around and learn about the world. He was stuck in a catch-22, a double-whammy, that prevented him from engaging with things and others, and his development seemed hindered as a result.

Cillian's physical therapist was the one who introduced us to the Go Baby Go! Program. It was started by a scientist who set out to study some of the same questions I found myself asking about the link between mobility and development for Cillian. It even included designs of easy-to-build robots to get children with motor disabilities moving.

With the help of a local high-school robotics team and open-source plans from Go Baby Go!, we built Cillian a car designed specifically with his disability in mind.