EXPLORING WHAT MAKES US HUMAN

Social, Behavioral & Economic Sciences

NSF

National Science Foundation

Focusing
on People

All the time, we engage in behavior—thinking, feeling, sensing, perceiving and doing, either alone or while interacting with others. Groups of people cooperate or clash. We create the global economic, social and political conditions that help define the possibilities for the nation and for ourselves as individuals. This human landscape is the subject of the social, behavioral and economic sciences.

Research and discovery in the behavioral and social sciences have vast practical applications including using the understanding of how the brain processes information to improve behavior, informing disaster response and disease prevention, and predicting how investments shape the economy.

With less than 5 percent of the National Science Foundation's (NSF) research budget, the Directorate for Social, Behavioral & Economic Sciences (SBE) is the agency's smallest funding arm. However, its impact is far-reaching. Thousands of SBE-supported researchers have contributed to securing the nation, sustaining new industries, improving well-being, and generating billions of dollars of revenue for the U.S. economy.

SBE Research to Prepare for Tomorrow

SBE research enriches all parts of society, including government, academia, education, and business and industry. For example, Google's initial popularity as a search engine was due to an algorithm developed by NSF-supported computer scientists. Now, social science research in network analysis, decision making and user behavior helps Google maintain its competitive edge in today's global marketplace. Microsoft, Yahoo! and Google are among the IT powerhouses that routinely rely on SBE research, methods and datasets. Anthropologists and sociologists are regularly employed by development, product and marketing teams at large corporations, helping companies innovate.

Fundamental SBE research may take decades to mature from an idea into a practical application. For instance, SBE-funded scientists recently applied abstract ideas from mathematical game theory developed over the past century to create algorithms to match healthy kidney donors with gravely ill recipients. This work also gave rise to the Federal Communications Commission's spectrum auction system that generates over $60 billion in revenue for the U.S. Department of the Treasury. Future generations will continue to reap the rewards of today's investments in fundamental SBE research.

SBE-funded scientists also have a central role to play in the future of science. No one discipline or mission-driven agency can meet tomorrow's challenges without also focusing on the people component. Solutions to global challenges of economic competitiveness, information access, and physical and cybersecurity will increasingly rely on interdisciplinary research with behavioral and social science components.

Understanding the brain is one of the most difficult challenges in all of science. SBE participates in the BRAIN (Brain Research through Advancing Innovative Neurotechnologies) Initiative to unravel the mysteries of the brain and how it creates sensation, perception, cognition and action.

Formed in the late 1980s with SBE support, the National Center for Geographic Information and Analysis created new analytical methods to handle very large databases of geographic information. This led to many applications, from improved statistical methods for scientists to mapping capabilities on our smartphones.

## NSF's Social, Behavioral & Economic Sciences Portfolio

As the population expands and becomes more diverse, our quality of life increasingly depends on understanding human factors. Supporting the best and brightest scientific minds in the social, behavioral and economic sciences is imperative to sustaining our quality of life and to enabling solutions to the grand challenges facing society. This important work is supported by the following divisions and programs in SBE.

Behavioral and Cognitive Sciences develops and advances scientific knowledge about humans, spanning brain and behavior, language and culture, origins and evolution, and geography and the environment.

Social and Economic Sciences enhances the understanding of human, social and organizational behavior by building social science infrastructure and by developing social disciplinary and interdisciplinary research projects that advance knowledge and data resources.
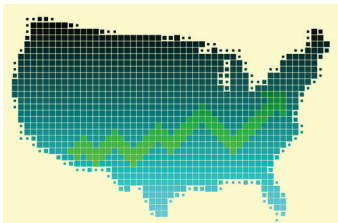
National Center for Science and Engineering Statistics collects, interprets, analyzes and disseminates objective data on the U.S. science and engineering enterprise.
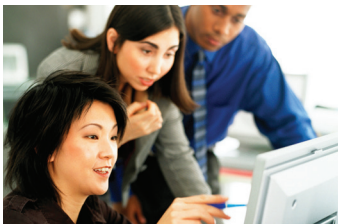
Office of Multidisciplinary Activities seeds multidisciplinary activities for the future and plays a critical role in the development of infrastructure to support interdisciplinary activities.

This brochure highlights SBE research and education that directly impacts our lives. These few examples epitomize a rich portfolio of research that is helping us understand what makes us human.

Credits: Thinkstock

SBE Research Impacting Our Daily Lives

As the U.S. population expands and becomes more diverse, our quality of life increasingly depends on understanding behavioral and economic factors that can help sustain the environment, prevent illness, maintain a robust economy and curtail conflict. Supporting the best and brightest scientific minds in the SBE sciences is crucial to achieving these goals. The following projects illustrate cutting-edge research in the SBE sciences.

Real-time, First-line Emergency Response

Geologists are constantly trying to improve the prediction of natural disasters, but their work would be in vain if not for social scientists' understanding of how people react during an emergency. Scientists designed a computer-based disaster mitigation system to ensure people in the path of impending danger heed emergency instructions. The system utilizes ultra-fast Internet systems to deliver real-time information to emergency workers and residents. The system has already been implemented in Chattanooga, Tenn.

Value of a Good Teacher

By tracking 1 million elementary-school students, SBE-funded researchers found that students with a good teacher (those who have the biggest impact on students' standardized test scores) earned an extra $52,000 over their lifetime when compared to students with an underperforming teacher. This equates to an extra $1.4 million earned per classroom. Good teachers truly nurture the nation's economy.

Reading Readiness for a Literate Society

SBE-funded researchers have found that infants understand the meaning of some words much sooner than previously thought. At 6 months, babies can understand the meaning of words related to foods and body parts. This research changes the way we understand language acquisition, which is important for enhancing reading readiness and literacy in young people. Studies show that 6-year olds who have been exposed to over 30,000 words a day are better readers than their peers in less talkative families.


Auctioning the Airwaves

NSF-supported researchers provided the Federal Communications Commission (FCC) with its current system for apportioning the airwaves via a practical application of game theory and experimental economics. Since their inception in 1994, FCC "spectrum auctions" have netted over $60 billion in revenue for the federal government. The U.S. system of partitioning airwaves is now emulated in several other countries around the world, resulting in total worldwide revenues in excess of $200 billion.

A More Effective Police Force

SBE-funded anthropologists and mathematicians have reapplied algorithms that predict earthquake aftershocks to create a crime prediction model. The model gathers years of crime data and deduces where and when property crimes are most likely to occur. After police implemented the model in Los Angeles's Foothill precinct, property crime decreased 12 percent relative to surrounding areas. This technology is transforming police work in Los Angeles, where 10,000 police officers must protect over 4 million residents.
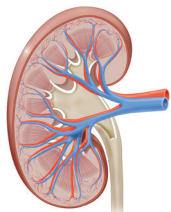
Facilitating Organ Exchange

Almost 20,000 kidney transplants take place in the U.S. each year, and the waiting list continues to grow. Economist and 2012 Nobel Laureate Alvin Roth led a team of researchers that developed a computational technique that greatly expands the pool of safe exchanges in a chain of cooperating pairs of donors and recipients. As a result, paired transplants have risen dramatically: from two in 2000 to 443 in 2012.

Leading the Pack in Economics Research

The economy of the U.S. is the world's largest, and understanding how goods and services are exchanged underpins its growth and sustainability. SBE-funded economists have been studying important economic principles for years, and their work is world renowned. Fifty of the 74 recipients of the Nobel Prize in Economic Sciences have received NSF funding. In fact, every winner since 1998 has been an NSF grant recipient. The work of the 2013 Nobel recipients, Eugene Fama, Lars Peter Hansen and Robert Shiller underlies the understanding of stock price fluctuations and has transformed market practices. In 2006, Shiller also predicted the housing market crisis.

Improving Public Health by Fighting Obesity

More than one-third of U.S. adults are obese, which contributes to heart disease, stroke, type 2 diabetes and certain cancers. Annual medical costs associated with obesity are nearly $150 billion. SBE-funded researchers demonstrated that energy expenditure in traditional hunter-gatherers living in Tanzania was similar to that of Westerners, suggesting that obesity in U.S. and European adults may be more a consequence of diet than physical activity. Cognitive neuroscientists have discovered how different brain regions are involved in regulating food choices, and have suggested that it may be possible for people to improve their self-control with practice. These findings inform the development of interventions to combat obesity.

Communication Savvy Soldiers

In military situations, cross-cultural communication errors can be disastrous. Uncertainty about whether one person wishes another harm can dangerously escalate. SBE-funded researchers studied nonverbal communication cues such as facial expression, vocal tone and body language. Based on this work, the Army Research Institute now incorporates nonverbal communication education into soldier training. Enhancing troops' interpersonal skills enables them to better anticipate and diffuse conflict, as well as facilitate cooperation and compromise.

Live Better, Longer: How Music Trains the Brain

Scientists supported by SBE have shown numerous benefits of musical training. Studies in older adults show that lifelong musical training improves memory and the ability to discern the spoken word from background noise, two important brain functions that decline with age. More recent research demonstrates that a moderate amount of musical training early in life is associated with faster brain processing time later in life, long after music lessons stopped. Music lessons as a child help prevent age-related decline of brain function long into adulthood.

Oldest Primate Skeleton Unearthed

An NSF-funded paleontologist, part of an international team, recently helped discover a nearly complete skeleton of a tiny, tree-dwelling primate dating back 55 million years. It is the oldest primate skeleton of this quality and completeness ever discovered.

More Ways
SBE Research Impacts People's Lives

SBE research forms the nation's bedrock of fundamental knowledge on human behavior, interaction, social and economic systems, and organizations. SBE-supported research has led to discoveries that have both enhanced fundamental knowledge and provided value to people all around the globe.

Augmenting learning and teaching

Ascertaining how war shapes governments

Charting human origins

Creating a diverse, educated workforce

Defending our nation

Developing robots to educate developmentally and learning-disabled children

Documenting endangered languages

Elucidating how we learn

Encouraging healthy and resilient brains

Improving disaster response

Informing economic policy and international relations

Optimizing the use of vital resources

Predicting outbreaks of invasive pests
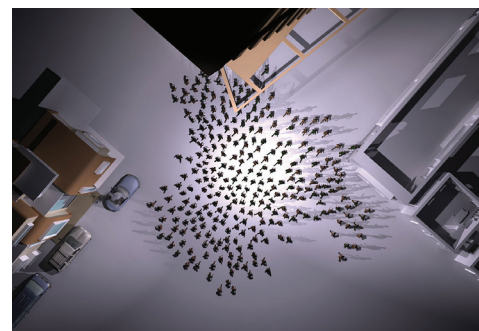
Strengthening the legal system

Understanding human behavior

SBE-funded research on self-affirmation has been used to improve academic performance of minority middle-school students.

Maine lobstermen collectively adopted conservation ethics that resulted in a sustainable industry over the past 65 years based on SBE-funded research.

Using a virtual urban environment populated by thousands of artificial agents, scientists can study the underlying order of seemingly chaotic crowds and inform emergency evacuation planning.

Providing Crucial Data
for the Nation

Another critical role of SBE is to provide authoritative, objective data to help industries understand U.S. research and development (R&D) performance. The National Center for Science and Engineering Statistics (NCSES) provides comprehensive data on all aspects of U.S. competitiveness in science and technology. NCSES takes the pulse of the nation's science and engineering (S&E) enterprise, helping U.S. industries understand recent globalization trends and international competition. Data are used to assess trends, formulate policy, make international comparisons and more.

Below are a few statistics from NCSES products and two significant NCSES reports that are Congressionally mandated.

U.S. R&D Expenditures. R&D activities are an important input to commercial innovation. U.S. R&D expenditures totaled $428.2 billion in 2011, an increase of $20.5 billion over the 2010 level. The preliminary estimate of the 2012 U.S. total for R&D is $452.6 billion.

S&E Workforce. A skilled labor force is critical to U.S. innovation and economic growth. Nearly 22 million people classified as scientists and engineers were employed in the U.S. as of October 2010. In 2010, women were 45% of the overall S&E workforce and held 28% of S&E jobs.

Graduate Students in S&E. Graduate level scientists and engineers provide vital research capabilities for U.S. innovation. Enrollment of fulltime graduate students in S&E grew approximately 25%, from more than 325,000 students in 2002 to more than 410,000 in 2011 in U.S. academic institutions.

R&D in the Business Sector. The business sector, the largest performer of U.S. R&D, spent over $294 billion in the U.S. in 2011 (69% of the national total), $15.1 billion more than in 2010. Universities/colleges and the federal government performed $62.5 billion (15%) and $53.5 billion (13%), respectively, on U.S. R&D in 2011.
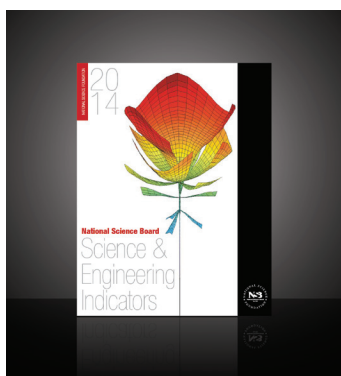
Science & Engineering Indicators. This National Science Board publication provides quantitative information about the U.S. S&E enterprise. It includes comprehensive information on STEM education at all levels, the S&E workforce, state, national, and international R&D performance, and U.S. competitiveness in technology.
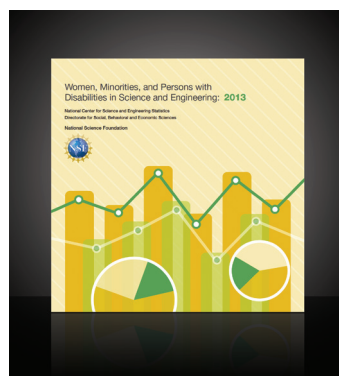
Women, Minorities, and Persons with Disabilities in Science and Engineering. This biennial publication provides information on the participation of women, minorities and persons with disabilities in S&E education and employment. Most notably, underrepresented minorities are an increasing fraction of undergraduate students, and white students are a decreasing fraction.

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