

**SOCIAL, BEHAVIORAL, AND ECONOMIC
SCIENCE RESEARCH:
OVERSIGHT OF THE NEED FOR FEDERAL
INVESTMENTS AND PRIORITIES FOR FUNDING**

HEARING
BEFORE THE
SUBCOMMITTEE ON RESEARCH AND SCIENCE
EDUCATION
COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY
HOUSE OF REPRESENTATIVES
ONE HUNDRED TWELFTH CONGRESS
FIRST SESSION

THURSDAY, JUNE 2, 2011

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SCIENCE
RESEARCH: OVERSIGHT OF THE
NEED FOR FEDERAL INVESTMENTS AND
PRIORITIES FOR FUNDING**

THURSDAY, JUNE 2, 2011

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:02 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Mo Brooks [Chairman of the Subcommittee] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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Subcommittee on Research and Science Education
*Social, Behavioral, and Economic Science Research: Oversight of the Need for Federal
Investments and Priorities for Funding*
Thursday, June 2, 2011
10:00 a.m. - 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

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Assistant Director, NSF Social, Behavioral, and Economic Science Directorate

Dr. Hillary Anger Elfenbein
Associate Professor, Washington University in St. Louis

Dr. Peter W. Wood
President, National Association of Scholars

Ms. Diana Furchtgott-Roth
Senior Fellow, Hudson Institute

HEARING CHARTER

**COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND
SCIENCE EDUCATION
U.S. HOUSE OF REPRESENTATIVES**

**Social, Behavioral, and Economic
Science Research:
Oversight of the Need for Federal Investments
and Priorities for Funding**

THURSDAY, JUNE 2, 2011
10:00 AM–12:00 PM
2318 RAYBURN HOUSE OFFICE BUILDING

1. Purpose

On Thursday, June 2, 2011, the Subcommittee on Research and Science Education will hold a hearing to examine the need for Federal investments in the social, behavioral, and economic sciences; to better understand the impact of this type of research; and to assess its value to the American taxpayer. The hearing will also examine Federal research funding and priorities for these sciences at the National Science Foundation, including the fiscal year 2012 budget request.

2. Witnesses

Dr. Myron Gutmann, Assistant Director, Directorate for Social, Behavioral, and Economics Sciences, National Science Foundation.

Dr. Hillary Anger Elfenbein, Associate Professor of Organizational Behavior, Olin Business School, Washington University in St. Louis.

Dr. Peter W. Wood, President, National Association of Scholars.

Ms. Diana Furchtgott-Roth, Senior Fellow, Hudson Institute.

3. Overview

- The social, behavioral, and economic sciences consist of a wide array of fields, including anthropology, archaeology, economics, geography, linguistics, history, neuroscience, political science, psychology, sociology, criminology and law. Often multidisciplinary in nature, the social sciences can provide insight into human behavior that is essential to developing and understanding new technologies and science.
- The main support for basic research in the (non-medical) social and behavioral sciences comes from the National Science Foundation (NSF), accounting for approximately 58 percent of federal support for basic research at U.S. colleges and universities.
- Within NSF, the Directorate for Social, Behavioral, and Economic Sciences (SBE) is responsible for the varied research endeavors that fall under these sciences. SBE has requested \$301.1 million for FY12, an 18 percent increase from FY10 enacted funding levels. SBE supports approximately 58 percent of Federally funded basic research in academic institutions in the social, behavioral, and economic science fields.

4. Background*Social, Behavioral, and Economic Sciences*

The social, behavioral, and economic sciences focus on human activity. Historically rooted, evidence of these sciences can be traced to ancient philosophers, scientific pioneers of their time. The focal point of social, behavioral, and economic sciences is the analysis of the human brain, human behavior, and the actions of groups and

organizations. “The social, behavioral and economic sciences comprise a number of different disciplines focused on the common goal of developing a deeper understanding of human beings at every level, from brains, to individual behavior, to societies. The quest for deeper understanding of humans is key to managing society’s most critical challenges.”¹

Anthropology, archaeology, economics, geography, linguistics, neuroscience, political science, psychology, sociology, and statistics are just some of the diverse fields that fall under the social, behavioral, and economic sciences. From research about historical migration patterns to research about speech patterns, these sciences cross a myriad of issues that have influenced or will affect human development.

Examples of research in the social, behavioral, and economic sciences include the study of the human behavior under stress in order to understand and address the effects of combat tours of duty or extended deployments; the study of nuclear deterrence strategy during the Cold War; examining the causes and consequences of criminal behavior; and economic measurements regarding the effects and significance of Federal budget deficits.²

The Federal Role

Policy researchers and economists tend to agree that public investment in science can yield high rates of return to society. “Without the data, research, and analyses that [social, behavioral, and economic] scientists can provide, there is a greater likelihood of engaging in ineffective or counterproductive policies.”³ Examples of scientific progress and policy applications stemming from social, behavioral, and economic sciences are abundant. Collecting data after natural or man-made disasters is essential for preparing for potential catastrophes, training emergency response teams, and planning emergency procedures. Research on the spread of infectious disease utilizes statistical models accounting for numerous variables allowing for a better understanding of how and why disease spreads as well as the identification of methods to mitigate the spread of disease. Complex national security missions, which range from counterinsurgency to security and stability operations, are better served by a security force that understands and appreciates the individual, tribal, cultural, ethnic, religious, social, economic, and other aspects of the local human terrain.

In January 2009, the Bush Administration released a National Science and Technology Council Report, *Social, Behavioral and Economic Research in the Federal Context*, providing the most recent assessment of the Federal role and opportunities for the social, behavioral, and economic sciences in order to “provide policymakers with evidence and information that may help address many current challenge areas in society, including education, health care, the mitigation of terrorism, the prevention of crime, the response to natural disasters, and a better understanding of our rapidly changing global economy.”⁴

The report listed three foundational research themes: 1) Understanding the Structure and Function of the Brain in order to provide insight into individual behaviors; 2) Understanding the Complexity of Human Societies and Activities to capture the webs of interpersonal and interorganizational ties within and across populations; and 3) Understanding Human Origins and Diversity.

In addition, the report identified four key priority research areas for the Federal government: 1) Develop specific tools and technologies for social, behavioral, and economic studies; 2) improve methods for collecting and managing data; 3) Build more integrated systems to allow for sharing across data sets; and 4) Focus on scientific questions with immediate policy implications to ensure that policies generate evidence of their efficacy.

While calling for “sustained investment and ongoing dialog among Federal agencies, academic and private sector researchers, and policymakers,”⁵ the report also notes that not all social, behavioral, or economic sciences “require or are even appropriate for government support. For example, consumer behavior and the successes and failures of commercial marketing campaigns are major targets of SBE research but are well funded through industry support.”⁶

¹ *Social, Behavioral and Economic Research in the Federal Context*, National Science and Technology Council, Subcommittee on Social, Behavioral and Economic Sciences, January 2009.

² *Fostering Human Progress: Social and Behavioral Science Research Contributions to Public Policy*, Consortium of Social Science Associations, October 2001.

³ *Social, Behavioral and Economic Research in the Federal Context*, National Science and Technology Council, Subcommittee on Social, Behavioral and Economic Sciences, January 2009, p. 5.

⁴ *Ibid.*, cover letter.

⁵ *Ibid.*, p. 2

⁶ *Ibid.*, p. 6

Federal Funding

Basic and applied research in the social, behavioral, and economic sciences is funded out of a number of federal agencies, led by the National Institutes of Health (NIH) and the National Science Foundation (NSF). According to research funding statistics compiled by NSF,⁷ a total of \$1.12 billion was obligated to basic and applied research in all social sciences for fiscal year 2009 (FY09), including economics. Psychology was counted separately and was funded at a total of \$1.86 billion in FY09, of which \$1.71 billion was funded by Health and Human Services (primarily NIH). Federal support for academic research in particular was \$733 million for social sciences and \$856 million for psychology.

The basic Federal research funded in the social, behavioral, and economic sciences focuses on understanding why humans think, feel and act the way they do; the study of interpersonal behavior from small groups to global forces; how humans relate to the rest of the natural world; and how we came to possess our uniquely human abilities. The main support for basic research in the (non-medical) social and behavioral sciences comes from the NSF, accounting for approximately 58 percent of federal support for basic research at U.S. colleges and universities. In some fields, including archaeology, political science, linguistics, and non-medical aspects of anthropology, psychology, and sociology, NSF is the predominant or exclusive source of federal basic research support.

The SBE budget request for FY12 is \$301 million, an 18 percent increase over FY10. Approximately 14 percent of SBE's budget is used not for basic research but to fund the collection and analysis of data on science and engineering research, education, and workforce trends (including the data presented here), resulting in the biannual "S&E Indicators."

The National Science Foundation

The social, behavioral, and economic sciences have been funded since the late 1970s at the National Science Foundation (NSF), originally as part of a combined Directorate with biological sciences. In the 1990s, the Directorate for Social, Behavioral, and Economic Sciences (SBE) was established. The SBE Directorate seeks to "promote the understanding of people and their lives by supporting research that reveals basic facets of human behavior; to encourage research that helps provide answers to important societal questions and problems; to work with other scientific disciplines to ensure that basic research and the solutions to problems build upon the best multidisciplinary science and to provide mission-critical statistical information about science and engineering in the U.S. and the world."⁸

The SBE Directorate supports research that sustains a primary knowledge of human behavior and interaction, social and economic systems, and organizations and institutions. To improve the understanding of science and engineering, SBE provides tools for tracking human and institutional resources required to build the nation's science and engineering infrastructure. Furthermore, the SBE Directorate works to supply evidence and resources to respond to many of today's challenges, ranging from education to terrorism. SBE funded scientists, who cover myriad scientific fields, perform interdisciplinary research that takes advantage of a new set of tools and holds the promise of providing insights and solutions not otherwise available. Research conducted through SBE includes efforts to restructure regulatory mechanisms, assess the impact of economic policies on economic growth, and understand the implications of tax policy changes in order to bolster work to strengthen the U.S. economy.

It is important to note that while most of the research currently funded by NSF in the social and behavioral sciences is not driven by any one application, the line between basic and applied research in these fields can often be blurred. For example, a sociologist interested in the successes and failures of teamwork in a small business environment might make fundamental discoveries applicable to other environments, including the military. As a result, much of the academic research currently funded by NSF may ultimately find application in national security (or other fields), even when the research was focused on non-military populations.

⁷ Preliminary data for FY2009 federal research obligations. National Center for Science and Engineering Statistics. National Science Foundation. Data are based on self-reporting by agencies. In many cases, especially where there is interdisciplinary work, it is hard to tally exact dollars spent on one field or another, so these values are at best an estimate.

⁸ <http://www.nsf.gov/sbe/about.jsp>

The SBE Directorate has requested \$301.1 million for FY12, an 18 percent increase from FY10 enacted funding levels.⁹ In total, the Directorate supports approximately 3,500 senior researchers, 2,500 graduate students, 1,330 undergraduate students and 700 postdoctoral researchers and other professionals at U.S. universities and research institutions. Currently, SBE funding accounts for 3.6 percent of the entire NSF budget.

The SBE Directorate participates in a number of crosscutting and NSF-wide projects. The Directorate is organized in four parts:

Division of Behavioral and Cognitive Sciences

The Division of Behavioral and Cognitive Sciences (BCS) supports research and related activities to advance scientific knowledge about humans, spanning anthropology, geography, and cognitive and behavioral sciences. Fields of study include cognitive neuroscience, language and culture, origins and evolution, and the environment. The FY12 budget request for BCS is \$105.9 million, a 12 percent increase from FY10 enacted funding levels.

Division of Social and Economic Sciences

The Division of Social and Economic Sciences (SES) works to improve the understanding of human, social and organizational behavior and economic, political and social institutions. Research conducted through SES includes projects preparing for and mitigating the effects of natural disasters and projects focusing on human cognition and behavior. The FY12 budget request for SES is \$113.8 million, nearly a 15 percent increase from FY10 enacted funding levels.

Office of Multidisciplinary Activities

The Office of Multidisciplinary Activities (SMA) is a central location for SBE activities that work across disciplinary boundaries. SMA works to develop infrastructure support for interdisciplinary activities and helps to seed future multidisciplinary activities. Minority Postdoctoral Research Fellowships (MPRF), Research Experiences for Undergraduates (REU) Sites, Science of Science and Innovation Policy (SciSIP), and agency-wide Science of Learning Centers (SLCs) are funded out of SMA. The FY12 budget request for SMA is \$43.4 million, over a 60 percent increase from FY10 enacted funding levels.

National Center for Science and Engineering Statistics

The National Center for Science and Engineering Statistics (NCSES) collects, interprets, analyzes, and disseminates objective data on science and engineering, including the widely used biennial *Science and Engineering Indicators*. NCSES data collections include those related to U.S. competitiveness and STEM education. NCSES is required to supply information that is useful to practitioners, researchers, policymakers, and the public, and as such releases nearly 30 reports annually. The FY12 budget request for NCSES is \$38 million, nearly a 10 percent increase from FY10 enacted funding levels.

Major investments in the FY12 SBE Directorate budget request include:

- \$57 million, a 174 percent increase, for clean energy research in the Science, Engineering, and Education for Sustainability (SEES) portfolio (NSF priority investment). In addition to supporting the SEES Sustainability Research Networks, Sustainability Energy Pathways and Postdoctoral Fellowships, funding will also strengthen “existing climate research and energy investments, and [support] both existing and new investments in understanding energy use and in decision making, coastal communities, and vulnerability and resilience.”
- \$12 million in new funding for the NSF-wide Cyberinfrastructure Framework for 21st Century Science and engineering (CIF21) to fund Observation Data network Pilots, Research Data on Innovation, research on understanding and designing the 21st century networked society, and improved access to the large surveys supported by SBE.
- \$12 million in new funding for research on cybersecurity, economics and society as part of NSF’s commitment to research in the area of cybersecurity. SBE’s specific role will be to support the Cyber Economic Incentives theme within Comprehensive National Cybersecurity Initiative (CNCI).

⁹ All budget details come from the *National Science Foundation FY12 Budget Request to Congress*, Social, Behavioral and Economic Sciences Section.

Chairman BROOKS. The Subcommittee on Research and Science Education will come to order. Good morning. Welcome to today's hearing entitled, "Social, Behavioral, and Economic Science Research: Oversight of the Need for Federal Investment and Priorities for Funding." In front of you are packets containing the written testimony, biographies, and truth in testimony disclosures for today's witness panel.

I now recognize myself for five minutes for an opening statement.

Good morning and welcome to all of our witnesses. Today's hearing presents us with an opportunity to better understand the research being conducted in the social, behavioral, and economic sciences and to take a closer look at the federal funding of such research.

The social, behavioral, and economic sciences are those that focus on human behavior and interaction. Often termed the soft sciences to distinguish them from the physical and life sciences, these sciences run the gamut from geography and sociology to linguistics and political science. In fact, we have four different disciplines represented at the witness table today: history, psychology, anthropology, and economics.

The Federal Government invests in social, behavioral, and economic sciences through several agencies in order to better understand issues such as how children learn, how soldiers think, and how humans react to disease.

The National Science Foundation, whose oversight falls within the jurisdiction of this Subcommittee, is the largest federal supporter of the social, behavioral, and economic science research, funding close to 60 percent of basic research for these sciences at academic institutions. It is my understanding that in several disciplines it is either the predominant or exclusive source of federal basic research support.

The goal of this hearing is not to question whether the social, behavioral, and economic sciences produce interesting and sound research, as I believe we all can agree that they do. Rather, the goal of our hearing is to look at the need for Federal investments in these disciplines, how we determine what these needs are in the context of national priorities, and how we prioritize funding for these needs, and only, excuse me, not only within the social science disciplines but also within all science disciplines, particularly when Federal research dollars are scarce.

As with all of the hearings I have chaired or co-chaired this Congress, I am particularly interested in understanding the NSF investments in these sciences, including the amounts asked for in the fiscal year 2012, budget request and how those priorities were made. In an effort to be responsive to the American taxpayer, Congress needs to ensure that all Federal funding decisions are wise and produce significant value for this Nation.

I look forward to a healthy discussion with all of our esteemed witnesses today, and I thank you for joining us.

[The prepared statement of Chairman Brooks follows:]

PREPARED STATEMENT OF CHAIRMAN MO BROOKS

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behavioral, and economic sciences and to take a closer look at the Federal funding of such research.

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I look forward to a healthy discussion with all of our esteemed witnesses today, and I thank you for joining us.

Chairman BROOKS. The Chair now recognizes Mr. Lipinski from Illinois for an opening statement.

Mr. LIPINSKI. Thank you, Chairman Brooks. As a former social scientist this is a topic of particular interest to me. In the 110th Congress when Congressman Baird chaired this Subcommittee, he held a series of three hearings examining the role of social, behavioral, and economic sciences in helping develop solutions to some of society’s most pressing challenges.

There was a focus of these hearings on energy, national security, and health. During these hearings we heard testimony from 13 witnesses, all of whom agreed with little or no reservation that the SBE sciences provide significant benefits to the society and a good return on taxpayer investments.

Now, a few years before that when Republicans held the majority and my friend Bob Inglis chaired the Subcommittee, he held a hearing on the role of social science research in disaster preparedness and response. I want to elaborate a bit on that topic in particular because I believe that with the severe floods, tornados, wildfires, hurricanes, and oil spills that hit many of our communities in recent years and the loss of life and property we have witnessed from some of these events, especially just in the last few weeks, this will resonate with all of us.

The Geography and Spatial Sciences Program within the SBE Directorate has been instrumental in advancing the use of geographic information systems or GIS. These tools have helped us visualize and understand the vulnerabilities of communities to natural disasters, and they have helped policymakers make better decisions on where to site the critical infrastructure.

Science funded by the SBE Directorate also helps us understand how to plan for and respond to emergencies. I would particularly like to mention the Decision, Risk, and Management Science Program which aims to increase understanding and effectiveness of decision making by individuals, groups, organizations, and society.

Now, I am probably a little biased because I received my Master's degree in a somewhat related field, but I think this is an absolutely critical area of research. We saw the need in the BP oil spill with organizational and decision making problems compounding technological ones. We also are seeing evidence of human and regulatory failure at the Fukushima reactor in Japan. SBE research can help us better quantify and evaluate risks, build resilient organizations, and help emergency management planners develop the most effective strategies for keeping members of the community safe.

And then once the immediate danger has passed, science funded by the SBE Directorate helps us understand the short-term and long-term implications of how individuals and communities respond to these events.

Now, there are some who would presume to be able to determine whether a research proposal is important enough to society to merit support based solely on the title of the grant. I think a story from a few years back would be instructive and stands as a warning to those who try to judge a grant by its title, be it in SBE or any other field.

Forty years ago Senator William Proxmire created the Golden Fleece Awards long before Taxpayers for Common Sense appropriated the term. Senator Proxmire famously gave one of these awards to E.F. Knipling for his research on the sexual behavior of the screw-worm fly. The Senator did not know it at the time, but the screw-worm is a parasite that kills livestock and occasionally humans, and this particular line of research helped save the lives of millions of livestock and as a result saved the cattle industry \$20 billion.

That was a \$20 billion return on a \$250,000 grant. On top of that consumers enjoyed a five percent decrease in the cost of beef at the supermarket. Dr. Knipling earned—ended up winning the 1992 World Food Prize for his work on parasites, and the Senator ended up apologizing for his attack.

Now, I tell this story not because I want to pick on Senator Proxmire or because I think the NSF is perfect. Reasonable people might disagree about priorities within the SBE Directorate, and it is our job to be vigilant and to make sure that taxpayer dollars are being spent wisely. And in spite of my own background or maybe because of it I question the value of some social science research that I read sometimes out there.

I am going to paraphrase our former colleague, Dr. Baird, in saying that in today's hearing as in the previous four hearings I mentioned, I hope we are all prepared to have a rational discussion about the value of social, behavioral, and economic sciences overall to our society and to the taxpayer.

And so I thank the Chairman for holding this hearing today. As I said, I think it is always important that we do make sure that the taxpayers' money is being used wisely, and I want to thank our

witnesses for being here this morning. I look forward to your testimony.

[The prepared statement of Mr. Lipinski follows:]

PREPARED STATEMENT OF RANKING MEMBER DANIEL LIPINSKY

Thank you Chairman Brooks. As a former political science professor this is a topic of particular interest to me. In the 110th Congress, when Congressman Baird chaired this Subcommittee, he held a series of three hearings examining the role of the social, behavioral, and economic—or SBE—sciences in helping to develop solutions to some of society's most pressing challenges. The themes he selected were energy, national security, and health. During these three hearings, we heard testimony from 13 witnesses, all of whom agreed with little or no reservation that the SBE sciences provide significant benefits to society and return on taxpayer investments.

A few years before that, when Republicans held the majority and my friend Bob Inglis chaired this Subcommittee, he held a hearing on "The Role of Social Science Research in Disaster Preparedness and Response." I want to elaborate a bit on that topic in particular because I believe that with the severe floods, tornadoes, wildfires, hurricanes, and oil spills that have hit many of our own communities in the last few years, and the loss of life and property we have witnessed from some of these events just in the last few weeks, this will resonate with all of us. The Geography and Spatial Sciences Program within the SBE Directorate has been instrumental in advancing the use of geographic information systems—or GIS. These tools have helped us visualize and understand the vulnerabilities of communities to natural disasters, and they have helped policy makers make better decisions on where to site critical infrastructure.

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SBE research can help us better quantify and evaluate risks, build resilient organizations, and help emergency management planners develop the most effective strategies for keeping members of their communities safe. And then, once the immediate danger has passed, science funded by the SBE Directorate helps us understand the short-term and long-term implications of how individuals and communities respond to these events.

Now there are some who would presume to be able to determine whether a research proposal is important enough to society to merit support based simply on the title of a grant. I think a story from a few years back would be instructive and stand as a warning to those trying to judge a grant by its title, be it in SBE or any other field. Forty years ago, Senator William Proxmire created the "Golden Fleece Awards," long before Taxpayers for Common Sense appropriated the term. Senator Proxmire famously gave one of these awards to E.F. Knipling for his research on "The Sexual Behavior of the Screw-worm Fly." Now the Senator didn't know it at the time, but the screwworm is a parasite that kills livestock, and occasionally humans, and this particular line of research helped save the lives of millions of livestock and as a result saved the cattle industry \$20 billion. That was a \$20 billion return on a \$250,000 grant, by the way. On top of that, consumers enjoyed a 5 percent decrease in the cost of beef at the supermarket. Dr. Knipling, ended up winning the 1992 World Food Prize for his work on parasites, and the Senator ended up apologizing.

Now I tell this story not because I want to pick on Senator Proxmire or I think the NSF is perfect. Reasonable people might disagree about priorities within the SBE Directorate, and it is our job to be vigilant and to make sure that taxpayer dollars are being spent wisely. And in spite of my academic experience, I myself question the value of some of the social science research out there. But I am going to paraphrase our former colleague, Dr. Baird, in saying that in today's hearing, as in the previous four hearings I mentioned, I hope we are all prepared to have a rational discussion about the value of the social, behavioral, and economic sciences overall to our society and to the taxpayer. I want to thank the witnesses for being here this morning and I look forward to your testimonies.

Chairman BROOKS. Thank you, Mr. Lipinski, for your remarks and your insight. If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time I would like to introduce our witness panel. Dr. Myron Gutmann is the NSF Assistant Director for the Social, Behavioral, and Economic Science Directorate. Prior to his appointment at NSF he chaired the Inter-University Consortium for Political and Social Research at the University of Michigan and specializes in historical demography and population, environment relationships, with a focus on Europe and the Americas.

Dr. Hillary Anger Elfenbein, have I pronounced that correctly? Okay, thank you—is Associate Professor of the Olin School of Business at Washington University in St. Louis. She holds a Ph.D. in organizational behavior from Harvard and specializes in emotion in the workplace research.

Dr. Peter Wyatt Wood is President of the National Association of Scholars. Prior to this position, he had a distinguished career as Professor of Anthropology at both Boston University and at Kings College as well as provost at Kings College.

Ms. Diana Furchtgott-Roth. Did I get that one correct? Okay, thank you—is a Senior Fellow and Director of the Center of Employment Policy at the Hudson Institute. Prior to her current employment she was Chief Economist for the Department of Labor.

As our witnesses should know, spoken testimony is limited to five minutes each, after which the Members of the Committee will have five minutes each to ask questions.

I now recognize our first witness, Dr. Myron Gutmann, Associate Director, Directorate for Social, Behavior, and Economic Science, National Science Foundation.

**STATEMENT OF DR. MYRON GUTMANN,
ASSISTANT DIRECTOR, NSF SOCIAL, BEHAVIORAL,
AND ECONOMIC SCIENCE DIRECTORATE**

Dr. GUTMANN. Chairman Brooks, Ranking Member Lipinski, and Members of the Subcommittee, good morning. Thank you for inviting me to testify today about the important research that the National Science Foundation supports in the social, behavioral, and economic sciences and how that research is contributing to the Nation's benefit.

NSF is the only agency in the Federal Government that supports basic research in the social and behavioral sciences. It does so in an environment that encourages transformative scientific process, progress that crosses all boundaries.

Through the SBE Directorate, the NSF funds more than half of the university-based social and behavioral sciences research in the Nation and almost all of the transformative basic science research that our society requires. The American people can take great pride in our record of achievement, which includes support for 43 Nobel laureates in economics. Among them is the first woman to win the economics award, Dr. Elinor Ostrom.

Our sciences are concerned with human actions and decision making at every level and at every scale. Researchers study everything from the cells and structures of an individual brain to indi-

vidual behavior to the actions of social groups and organizations. Our mission in research and training encompasses the disciplines of neuroscience, psychology, geography, economics, anthropology, political science, sociology, and linguistics.

In addition to the two research divisions, the social and economic sciences division and the behavioral and cognitive sciences division, the SBE Directorate houses the National Center for Science and Engineering Statistics, which produces data about science and engineering that are widely used in higher education, industry, and government.

Through partnerships with other NSF Directorates and federal agencies the scientists we support bring their unique expertise to the scientific and societal problems of today and tomorrow. We have recently partnered with the Department of Defense to fund research that will help understand the challenges of terrorism and national security and advance democracy around the world.

In terms of the allocation of funding, our largest commitments are to economics, to neuroscience, psychology, learning, and language, to inter-disciplinary science related to decision making, and to our statistical programs. We also allocate resources to smaller programs based on the needs of the science, and the quality of the proposals we receive.

Thousands of scientists assess the merit of the 5,000 proposals we receive annually, leading to some 1,100 awards. Our basic research is transforming areas of science ranging from crisis management and response to the organization of the brain and ways that the brain converts thought to action. This is a body of work with potential implications for understanding autism, PTSD, and other cognitive disorders.

In one example, a team composed of SBE scientists, biomechanical engineers, computer scientists, and others built a brain computer language interface for an individual with complete paralysis. He learned to communicate using an artificial speech synthesizer controlled by his mental efforts.

U.S. taxpayers have already seen measurable gains, SBE-supported fundamental developments in geographical information systems. These technologies have resulted in a multi-billion dollar U.S.-based industry, jobs for our citizens, and great societal benefits.

In another notable example, researchers supported by SBE apply economic matching theory to develop a system for kidney transplants that shortened waiting times and has the potential to save thousands of lives.

Most dramatically for our Nation's spectrum auctions also based on theoretical research supported by SBE generated more than \$50 billion for the U.S. Treasury between 1994 and 2007. There is much more that our scientists can and will do in the future with our Nation's support.

Thank you for the opportunity to share some of our research with you today. I look forward to answering your questions.

[The prepared statement of Dr. Gutmann follows:]

PREPARED STATEMENT OF DR. MYRON GUTMANN, ASSISTANT DIRECTOR,
NSF SOCIAL, BEHAVIORAL, AND ECONOMIC SCIENCE DIRECTORATE

Chairman Brooks, Ranking Member Lipinski, and Members of the Subcommittee, good morning. Thank you for inviting me to testify today on the important work that the National Science Foundation (NSF) is supporting in the social, behavioral, and economic sciences and their contribution to the nation's future. Let me briefly describe the Directorate for Social, Behavioral, and Economic Sciences (SBE) before talking specifically to the innovative research we support and the ways it benefits the lives of the American people.

1. What is the mission and organization of the NSF Directorate for Social, Behavioral, and Economic Sciences?

The social, behavioral, and economic sciences—familiarily known as the “SBE sciences”—increase fundamental understanding of human social development and interaction and of human behavior, as individuals and as members of groups and more formal organizations. Our sciences contribute knowledge that has societal relevance and can inform critical national areas such as job creation, health care, education, public safety, law enforcement, and national security, among others. NSF's SBE directorate is unique in that it houses a mosaic of related programs enabling fundamental research in cross-cutting topics by combinations of economists, political scientists, sociologists, psychologists, linguists, neuroscientists, anthropologists, and other social and behavioral scientists. This focus on fundamental research allows us to collaborate effectively with our colleagues in other directorates and federal agencies to address problems that range from coastal flood response to the needs of an aging population, to preparing our military with the insights they need to understand behavior in a changing world.

Through the SBE directorate, the NSF funds approximately 57 percent of the university-based social and behavioral sciences research in the nation. The American people can take great pride in our record of achievement, which includes, for example, support for 43 of the Nobel laureates in economics since the award was first given in 1969. Among them is the first woman to win the award in economics, Dr. Elinor Ostrom, who shared the prize in 2009 with Dr. Oliver E. Williamson.

The directorate is organized into three divisions: Social and Economic Sciences (SES); Behavioral and Cognitive Sciences (BCS), and the National Center for Science and Engineering Statistics (NCSES, formerly known as Science Resources Statistics). NCSES is one of the major statistical agencies of the U.S. government and works with other federal and international statistical agencies to develop baseline statistical data on the science and engineering enterprise that is heavily used in higher education, industry, and government. This innovative unit has pioneered changes in survey design and new ways of presenting publications and data online to enable their broader access and use, and expects to pilot the Microbusiness Innovation Science and Technology survey and the Early Career Doctorates Survey in 2012. NCSES is the unit within NSF that provides the data and analytic support required by the National Science Board for the development and production of its biennial report on the U.S. and international science and engineering enterprise, *Science and Engineering Indicators*.

The Division of Social and Economic Sciences (SES) comprises eight programs that support research to develop and advance scientific knowledge focusing on economic, legal, political and social systems, organizations, and institutions. SES also supports research on the intellectual and social contexts that affect the development and use of science and technology and invests in research that advances statistical and survey methodologies and measurements. This difficult methodological work is central to reliable social science research and undergirds a range of studies from public opinion polls to studies of how Americans balance work and family life. SES cooperates with other federal agencies to fund three major national surveys that form the backbone of much social science research and teaching. For example, about 400,000 students per year use the General Social Survey (GSS) in their classes to study ways that American society has changed since 1972, and to learn research methods of social and statistical analysis.¹

The Division of Behavioral and Cognitive Sciences (BCS) encompasses ten programs that support research to develop and advance scientific knowledge, focusing on human cognition, neuroscience, child development, language, social behavior, and culture as well as research on the interactions between human societies and the

¹ The General Social Survey, <http://www.norc.oregonstate.edu/projects/General+Social+Survey.htm>. The other two surveys are the Panel Study of Income Dynamics (<http://psidonline.isr.umich.edu/>) and the American National Election Studies (<http://www.electionstudies.org/>).

physical environment. Understanding the brain and its development and learning how to deploy that understanding require research that spans a huge range, from the study of intricate cellular and molecular mechanisms at the neuronal level to the network activities of the entire brain to the physical and social context in which brains process information. A dramatic example is the demonstration of a brain-computer interface by which an individual with complete paralysis due to a brain-stem stroke was able to learn to communicate using an artificial speech synthesizer controlled by his mental efforts.²

Finally, my office, the Office of the Assistant Director, also houses several research programs through the SBE Office of Multidisciplinary Activities (SMA). These include support for cross-disciplinary activities, many of which partner with other directorates, as well as support for undergraduate and graduate students on whom future science depends. For example, Baruch College has developed a Research Experience for Undergraduates (REU) pipeline program that attracts and prepares students from diverse backgrounds to be competitive for entry into graduate programs in psychology and other scientific disciplines. Twelve of the 32 students who completed the program between 2007 and 2010 have applied to graduate programs in psychology (10) and medicine (2), and all have been accepted.³ Other REU programs have been designed to engage undergraduates in understanding research problems in disaster mitigation, preparedness, response and recovery, warnings and technology, and disaster vulnerability and resilience and the effects of fatigue on physiological, psychological, cognitive, behavioral, health, and social performance in military, medical, and law enforcement personnel. As the Baruch College experience shows, not only does this participation contribute to the nation's knowledge base but it also helps guide students into careers in these fields.

In addition, the directorate co-sponsors and leads STAR METRICS, a multi-year, multi-agency partnership with research institutions to measure the effects of research investments on innovation, competitiveness, and science. STAR METRICS brings together participating universities who voluntarily provide financial information. With these data, the program—for the first time—will be able to describe job creation from NSF investments at the county level for each participating university beginning with data supplied in the first quarter of this year.

In keeping with the insights that flow from interdisciplinary collaborations, there is substantial formal and informal cooperation among programs, both within and between the divisions as well as with programs in other directorates and agencies. For example, both SES and BCS support neuroscience research. In addition to research supported in the Cognitive Neuroscience program, the Perception, Action and Cognition program (SBE/BCS) supports neuroscience research across a range of topics, including cognitive flexibility, the neural basis for reading in deaf individuals, and visual attention, and the Decision, Risk and Management Sciences program in SBE/SES supports research on the neural basis for decision making and risk assessment.

SBE has longstanding partnerships with the NSF Directorates for Computer and Information Science and Engineering, Biological Sciences, Geosciences, and Engineering, as well as with the NSF Office of Cyberinfrastructure. These partnerships are critical to understanding science in its human context and to developing effective new technologies that will be used by Americans and will contribute to jobs and economic development. In the past, SBE has had programs with the Department of Defense, to assist them in understanding factors underlying conflict and cooperation. This year, we are again contributing to the multi-agency, international Digging into Data Challenge, led by the National Endowment for the Humanities, and will also contribute to the National Robotics Initiative. These partnerships bring SBE's expertise in understanding human behavior to the important national challenges of developing and using new technology and dealing with the flood of data confronted by our scientists and citizens.⁴

2. How are awards made and how are funding priorities established?

Approximately 5,000 research proposals are submitted to the directorate each year and about 1,100 awards are made after proposals are reviewed by competitive merit review advisory panels. Merit review is a critical element in the nation's re-

²NSF Award Number 0542013, "The Temporal Dynamics of Learning," Garrison Cottrell, Ph.D., Principal Investigator, University of California, San Diego, California.

³NSF Award Number 0648859, "Basic and Applied Dimensions of Scientific Psychology: Research Experience for Undergraduates at Baruch College—CUNY". Charles Scherbaum, Principal Investigator. CUNY Baruch College, New York.

⁴David Lazer et al., "Computational Social Science," *Science* 323, no. 5915 (6 February 2009): 721–23; Gary King, "Ensuring the Data-Rich Future of the Social Science," *Science* 331, no. 6018 (11 February 2011): 719–21.

search enterprise, which has been a key to America's track record in scientific innovation, something that will fuel American competitiveness in the next century. NSF's review processes remain, in the words of the National Academies, among "the best procedures known for insuring the technical excellence of research projects that receive public support."⁵ All research proposals are evaluated by a combination of written reviews, discussions by advisory panels, and consideration by scientific program officers before awards are made. Overall, in the 2010 funding cycle, many thousands of scientists from the U.S. and overseas wrote reviews and participated in SBE panels and advisory committee meetings to provide independent advice on individual applications and the directorate's programs. The divisions, major programs, and research offices are regularly reviewed by external Committees of Visitors, and an Advisory Committee to the directorate meets twice a year.

Funding priorities are established by the merit review process, with guidance from advisory groups and after discussions among the NSF leadership. Eighty to eighty-five percent or more of awards made by SBE are submitted to the programs described above in BCS, SES, and SMA and reviewed by program officers and panels before decisions are made. The remaining fifteen to twenty percent of awards are the result of cross-disciplinary competitions in which SBE is a participant. These competitions are generated by discussions among staff at the program officer, divisional leadership, and assistant director level, in order to arrive at broad scientific discoveries. Recent successful examples of specialized competitions include our Decision Making Under Uncertainty program; Cyber-enabled Discovery and Innovation; Water, Sustainability, and Climate; and the Digging into Data Challenge.

In the broadest sense, SBE makes use of multiple mechanisms to consult with the public, the scientific community, and other agencies to understand scientific priorities and make plans for the future. NSF was one of several agencies that contributed to the 2009 publication, *Social, Behavioral, and Economic Science in the Federal Context* a publication of the NSTC's Committee on Science's SBE Subcommittee.⁶ Over the past year NSF's Advisory Committee for the Social, Behavioral and Economic Sciences has been at work on a report on future areas of scientific development in the SBE sciences, which we expect to be produced in fall 2011. I have also led an effort called "SBE 2020" to collect ideas from individuals and groups about how to plan for SBE science a decade from now. We received many suggestions in response to this request. I have begun discussing our conclusions from this activity, and we expect to issue a formal report this summer. All these efforts help us to build on the successes of our existing programs while we plan and set funding priorities for the future.

Assessment and evaluation is an important element in this process, and it requires a science of its own. That's why SBE developed the Science of Science and Innovation Policy Program (SciSIP), why we took the lead in the STAR METRICS activity, and why we continue to find innovative ways to spur the science of innovation and to evaluate our own work.⁷ That is also why we invest so heavily in the National Center for Science and Engineering Statistics, and in its publications.

3. What are the benefits to the U.S. taxpayer?

The National Science Foundation is unique in its support for fundamental research across all of the fields of science and engineering together with the educational programs that sustain them. As NSF Director Dr. Subra Suresh said in his congressional testimony earlier this year, the foundation "advances the frontiers of all scientific disciplines and it develops the human capital to forge the next generation of breakthroughs."⁸ SBE scientists study topics as diverse as the developmental psychology of children as young as five months and the causes and consequences of terrorism. Our sciences have the potential to offer an integrated view of a single broad topic across multiple scales, and our findings lead to fundamental insights and point toward solutions that affect job creation, health care, public safety, education, and other shared national and international challenges. In the last year, for example, SBE supported neuroscience researchers at Stanford University who used

⁵ Committee on Science, Engineering, and Public Policy, *Major Award Decisionmaking at the National Science Foundation* (Washington, DC: National Academy Press, 1994), p. 1.

⁶ National Science and Technology Council, Subcommittee on Social, Behavioral and Economic Sciences, *Social, Behavioral, and Economic Science in the Federal Context*, 2009. <http://www.whitehouse.gov/galleries/NSTC%20Reports/SBE%20in%20the%20Federal%20Context%20for%20NSTC%204-21-09.pdf>

⁷ Comparative Assessment of Peer Review (CAPTR) Workshop, April 22–23, 2010, <http://scienceofsciencepolicy.net/event/comparative-assessment-peer-review-capr-workshop>

⁸ Dr. Subra Suresh, Remarks on the NSF's 2012 Budget Request to Congress, February 14, 2011, <http://www.nsf.gov/news/speeches/suresh/11/ss110214—nsfbudget.jsp>

functional magnetic resonance imaging (fMRI) to study the anatomy of the human visual cortex and its response to images of faces and limbs. Their findings overturned two prior theories of the brain's organization and may have application to autism and other cognitive disorders.⁹

This example plus ones mentioned earlier suggest the range and complexity of the SBE sciences. I would like to take the rest of my time to talk in more detail about some of the work that has had immediate benefit while illustrating some of the long-term research challenges.

3.1 SBE research has resulted in measurable gains for the U.S. taxpayer

Matching markets and kidney transplants. Researchers in economics at Harvard University, the University of Pittsburgh, and Boston College have applied economic matching theory to develop a system that dramatically improves the ability of doctors to find compatible kidneys for patients on transplant lists. Organ donation is an example of an exchange that relies on mutual convergence of need. In this case, a donor and a recipient. This system allows matches to take place in a string of exchanges, shortening the waiting time and, in the case of organ transplants, potentially saving thousands of lives.¹⁰ Similar matching markets exist in other contexts, for example, for assigning doctors to residencies.

Spectrum auctions. Spectrum auctions have generated \$54 billion for the U.S. Treasury between 1994 and 2007 and worldwide revenues in excess of \$200 billion. Researchers at Stanford University and the California Institute of Technology, supported by grants from SBE, developed the simultaneous ascending auction mechanism as a technique for auctioning off multiple goods whose values are not fixed but depend on each other. The mechanism was then tested experimentally and further refined before being implemented by the Federal Communications Commission. In this auction, all of the goods are on the selling block at the same time, and open for bids by any bidder. By giving bidders real-time information on the tentative price at each bid stage, bidders can develop a sense for where prices are likely to head and adjust their bids to get the package of goods they want. This process enables "price discovery," helping bidders to determine the values of all possible packages of goods. These auctions not only raise money, but ensure efficient allocation of spectra so that the winners of the auction are indeed the individuals who value the spectra the most. Applied with great benefit for the U.S. taxpayer in the FCC spectrum auctions, this method has also been extended to the sale of divisible goods in electricity, gas, and environmental markets.¹¹

3.2 SBE investments in innovation have improved disaster and crisis response

Geographic Information Systems (GIS). SBE has supported development of Geographical Information Systems technologies, which have produced both great societal benefits and the creation of an extremely valuable industry. In the mid-1980s NSF made a commitment to fund the National Center for Geographic Information and Analysis (NCGIA) at three universities, the University of California, Santa Barbara, the University of Maine, and the State University of New York at Buffalo. The research supported there contributed significantly to the development of the multi-billion-dollar Geographic Information Systems (GIS) industry. These systems are now applied by states, counties, and localities for many purposes, from planning to disaster response, evidenced in New York City during the September 11, 2001 attacks. GIS also became the backbone of crime mapping activities such as CompuStat that have played such an important role in the crime reduction America has experienced in the past two decades. These GIS systems are also used by the private sector to improve delivery systems and to plan for the locations of stores and other businesses. The NCGIA continues to this day, now as an independent body, exploring ways of making GIS better and helping to educate new users.

⁹ NSF Award Number 0920865, "Face Perception: Mapping Psychological Spaces to Neural Responses," Kalanit Grill-Spector, Principal Investigator, Stanford University, California.

¹⁰ NSF Award No. 0616470, "Collaborative Research: Kidney Exchange," Tayfun Sonmez, Principal Investigator, Boston College, Massachusetts; NSF Award Number 8908696, "Coordination and Operation of Two-sided Matching Markets: Theory and Evidence," Alvin Roth, Principal Investigator, University of Pittsburgh, Pennsylvania; NSF Award Number 9121968, "Jumping the Gun: Intertemporal Instability in Two-sided Matching and Related Markets, Theory and Evidence," Alvin Roth, Principal Investigator, Harvard University, Massachusetts.

¹¹ NSF Award Number 9207850, "Topics in Price Theory and Game Theory," Robert Wilson, Principal Investigator, Stanford University, California; NSF Award Number 9320733, "Complementarity: Comparative Statics, Coordination and Change," Paul Milgrom, Principal Investigator, Stanford University, California; NSF Award Number 9512394, "Development of Instrumentation for Institutional Process Design and Laboratory Testing in Economics and Political Science," Charles Plott, California Institute of Technology, California.

The earthquake and tsunami in Japan together with our own experiences in the wake of Hurricanes Katrina and Rita, recent tornados in Alabama and Missouri, and flooding along the Mississippi River amplify the importance attached to understanding how people behave in time of crisis, which enables better advance planning and improves first responses. SBE has supported science in these areas by funding researchers who explore and simulate human evacuation behavior, as well as teams of researchers who conduct fieldwork in the immediate aftermath of a disaster in Louisiana (2005),¹² Chile (2010),¹³ and the Gulf after the Deepwater Horizon oil spill (2010).¹⁴ SBE also funds constructing computational simulations to detect subtle changes and behaviors under different conditions. For example, researchers at the University of Michigan and the University of Delaware simulated a building's collapse in order to observe people's reactions to the physical disaster, in order to better understand how to prepare for similar events.¹⁵ Investigators at Arizona State University and the University of Central Florida built models of pedestrian behavior that could be used to compare and predict behavior under both calm and emergency conditions, leading to more effective evacuation strategies, disaster planning, and assistance for first responders.¹⁶

Two findings that weave through much of this research are the importance of protecting social networks—evacuees after Hurricane Katrina and the Gulf oil spill fared better when their families and social networks were retained—and the importance of sustaining trust. Indeed, those evacuees whose social contexts were preserved were more cooperative and willing to trust the government.¹⁷

Engaging citizens. One of the outcomes of these studies is a changed view of citizen involvement. Rather than seeing residents as passive observers or as victims, new findings show ways in which individuals actively participate in managing and responding to crises. Scientists at UC–Santa Barbara, the University of Washington, and Texas A&M University are in the second year of a three-year award to study the phenomenon of volunteered geographic information, which is part of a larger trend of user-generated content enabled by contemporary information and communication technologies. We have already witnessed how the wide distribution of handheld and mobile devices together with access to fast connections and the ease of uploading information have contributed to this year's Arab Spring. Closer to home, citizens have contributed real time, highly detailed, local observations that take on special significance in responses to crises, like floods or wildfires where conditions can change rapidly. Citizen-supplied real-time information about the location of a wildfire can save lives and dollars by allowing first responders to do their job more effectively. We have already witnessed outpourings on Twitter and other social media during crises. The point of the study is to go beyond anecdotal information and to test accuracy and quality of the data, examine methods for synthesizing and analyzing it, and understand motivations for participation.¹⁸

3.3 SBE's long term investment in fundamental research enables breakthroughs in key areas

Decentralized decision-making and shared resources. Rich traditions in sociology, political science, economics, and psychology have explored models of indi-

¹² NSF Award Number 0552439, SBIR: Cooperation among evacuees in the aftermath of Hurricane Katrina, Rick Wilson, Principal Investigator, Rice University, Houston, Texas

¹³ NSF Award Number 1036354, "RAPID: Collaborative Research: The Political Costs of Natural Disasters: Democratic Support, Authoritarian Attitudes, and Blame Attribution after Chile's 2010 Earthquake," Gregory Love, Principal Investigator, University of Mississippi, Mississippi.

¹⁴ NSF Award Number 1042786, "RAPID: Social Context and Emotional Response to Disaster," Christopher Kenney, Louisiana State University & Agricultural and Mechanical College, Louisiana

¹⁵ NSF Award Number 0824737, "Collaborative Research: Project IBORC: Interaction between Building and Occupant Responses during Collapse," Serif El-Tawil, Principal Investigator, University of Michigan Ann Arbor, Michigan.

¹⁶ NSF Award Number 0643322, "CAREER: Exploring the Dynamics of Individual Pedestrian and Crowd Behavior in Dense Urban Settings: A Computational Approach," Paul Torrens, Principal Investigator, Arizona State University, Arizona; NSF Award 0527545, "DHB—Modeling in Social Dynamics: A Differential Approach," David Kaup, Principal Investigator, University of Central Florida, Florida.

¹⁷ NSF Highlight ID 22702, "Preparing for the Aftermath of Crisis"; see also NSF Award Number 0728934, "DRU Modeling Communication Response and Economic Impacts of Risk Amplification following a Terrorist Strike," William Burns, Principal Investigator, Decision Science Research Institute, Oregon.

¹⁸ NSF Award Number 0849910, "Collaborative Research: A GIScience Approach for Assessing the Quality, Potential Applications, and Impact of Volunteered Geographic Information," Michael Goodchild, Principal Investigator, University of California-Santa Barbara, California.

vidual and group conflict, competition, and cooperation, resource allocation, and markets. Nobel laureate Ostrom, who now holds appointments at Indiana University and Arizona State University, has done fundamental work with her colleagues over the last 30 years in so-called “common pool resources.” A “common pool resource” is a naturally occurring or human constructed system, like fishing grounds, water, forests, pasture, or irrigation systems, that is typically shared and is vulnerable to overuse, congestion, or potential destruction.

Ostrom combines fieldwork, observation, and laboratory studies to articulate formal models about trust, behavior, and cooperation that show the conditions under which groups will cooperate to manage shared, vulnerable resources, like forest and irrigation systems, without outside intervention. For example, when she studied irrigation systems in Nepal, she found that the farmers’ systems were relatively “primitive” from the perspective of engineering but the farmers were able to grow more crops and run their systems more efficiently than those designed by outside experts.¹⁹ Ostrom’s work, like others, points to the importance of understanding interactions in a context of “nested systems” of local, regional, and national governance and, in particular, to the importance of understanding local decision making. In a series of studies of self governing communities, researchers at the University of Michigan,²⁰ UC–Davis,²¹ and University of Colorado²² have continued to identify the importance of local or municipal decision making and the conditions under which self-governance is likely to be successful.

Brain, cognition, and learning. Recent research in the developmental sciences shows us the importance of engagement in learning and that this engagement can begin at a very young age. Several separate but converging lines of research have enhanced our understanding of cognitive and social development from infancy to adolescence and, in particular, the importance of being an active and engaged learner. For example, scientists at the University of Delaware developed a type of joystick mechanism that enables infants to drive a small motorized robotic device, which showed that children’s general language and motor development are improved through the enhanced mobility experience with the driving device.²³ This suggests that infants who are able to control their movements through the environment are stimulated and learn about their world in a way that has a direct and lasting influence on their cognitive, social, language and motor abilities.²⁴ Researchers at Indiana University have also found that children learn words for objects more readily when allowed to hold the object rather than just seeing the object held and labeled in front of them.²⁵ Finally, a stream of collaborative research has looked at the influences of television, videos, and computer games on children from infancy to 6 years old, suggesting that young children may face limitations in ability to understand information contained in these media. One set of studies even found that slower language development was associated with use of a popular early childhood video that is advertised as being educational. However, the findings also suggest that when children are actively engaged in viewing television or videos with an adult who can label the content and ask questions and provide narration, children’s ability to learn the content provided in the video is enhanced.²⁶

¹⁹ Elinor Ostrom, *Beyond markets and States: Polycentric Governance of Complex Economic Systems*, December 8, 2009, Slide 24 <http://nobelprize.org/nobel-prizes/economics/laureates/2009/ostrom-lecture-slides.pdf>

²⁰ NSF Award Number 0961868, “Collaborative Research: Do Institutions Affect the Attitudes and Behavior of Constituents? Evidence from an Environmental Management Program in India,” Elisabeth Gerber, University of Michigan Ann Arbor, Michigan

²¹ NSF Award Number 0921904, “Collaborative Research on Governing Complex Commons: Policy networks in an Ecology of Games,” Mark Lubell, Principal Investigator, University of California–Davis, California

²² NSF Award Number 0648447, “Decentralization, Local Institutions, and Environmental Change: A Cross-Sectional Time-series Study of Forest Governance in Latin America,” Krister Andersson, Principal Investigator, University of Colorado at Boulder, Colorado.

²³ NSF Award 0745833, “Robot Enhanced Mobility: The Capacity for Your Infants to Learn Real World Navigation, and its Effect on Perception, Action and Cognition Development,” James Galloway, Principal Investigator, University of Delaware, Delaware.

²⁴ NSF Award Number 0745833, “Robot Enhanced Mobility: The Capacity for Your Infants to Learn Real World Navigation, and its Effect on Perception, Action and Cognition Development,” James Galloway, Principal Investigator, University of Delaware, Delaware

²⁵ NSF Award Number 0924248, “The Sensorimotor Dynamics of Naturalistic Child-Parent Interaction and Word Learning,” Chen Yu, Principal Investigator, Indiana University, Indiana; NSF Award Number 0544995, “Grounding Word Learning in Multimodal Sensorimotor Interaction,” Chen Yu, Principal Investigator, Indiana University, Indiana.

²⁶ NSF Award Number 0623871, “IRADS Collaborative Research: Influences of Digital Media on Very Young Children,” Sandra Calvert, Georgetown University, Washington, DC; NSF Award Number 0623856, “IRADS Collaborative Research: Influences of Digital Media on Very Young Children,” Elizabeth Vanderwater, Principal Investigator, University of Texas at Austin, Texas;

One of the remarkable features of this research is the very young age of the subjects. Other studies show that infants take in a surprising amount of information in the first months of life. A team at UCLA found that the ability to distinguish between languages develops between the ages of 5 and 7 months,²⁷ and a second team at Yale showed that infants as young as 6 months could begin to interpret social interactions. In their experiments, an infant who sees one puppet helping another puppet is likely to exhibit a preference for that helper in the future. Conversely, infants will then avoid a puppet that “hinders” the goals of another. Even many developmental scientists were surprised that children this young have the ability to reason about complex social behaviors like “helping” and “hindering”.²⁸

Understanding learning is a key that helps unlock important questions in education, learning, and parenting as well as the interaction between individuals and their environment. NSF’s role in this area is unique because of the ability to support basic cognitive science, neuroscience, and social science about learning. Consider just one example: A psychologist at Boston University is investigating how emotion enhances memory, and how it interferes with memory. Understanding how memory and emotion interact may have important implications for evaluating eyewitness testimony, including the influence of biases and stereotyping (which an anthropologist at Emory University is studying). Together, these studies of how neural mechanisms of encoding and recall are affected by emotion may yield better understanding of the biological basis for memory deficits that accompany mood disorders such as post-traumatic stress disorder (PTSD), depression, and anxiety. NSF does not fund clinical research, but the basic research it funds yields knowledge of cognitive deficits and affected brain regions can inform studies of specific neurotransmitters and pharmacological interventions and the development of more accurate diagnostic tools.

Relevance to national security. In recent decades, research supported by NSF has produced new understandings of human development and social dynamics; of perception, memory, linguistic, and reasoning processes; of how people behave as individuals and collectively; and insight into economic systems, all topics that bear upon understanding the threats to our national security and crafting robust interventions and responses. For example, a recent project found that intermediate levels of political freedom and geographic factors contribute significantly to causes of terrorism, challenging the common view that terrorism is rooted primarily in poverty.

NSF also supports significant levels of fundamental research in the major research areas identified in the National Research Council’s “Human Behavior in Military Contexts” 2008 report. Here are a handful of examples: Investigators at the University of Michigan studied ethical and religious motivations in political and economic choices. This work not only challenges conventional models of decision making but is particularly important for understanding regional conflicts and local cultural and political systems heavily influenced by differing ethical and religious values.²⁹ It has direct application to helping warfighters and humanitarian aid workers develop essential intercultural competences. Another team at Miami University (Ohio) is studying group behavior in problem solving under different conditions and ways in which problem solving may contribute to group cohesion, which is a common set of social dynamics in the armed services.³⁰ Finally, a number of projects look at the role of emotions in social interactions and verbal and non-verbal communication. These projects contribute to our ability to detect deceptive behaviors and speech as well as facilitate interactions in cross-cultural contexts or contexts in which verbal communication may be insufficient, for example, when managing a crisis involving non-English speakers.

NSF Award Number 0623888, “IRADS Collaborative Research: Influences of Digital Media on Very Young Children,” Daniel Anderson, Principal Investigator, University of Massachusetts at Amherst, Massachusetts.

²⁷ NSF Award Number 0951639, “Development of Native Language Preference: Behavioral and Physiological Indices,” Megha Sundara, Principal Investigator, University of California-Los Angeles, California; NSF Award Number 0957956, “Development of Phonotactic Knowledge in Infancy,” Megha Sundara, Principal Investigator, University of California-Los Angeles, California.

²⁸ NSF Award Number 0715557, “Social Evaluation in Infants and Toddlers,” M. Karen Wynn, Principal Investigator, Yale University, Connecticut.

²⁹ NSF Award Number 0527396, “Sacred Values in Decision Making and Cultural Conflict,” Scott Atran, Principal Investigator (lead), Douglas Medin (Co-Principal Investigator), Jeremy Ginges (Co-Principal Investigator), Jessica Stern (Co-Principal Investigator), University of Michigan Ann Arbor, Michigan.

³⁰ NSF Award Number 0744696, “Coordination in Small Groups: Matching and Mismatching,” Susanne Abele, Principal Investigator, Garold Stasser (Co-Principal Investigator), Miami University, Ohio.

Ultimately, the goal is to integrate findings across necessarily specialized research areas so that we eventually will unpack the relationships between brain and behavior, among individuals, and between individuals, groups, and their social and physical environments.

Thank you for the opportunity to share some of our research with you today. I look forward to answering your questions.

Chairman BROOKS. Thank you, Dr. Gutmann.

Next the Chair recognizes our second witness, Dr. Hillary Anger Elfenbein, Associate Professor, Washington University in St. Louis.

**STATEMENT OF DR. HILLARY ANGER ELFENBEIN,
ASSOCIATE PROFESSOR OF ORGANIZATIONAL BEHAVIOR,
WASHINGTON UNIVERSITY IN ST. LOUIS**

Dr. ELFENBEIN. Chairman Brooks, Ranking Member Lipinski, and distinguished Members of the Committee, it is an honor to appear before you today. I have been asked here to speak about my basic research in the social and behavioral sciences and how that work is being used by the military, business, and medicine to create a valuable return on investment for the U.S. taxpayer.

My core research is in the area of emotion recognition, that is our ability to recognize another person's facial expressions, vocal tones, and body language. This is a skill so fundamental that its absence is a warning sign of serious disorders such as schizophrenia and autism, which is a growing epidemic in our country. Basic research to understand topics like this serves as a foundation for later applications that can sometimes be years down the road.

The Army Research Institute took the initiative to use my research showing that emotion recognition accuracy partially breaks down across cultures. To quote them, "The course of events in Iraq and Afghanistan has emphasized the role of human rather than technological solutions in influencing the outcome of conflicts, making interpersonal skills an increasingly important set of tools for the war fighter."

In some cases errors in non-verbal communication have been tragic. For example, at checkpoints in Iraq where soldiers have been involved in needless escalation of conflict with civilians because they could not tell who did versus did not wish them harm. I recently served as a consultant for the Army's efforts to incorporate non-verbal communication training for our men and women going overseas.

My work is also used by industry as businesses increasingly focus on emotional intelligence and other related skills in the workforce to achieve a competitive edge. Our U.S. economy is increasing service-oriented, collaborative, and global.

My work also has applications in medicine, given that the link between emotional skills and emotional disorders is so strong that some researchers use emotion recognition tests as a way to monitor the effectiveness of their medical treatments.

As a business school professor I cannot help but point out the unusually high rate of return that we receive from investments in the basic sciences. America's support of cutting-edge basic research is an engine of innovation that creates university-level opportunities, attracting the best minds from all over the world. Education is a large export industry. Top scientists often stay in the U.S., start

companies here, and pay taxes here, repaying the federal investments many times over.

Only the public sector can make these investments because industry support is for research that has advanced closer to commercialization. Agencies like the NSF are in the best position to prioritize federal funding for SBE research because they draw from groups of scientists across a range of disciplines and perspectives rather than to rely on any one person's expertise.

The social and behavioral sciences in general are important because technology, health, industry, and politics are ultimately in the hands of people who behave rationally and irrationally. A critique often leveled at social scientists is that our research is obvious. Although findings can seem intuitive, the scientific process has demonstrated that many intuitions are wrong.

For example, strange behavior is no more common at the full moon, people do not blindly follow suggestions under hypnosis, and people with schizophrenia do not have multiple personalities. These findings are useful beyond their mere curiosity value in addressing real problems.

For example, the stigma and misunderstanding around mental illnesses such as schizophrenia prevents many people from seeking treatments that are readily available for the benefit of their families and for economic productivity.

In addition to intuitions that are wrong, some intuitions are also contradictory. For example, "too many cooks spoil the broth," and yet "many hands make light the work." When staffing a team, we need to know which one is right.

Ultimately in supporting basic research the nature of the scientific process is such that you cannot predict in advance where each project will go. That is why it is important to fund a portfolio of projects with the expectation that some may pay off but some may not.

From my own experience I can tell you that I did not anticipate the military applications at the time that I did my work. Indeed, in the spring of 2007 a first year member of Congress proposed canceling my NSF grant because he thought the title sounded silly. Ironically, this occurred just as the Army identified this same basic research as having applications for training our war fighters, and they issued a call for applied research that extended these basic findings.

This experience highlighted for me the relationship between basic and applied research; and how basic—how applied research uses basic research as its foundation. The NSF funds basic research. Some people might ask at a time of fiscal crisis whether we can afford to fund the social and behavioral sciences. I believe that we can't afford not to.

Thank you for this opportunity to speak today, and I would be glad to answer any questions you might have.

[The prepared statement of Dr. Elfenbein follows:]

PREPARED STATEMENT OF DR. HILLARY ANGER ELFENBEIN, ASSOCIATE PROFESSOR,
WASHINGTON UNIVERSITY IN ST. LOUIS

Introduction

Chairman Brooks and distinguished Members of the Committee, it is an honor to appear before you to discuss the important topic of federal funding in the Social, Behavioral, and Economic (SBE) sciences.

I've been asked to speak about my own basic research in the social and behavioral sciences, and how that work is being used by the military, business, and medicine to create a valuable return-on-investment for the US taxpayer. In addition, I have been asked to answer a number of questions relating to why it is in the taxpayer's interest to fund the SBE sciences, and how these funds should be prioritized.

Overview of my work in SBE

The request for written testimony asked: "Please provide an overview of your work in the social, behavioral, and economic (SBE) sciences, including how your work has been funded, how it is being used, and by whom."

My core research is in the area of emotion recognition—that is, our ability to recognize another person's emotions via nonverbal cues that include facial expressions, vocal tones, and body language. Emotion recognition is a skill so fundamental that its absence is a warning sign of serious disorders such as schizophrenia and autism, which is a growing epidemic in our country. In daily life, we often realize just how important emotion recognition is when we lose it temporarily through the use of email and text messages without access to nonverbal cues. For example, a member of Congress might use Twitter or a Blackberry to send messages to staff members or constituents, and find that some messages were misinterpreted with potentially harmful consequences.

Although this research topic may first seem a bit obscure, it is worth pointing out that I first became interested in emotion recognition while working in industry as a management consultant. It became clear to me in my day-to-day work that people were attempting to read each other's emotional expressions—not in an attempt to be social friends, but rather to get the crucial feedback they needed to get their jobs done. For example, formal performance reviews were time consuming to conduct and as a result occurred only infrequently, and between these reviews colleagues depended largely on supervisors' implicit reactions to the quality of their work. Likewise, in the absence of parliamentary procedures, turn-taking in meetings can be very implicit, and many times people are unsure whether they have the floor to speak—or whether they need to keep their good ideas to themselves. In the consulting industry, one speaks of "managing client expectations," for which recognizing the emotion of surprise loomed large as a sign that expectations were being violated in some way. As another example, it often took attention to subtle cues in order to know whether a colleague was being sarcastic versus sincere. Without catching the certain tone of voice, it was possible to disagree about whether a colleague meant what he had said—or whether he meant exactly the opposite. In becoming fascinated with these dynamics, it was clear to me not only that real people were making these kinds of judgments on a regular basis, but also that they were frequently getting them wrong. In getting these judgments wrong, their workplace, productivity suffered.

Having become interested in this topic, and reading about what scholars already knew, I found that questions about emotion recognition in the workplace were at the cutting edge of our scientific understanding. It also became clear that the importance of these and related emotional abilities was an idea resonating far outside of university walls. Notably, Daniel Goleman's books on *Emotional Intelligence* were runaway best-sellers—as of 2002 out-selling all but one of Forbes' 20 Most Influential Business Books of the previous two decades.

It was in this context that, after undergraduate training in Physics and Sanskrit language, I returned to Harvard to pursue a Ph.D. in the joint program in Organizational Behavior that combined graduate training in Psychology and Business. During these studies, I also earned a M.A. degree in Statistics and completed the required curriculum of the Master's in Business Administration (MBA). My graduate education was supported by a scholarship from the National Science Foundation.

Since that time, I have published a range of papers in internationally-respected academic journals in business and psychology. My three primary streams of research address in different ways how individuals navigate the social environment of their workplace. The first stream examines how co-workers' accuracy in understanding each other's emotional expressions contributes to individual and team-level workplace effectiveness. The second stream examines the impact of cross-cultural differences on the ability to understand emotions. Taken together, these two lines

of research contribute not only to our understanding of basic science, but also hold promise for applications to the challenges faced by today's firms and non-profits, which are more demographically diverse and global than ever before. My third stream of research addresses the dynamics of social interaction within workplace settings, including areas such as the role of personality on negotiation performance. The consistent thread running through my research is that it focuses primarily on how individuals interact with and judge other individuals.

I attempt to work as a basic scientist and also a boundary spanner, drawing on work across SEE and other domains to understand organizations and the people working in them. My 27 peer-reviewed articles and 8 invited chapters include publications in the *Academy of Management Annals*, the *Academy of Management Journal*, the *Journal of Applied Psychology*, the *Journal of Personality and Social Psychology*, *Organization Science*, *Psychological Bulletin*, and *Psychological Science*. The researchers who cite this work in their own research are even more diverse—with a count of over 575 citations spread across academic publications in business management, organizational behavior, social psychology, and personality psychology, as well as other areas ranging from cognitive neuroscience to clinical psychology, medicine, artificial intelligence, and developmental psychology.

Funding

In chronological order, I have been the recipient of three federal grants:

1. *National Science Foundation (NSF), Graduate Research Fellowship (GRF), \$75,000, 1998-2001.*

This was a three-year scholarship that paid for tuition in graduate school as well as basic living expenses. Awarded through a competitive process, these scholarships are intended to allow high-potential scientists to focus on their coursework and research. In my case, having scholarship assistance in graduate school allowed me to conduct the particular work described below that was singled out by the Army Research Institute.

2. *National Institute of Mental Health (NIMH), Behavioral Science Track Award for Rapid Transition (BSTART) Grant, "Effective Behavior through Understanding Emotion," R01MH071294-01, \$72,792, 2004-2006.*

This grant was part of an early-career program by the NIMH, with the intention to provide start-up funds for high-potential new faculty members doing research related to mental health. In my case, the link is a strong one, given that serious mental illnesses such as schizophrenia, autism, and alexithymia are characterized by deficits in emotion recognition among other symptoms. Thus, emotion recognition has been an area of intense collaboration and interchange among social psychologists, clinical psychologists, and physicians. The work funded by this grant has produced 3 academic publications, 1 paper in progress, 6 conference presentations, and contributed to the training of 3 doctoral students and numerous undergraduates.

3. *National Science Foundation (NSF), Social Psychology Program Grant, "Accuracy in the Cross-cultural Understanding of Others' Emotions," BCS-0617634, \$205,517, 2006-2012.*

This grant has been instrumental in expanding my stream of research on cross-cultural differences in the non-verbal communication of emotion. To date, the work funded by this grant has produced 2 publications, 8 papers in progress, and 11 conference presentations. In total, this work has contributed to the training of 1 post-doctoral fellow, 8 doctoral students, and numerous undergraduates, and has also involved 4 early-stage faculty members other than myself—from 10 different institutions around the world.

How the work is being used and by whom

The primary applications of my research have been in the military, business, medical, and educational settings.

Military Applications

The Army Research Institute took the initiative to use my research showing that emotion recognition accuracy partially breaks down across cultures. To quote them: "The course of events in Iraq and Afghanistan has emphasized the role of human rather than technological solutions in influencing the outcome of conflicts, making interpersonal skills an increasingly important set of tools for the warfighter." (See the Appendix)

In many theaters of war, we have too few translators and soldiers rely heavily on nonverbal communication. Even with sufficient numbers of translators, the initial moments of interacting with an enemy combatant or civilian can be too brief for conversation. This means that proper interpretation of nonverbal communication

is an important aspect of determining who is a friend versus foe in high-stakes situations. In some cases, mistakes are tragic, for example at checkpoints in Iraq where soldiers have been involved in potentially avoidable escalation of conflict with civilians because they could not tell who did versus did not wish them harm. Soldiers now know that the raised fist means nothing in Iraq and the upheld hand, if anything, means that it is safe to approach.

I recently served as a consultant for the ARI's efforts to incorporate nonverbal communication training for our men and women going overseas.

Business Applications

My work is also used by industry, as businesses increasingly focus on emotional intelligence and related skills in their workforce to achieve a competitive edge. The US economy is increasingly service-oriented, collaborative, and global.

For example, foreign auto companies build manufacturing plants in the United States, with the need for managers from abroad to communicate clearly with their American workers and vice versa. My research on training shows that biology is not destiny—that is, we can learn to recognize emotional expressions from a foreign culture with sufficient practice. Surprisingly, however, we do not learn these skills effectively from the traditional classroom setting that is effective in teaching most other topics.

As part of my focus on real-world business settings, I have been conducting workshops with business executives with guidance on how they can improve their emotional skills. Also relevant to business applications is the need to develop testing emotional skills, which can ultimately be used in hiring, training, and promotion. This is an area in which additional basic research is desperately needed, to keep up with the clamoring of interest from the public and industry to develop comprehensive tests of emotional skills.

Medical Applications

My work also has applications in medicine, given the link between emotional skills and emotional disorders. Many serious medical conditions involve an inability to identify and produce socially appropriate emotional expressions. One of these disorders is schizophrenia—a debilitating disease that is overrepresented in Veteran's Administration hospitals because its age of onset corresponds approximately to the age of men and women joining military service. Another one of these disorders is autism—a condition affecting both children and adults in our country. Autism is a growing epidemic so worrisome that many parents risk exposing their children to infectious disease out of an erroneous belief that vaccinations are linked to autism. Given these links, emotion recognition has been an area of intense collaboration and interchange among social psychologists, clinical psychologists, and physicians.

My recent NSF-funded basic work has revealed an opportunity to save scarce health-care dollars. Given the links described above, doctors and medical researchers have often used emotion recognition tests as a way to monitor patients' response to treatment. In these cases, some doctors also use tests of patients' ability to produce emotional expressions. In my research, I found that these two distinct tests produce results that are similar enough that it may not be necessary to use both of them. Given that the emotion recognition test costs only a small fraction of the expression test, this can produce a significant savings. Although it may seem intuitive that the same people tend to perform well on both of these diagnostics, the authoritative basic research had not previously been conducted—and, in its absence, scientists had speculated for decades about this effect.

Educational applications

As the US economy becomes increasingly collaborative, educators have attempted to provide students with the skills they will need to be competitive. Accordingly, many educational institutions from elementary schools to MBA programs have incorporated components of emotional intelligence and social skills into their curricula. In doing so, it has been important to have a scientific basis for training programs, for example drawing from research findings showing that we learn these skills from practice rather than traditional classroom-style instruction.

Why are social, behavioral, and economic sciences important to the physical and life science communities, to the Federal government, and to the American taxpayer?

The social and behavioral sciences in general are important because technology, health, industry, and politics are ultimately in the hands of people—who behave rationally and irrationally. The learning and implementation of all other sciences depends on the human factor.

We need to understand people's attitudes, behaviors, and thoughts—because it is people who deliver health care, people who save for their retirements, people who choose their elected leaders, people who fight wars, people who work in teams responsible for everything from emergency care to trial-by-jury to scientific research, and people who make the individual purchasing decisions upon which our entire economy rests. For example, “consumer confidence” is ultimately just an attitude, which is a psychological construct not necessarily tied directly to people's objective economic circumstances. Thus, we need to understand SBE constructs such as optimism and pessimism in order to understand our nation's prosperity. We need to understand SBE constructs related to how people learn if we want to have a strong, educated workforce to maintain American competitiveness. We need to understand SBE constructs related to how ideas spread from person to person in social networks if we want to combat terrorism by decreasing the spread of extremism through these networks.

In discussing the value of SBE sciences, it seems important to address the metaphorical “elephant in the room”—namely, the critique frequently leveled at social and behavioral scientists that our research findings are simply obvious. After all, why should we spend scarce resources on “funny science” just to prove what anyone could already have told us?

Although findings can often seem intuitive, the scientific process has demonstrated that many intuitions are actually wrong. For example, strange behavior is no more common at full moon, people do not blindly follow suggestions under hypnosis, and people with schizophrenia do not have multiple personalities. These findings are useful beyond their curiosity value, in addressing real problems. For example, the stigma and misunderstanding around mental illnesses such as schizophrenia prevents many Americans from seeking treatments that are readily available. Untreated mental illness creates a toll on the American family beyond the lost economic productivity of such individuals. Some intuitions are also contradictory—in many cases, research findings can seem intuitive, but the exact opposite finding would also have seemed equally intuitive. We need the scientific method to distinguish these competing intuitions from each other—again, not for the mere value of curiosity, but for the real implications of these findings. Finally, many research results may seem like common sense but, yet, they do not describe common practice. That is, people may nod their heads in agreement when hearing the findings, but they miss opportunities by not actually implementing these findings in their real lives and workplaces.

In my own research area, one non-obvious finding has been that traditional classroom-style instruction is of little use for people to improve their emotion recognition. Instead, people improve readily when given opportunities for practice—even when they practice without getting any hints at the right answers. This goes against the intuition some have that people are “just born” with such skills and that, as adults, there is nothing much we can do to improve. Indeed, we can improve quite readily with sufficient motivation and practice. This research finding also goes against the intuition of many educators to teach students basic rules and let them apply these rules to new situations—given that learning in emotion recognition requires individuals to figure out the rules for themselves. This surprising finding is useful for training our warfighters, and would not have been possible without federal funding of the basic sciences.

Another non-obvious finding in my research area has been just how poor the average person is at recognizing another person's emotional state from their nonverbal communication alone. Our intuitions tell us that we can read other people's expressions very accurately, but this intuition is often wrong. For example, in a carefully controlled study, I created video clips showing facial expressions, vocal tone, and body language, and viewers accurately chose the intended emotion only about 33% of the time. This was better than random guessing (1 in 5, or 20%), but not by much. It is a surprise that people just aren't that good at this fundamental skill, but it makes sense in the context of theories developed by SEE sciences. Notably, we tend to get information from multiple converging sources—including words and context in addition to nonverbal behavior—without typically relying on anyone source alone. However, our intuitions can lead us astray as we tend to believe in the accuracy of our interpretations of other people's nonverbal communication—given that we don't tend to get explicit feedback when we are wrong—which means that our confidence far outstrips our ability. In a theater of war, such overconfidence can endanger our men and women serving in uniform.

How does basic research in the social and behavioral sciences advance the scientific community? How does it serve the Federal government? How does this research advance or affect the lives of the general population today?

As a business school professor, I cannot help but point out the unusually high return that we receive from investments in the basic sciences. Our support of cutting-edge basic research is an engine of innovation that creates university-level opportunities attracting the best minds from all over the world. Top scientists often stay in the US, start companies here, and pay taxes here, repaying the federal investments many times over. From around the world, political and business leaders send their children to universities here—exposing them to American culture and improving our diplomatic relationships. Education is a large export industry for the US; bright young people are drawn to our universities for access to cutting-edge research-based instruction. In terms of research grant dollars themselves, the taxpayers' funds are used for equipment and also towards salaries for professors, students, and research participants—and so this money is itself pumped back into the US economy.

Only the public sector can make these investments. Private corporations cannot be expected to fund basic research because they focus on research that has advanced closer to commercialization, when there is the potential for a patent or other product that can be commercialized. Basic research is the foundation on which all other research stands. This is the case not only in the SBE sciences, but also in the physical and life sciences, in which government sources are critical for the basic underlying science that is needed en route to developing specific applications. These applications may be soon or they may be years down the road, but eventually the taxpayer investment is repaid as the science advances.

Basic research in the SBE sciences also advances the scientific community by improving our ability to educate—both educating scientists and educating our population more generally. For example, in the business school I teach students in the Master in Business Administration (MBA) program, who go on to help run the businesses, non-profits, and other organizations that employ our American workforce. There is no doubt in my mind that conducting, reading, and reviewing research in the SBE sciences makes me a more effective educator.

As mentioned earlier, ultimately, SBE research touches essentially every sector of American life. Human factors are implicated in topics as broad as childcare and eldercare, innovation, and knowing whether to trust someone else to "have your back."

Why is it in the American taxpayer interest for the Federal government to fund all disciplines within the social, behavioral and economic sciences? How should the Federal government prioritize funding for SBE research? How should NSF, specifically, prioritize funding for SBE research?

It is the nature of the scientific process to rely on data, and scientists are generally reluctant to make firm statements in the absence of relevant data. Accordingly, although I wrote above about the value of social and behavioral sciences in general, it would be outside of my expertise to discuss all of the SBE disciplines one-by-one.

From the outside, certainly some of the disciplines may seem less important than others. However, my own personal experience with the political review of federal grants highlights the importance of not judging a book by its cover. In the spring of 2007—several months after the Army Research Institute took interest in my work on emotion recognition across cultures—a first-year member of Congress proposed canceling the grant because he thought it sounded silly. My understanding is that he based this judgment solely on the title of the grant—"Accuracy in the Cross-cultural Understanding of Others' Emotions." To me, the moral of this story is that there is often more value to federally-funded science than what might appear from a title or a sound-bite.

It can be harmful to judge a book by its cover. A well-intentioned member of Congress advocated elimination of a program that had been singled out for its practical applications for the military, with other applications to business, medicine, and education.

Based on this experience, I would be reluctant from an outsider's perspective to identify a discipline within SBE that could be deemed entirely unworthy of funding. Agencies like the NSF are in the best position to prioritize Federal funding for SBE research because they draw from groups of scientists across a range of disciplines and beliefs, rather than rely on anyone person's expertise.

Prioritizing research topics within this review system, I strongly support the current trend of emphasizing science that is "transformative." This is a matter of en-

hancing the peer review process by emphasizing particular criteria to the reviewers, rather than taking scientific review out of the hands of subject matter experts. There can be a danger in subjecting scientific review to political oversight regarding the topics that are deemed important, because of the possibility of misjudging books by their cover,—however well-intentioned the process.

Peer review and science funding

A lot of questions are raised about the process of scientific peer review. I will take a stand and say that research studies need to be reviewed by people with sufficient background to understand them fully. This is not to say that the public does not have a role in guiding the priorities of scientific research but rather that, from the outside, the goal and importance of a research study may not be obvious.

The Coburn Report made clear the potential harm that could result from judging the book of scientific research only by its cover. Knowing just a headline might make a project seem wasteful when it has the potential for great benefits to American society. Scientists typically break down large problems into lots of smaller problems and, viewed out of context, these smaller problems may seem like poor uses of our nation's scarce resources. For example, putting shrimp on a treadmill would be a waste of money if the goal were merely for shrimp to get some exercise. However, it makes sense to develop a measurement of shrimp health if the goal is to examine the effect of environmental stress on the American food supply and fishing industry. We need to break down a large problem like this into smaller problems because, clearly, it would not be ethical or cost-effective to dump bacteria into the Gulf of Mexico and then study its effect. Another example that the press covered extensively from the Coburn Report was about a robot folding laundry. If the goal is to commercialize a laundry-folding robot tomorrow, then a machine taking 25 minutes to fold one towel is silly. However, if the goal is to train machines to conduct the kind of tasks that can help keep senior citizens living independently for as long as possible—at enormous savings to the American taxpayer—then developing the technology for a robot to fold one towel could be the first step in a long but very worthwhile journey.

A scientific problem can look unimportant from the outside, which is why it is valuable to have sufficient background and context to judge the work's potential merit. The peer review of science is certainly not perfect, and scientists are typically the first group to point out the various flaws in peer review. However, debates about its merit typically end with both sides conceding that it is the best option we have. (One is reminded of Winston Churchill's famous quote, "Democracy is the worst form of government, except all the others that have been tried.")

The ridicule of research when judged only by its cover highlights not the folly of peer review, but the responsibility of scientists to educate the public about their research and the scientific method more generally. In the current fiscal climate, we need our federally-funded researchers to do much more outreach to help the American taxpayer understand the relevance of their work. In addition to the one-page summaries that are currently published by the funding agencies, richer media could communicate the content of research and its broader impact for American society. Scientists should get into the habit of viewing their work the same way that it might look from the outside, in order proactively to explain their work from the outside in. There is an increasing trend of media coverage for the Social, Behavioral, and Economic sciences—suggesting that the public takes an interest in this work and values it—and most serious scientists welcome this chance to communicate and thank the public for its support.

Conclusion

Distinguished Members of the Committee, let me end by emphasizing the shared goal between members of Congress, the American public, and researchers in the Social, Behavioral, and Economic sciences. All of us care about building the basic knowledge that will ultimately lead to improving the effectiveness of the warfighter, the competitiveness of American industry, and the health and welfare of American citizens.

My own story is just one example of basic behavioral research that has practical applications for the military, business, medicine, and education. My research has benefited from federal research funding, and I am grateful for the chance to give back to the public that has supported this work. I also appreciate the opportunity to speak with you about the importance of this work. My hope is that this experience is the beginning of more productive dialogue with scientists—to speak to members of Congress about their work, why the work is important to this country, and why the NSF should fund it.

Appendix: Evidence of the U.S. military's interest in nonverbal communication across cultures

Army Research Institute OSD07-T004

TITLE: Training Soldiers to Decode Nonverbal Cues in Cross-Cultural Interactions

TECHNOLOGY AREAS: Human Systems

OBJECTIVE: Develop a computer-based training tool to improve Soldiers' ability to decode nonverbal behavior in cross-cultural interactions.

DESCRIPTION: The course of events in Iraq and Afghanistan has emphasized the role of human rather than technological solutions in influencing the outcome of conflicts, making interpersonal skills an increasingly important set of tools for the warfighter (Scales, 2006). Counterinsurgency, information operations, and stability operations require a high level of interaction with the local population, and in order for these interactions to yield useful intelligence or to facilitate identification of insurgents, Soldiers must have effective communication skills. As a result, greater resources have been allocated to developing proficiency in Middle Eastern languages. However, much of communication occurs through nonverbal channels, especially when language skills are minimal or absent. Recognition and accurate interpretation of others' nonverbal behavior is needed to identify opportunities to influence an individual or situation, such as civil affairs units seeking the cooperation of local leaders, or to discriminate hostile from friendly or neutral intent, such as infantry units operating security checkpoints. The cross-cultural nature of these interactions increases the likelihood of error, due to lower accuracy in cross-cultural emotion recognition (Elfenbein & Ambady, 2002a) and the tendency to apply ethnocentric interpretations of behavior.

The training goal is to prepare Soldiers to interpret and predict behavior more accurately in cross-cultural environments. Training should address the role of culture in nonverbal communication, identifying aspects of nonverbal communication that are universal, such as expression of emotion (Elfenbein & Ambady, 2002b), and aspects of NYC that are culture-specific, such as display rules, emblems, illustrators, and regulators (Ekman & Friesen, 1969). The culture-specific aspect of training should target a culture in the Middle East. Training should include nonverbal cues in multiple channels (e.g., vocal cues, kinesics) and describe circumstances under which certain channels are more reliable than others. Training should be computer-based and interactive, requiring student response and feedback. Training should not only identify reliable nonverbal cues, but also identify behaviors that may be commonly misinterpreted due to cultural differences. Particular attention should be paid to cues that can be observed from a distance, as observing facial expression may not always be practical when assessing a target for hostile intent and such behaviors are less consciously regulated than facial expressions (Ekman & Friesen, 1974). All training software/systems must be ADL/SCORM compliant.

Book: Sociocultural Data to Accomplish Department of Defense Missions: Toward a Unified Social Framework

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Sociocultural Data to Accomplish Department of Defense Missions: Toward a Unified Social Framework summarizes presentations and discussions that took place on August 16-17, 2010, at a National Research Council public workshop sponsored by the Office of Naval Research. The workshop addressed the variables and complex interaction of social and cultural factors that influence human behavior, focusing on potential applications to the full spectrum of military operations.

The workshop's keynote address by Major General Michael T. Flynn, U.S. Army, provided critical context about the cultural situation and needs of the military operating in Afghanistan. Additional presentations were divided into four panels to address the diverse missions encountered by the U.S. military worldwide. The workshop concluded with a final panel to discuss the strengths and weaknesses of different methods of acquiring and using relevant data and knowledge to accomplish these missions. The panel topics and presenters are listed below:

- Conflict Is Local: Mapping the Sociocultural Terrain David Kennedy, Hsinchun Chen, and Kerry Patton
- Bridging Sociocultural Gaps in Cooperative Relationships Robert Rubinstein, Alan Fiske, and Donal Carbaugh

- Building Partner Capacity with Sociocultural Awareness Jeffrey Sanchez-Burks and Shinobu Kitayama
- The Art of Sociocultural Persuasion Jeanne Brett, James Dillard, and Brant R. Burleson
- Tools, Methods, Frameworks, and Models Mark Bevir, Laura A. McNamara, Robert G. Sargent, and Jessica Glicken Turnley

Chairman BROOKS. Thank you, Dr. Elfenbein.

The Chair next recognizes our third witness, Dr. Peter Wood, President of the National Association of Scholars.

STATEMENT OF DR. PETER W. WOOD, PRESIDENT, NATIONAL ASSOCIATION OF SCHOLARS

Dr. WOOD. Thank you, Chairman Brooks and Ranking Member Lipinski.

The National Association of Scholars stands in a somewhat different position than representatives of the NSF or an esteemed researcher in the field of emotions. I represent roughly 3,000 faculty members, a great many of them social scientists and a great many who have been recipients of NSF funding over the years.

We are primarily concerned with the integrity of the research enterprise in higher education, but we also recognize that higher education is not an island, and that the academy has to play its role in the retrenchment of the federal budget, and that what we are facing with deep deficits in this country, and the overall need for financial stringency is something that the social sciences will have to bear as well as everybody else.

So the question that I would like to address in these few minutes is how we can do this with the least harm to our basic scientific enterprise. The National Science Foundation is not a profligate element in the government. Its review of proposals is notoriously very strict. The proposals that win funding are seldom trivial, and it has been pretty good in resisting appeals to short-term thinking and politicization. Not that those things have been totally absent; but in my view that once we have reviewed the NSF budget and other parts of the federal budget for the trivialities, there still is going to be a need to make cuts in areas that will affect some basic research.

So I think what the Committee needs, what Congress has to have in hand is some approach to triage; some way to figure out among a lot of very good proposals and well-intended funding which cuts can be made that will produce the least harm.

In my written testimony I suggested six principles that might guide that. The first is that a great deal of attention needs to be placed on where funding is available from outside the academy that might substitute for loss of NSF funds. There are numerous foundations in this country that do support basic research. As a university administrator I know that roughly half of our funding in research universities has come from non-governmental sources.

We can, if we devote ourselves to that task, probably make cuts in the federal budget that will do little harm to important basic research if outside funding is available, but those cuts need to be made strategically and tactically to be sure that they are in areas where there is private support.

The second consideration is that the NSF is a major player in the production of new PhDs in this country. It uses its funds, rightfully so, to support both graduate students who are in graduate programs and those who are finishing and working on their dissertations. But we produce way too many PhDs in the social, behavioral, and economic sciences. We know that because many of them end up forced into the market for contingent faculty members, they work as adjuncts for extraordinarily low wages, or they are forced out of the academic world altogether.

We need to be thoughtful about this that we can probably find ways to cut the budget that takes account of actual labor force needs. Economics plays a double role here.

Finally, well, not finally, but in a group of considerations I think the Committee needs to be aware that the social sciences have been to a lamentable degree infected by anti-science methodologies and anti-science ideologies.

In my own field of anthropology, recently the key association, the American Anthropological Association, has been floating the idea of eliminating science from its mission statement. I don't know that that is going to go through. There is pretty stiff opposition from those of us anthropologists who think our field is a science, but nonetheless, this anti-science element usually called post-modernism is broad and is part of what goes on in our fields.

Now, when I review the proposals that have actually been funded by the National Science Foundation, I see the little direct evidence that this ideology is present, but I am aware that anthropologists and other social scientists are very clever about disguising their real intentions, and that is something to pay attention to.

And finally, we are in an era in which higher education overall is in the midst of a deep restructuring, and it is important that the Committee take into account that just the rise of for-profit education and online education is going to change the market for social scientists. Thank you.

[The prepared statement of Dr. Wood follows:]

PREPARED STATEMENT OF DR. PETER W. WOOD, PRESIDENT,
NATIONAL ASSOCIATION OF SCHOLARS

Thank you for the opportunity to speak to the Subcommittee on Research and Science Education on the question of why social, behavioral, and economic sciences are important to the physical and life science communities, to the Federal government, and to the American taxpayer.

I am speaking today both as a social scientist who has benefitted from National Science Foundation funding and as the head of the National Association of Scholars, an organization whose membership includes more than five hundred social and behavioral scientists and economists, most of them senior scholars at colleges and universities. A few years ago, I resigned from a tenured position teaching anthropology at Boston University, and I am no longer pursuing funded research in my discipline. But as president of the NAS, I work with many people who are active in social science research and who depend to varying degrees on federal funding to carry their work forward.

The National Association of Scholars takes a broad view of the relationship between the academy and society. Our members are aware of the federal government's deep deficits and the overall need for budget cuts. We expect that the social sciences will have to bear their share of the financial stringency. The national interest in closing the gap between federal revenue and federal spending is rightly the priority of this Congress, and we know that will mean cuts to some important programs.

Our major concern—*my* major concern—is that these cuts be made shrewdly. The social, behavioral, and economic (SBE) sciences should not be x-ed out completely

from the budget of the National Science Foundation or other federal agencies. I will speak mainly of NSF programs, which I am more familiar with than programs run by other agencies. A great deal of NSF funding in the SBE disciplines goes to projects that are intellectually worthy. Only a small portion, in my judgment, is diverted to trivialities or is channeled to programs on the basis of their political appeal rather than their scientific merit. Of course, if funding for the SBE disciplines is to be trimmed, the place to begin is with those trivialities and politicized programs. But even if all these could be properly identified and statutory language could be written and passed that prevented similar abuses in the future, cutting them would probably fall short of what is needed. I expect Congress will have to go further and cut NSF funding for SBE research that has substantial merit. What we need is a principle for triage. Among all the worthy projects in the SBE disciplines, which ones stand out as most in need of NSF funding?

I have six suggestions. But before I get to those, I would like to offer a brief statement of my overall view and I would like to tackle the questions with which Chairman Brooks framed his invitation to me.

My overall view is this: the National Science Foundation was created to advance basic research. That was a good idea for the United States at the time and it remains so today. We need basic research not least because it is the deep source of almost all our technological and economic progress. The greatest advances have come not from researchers looking for better ways to build mousetraps but from researchers who are, so to speak, more interested in the mice. When Watson and Crick discovered the structure of DNA, they knew they had achieved something intellectually big, but its practical implications were invisible and it took decades before that discovery led to the miracles of genetic engineering we have today.

Examples of the long-term benefits of basic research in the natural sciences are more familiar than examples in the SBE sciences, but there too the liberal arts approach of pursuing the answers to the hard intellectual questions rather than the tempting practical ones has paid off. My discipline, anthropology, grew largely out of the amateur investigation of an upstate New York lawyer, Lewis Henry Morgan, who in the mid-19th century took an interest in the kinship terminology of the local Seneca Indians. From Morgan's work grew the whole enterprise of studying kinship and marriage patterns as the key to understand social structure in all human societies. Or to take another example, Adam Smith was not looking for ways to improve the manufacture of pins when he observed how the division of labor in pin factories led to efficiencies unavailable to the solo worker. Smith's observations presented in *The Wealth of Nations*, however, led to the very practical discipline of economics.

If we take the long view, investing in basic science pays off, even in the softer-seeming social sciences. And if we stick with that longer view, it is the near-term practical research that typically proves to have a short shelf-life.

Let me turn to Chairman Brooks' questions. He asked me:

Why are social, behavioral, and economic sciences important to the physical and life science communities, to the Federal government, and to the American taxpayer? How does basic research in the social and behavioral sciences advance the scientific community? How does it serve the Federal government? How does this research advance or affect the lives of the general population today?

To start, the social, behavioral, and economic sciences are important to the physical and life science communities because they illuminate the human condition. The life sciences are especially intertwined with the SBE sciences. Humans are a complex social animal. Our social complexity and our biological complexity are inextricable. We are equally biological and social organisms, and neither one side nor the other can be understood in isolation.

I realize how abstract this sounds. To bring it down to earth, think of transnational adoptions, which are now quite common in the United States. A little further on in these remarks I will have something to say about an NSF-funded research project that deals with transnational adoptions, so this is by no means a hypothetical case. We know from practical experience that infants adopted from abroad become culturally American with no special effort on the part of the adoptive parents. To the contrary, many adoptive parents try hard to give their adoptive children some sense of the culture and heritage they left behind, and it is not uncommon for these children as young adults to go abroad in search of their birth relatives and some sense of their cultural heritage. Biology matters to them; so does culture; and yet these sought-for links often prove very disappointing. The longed for connection just fails to materialize.

We are a species that thrives only in families, but families are a social reality that the social, behavioral, and economic sciences bring into focus. Our in-grained ability to form stable pair bonds between men and women requires social form, as does our

need to provide nurturing mothers and fathers to our offspring, who in comparison to all other animals, require an extraordinarily long period of dependent immaturity. That period of dependency is when we acquire most of what we call culture, and it is nearly impossible to un-do it, though we can add layers on top.

The complexity of these phenomena lies in the combination of necessity and fluidity. We cannot thrive without family and parents, but biology doesn't supply us with a single answer. Robins build their nests the same way every time. Human families differ dramatically from culture to culture. If we want to understand who we are, we have to achieve the stereoscopic view that captures the biologically essentially and socially contingent, and we have to grasp the power of that contingency.

Studying contingency might be the very definition of the social, behavioral, and economic sciences. I start with the example of the family because kinship is one of my anthropological specializations. But the stereoscopic vision is required in almost everything in the human condition. Our bodies have amazing capacities to develop and adapt, as well as all manner of frailties and susceptibilities to disease. Body mechanics and medicine can illuminate some of these strengths and weaknesses, but the full picture requires us to see how strengths flourish in response to social incentives and how our susceptibilities grow out of lifestyles. We gained susceptibility to tuberculosis because our ancestors domesticated cattle. We get sick with the flu because our ancestors domesticated chickens. Diseases that jump the species barrier are a biological fact, but these jumps occur in social contexts. The SBE sciences help us understand that context. The NSF's Ecology and Infectious Disease Program provides necessary funding to pursue this science.

Our frailties and diseases illustrate one of the intersections between life sciences and social sciences, but so does our positive capacities for complicated divisions of labor and our skill in creating mutually profitable exchange. We need the science of economics to trace out the complexity of specialization and exchange, but we need neuroanatomy and cognitive science to understand how specialization and exchange are even possible. No other animal has more than the barest rudiment of these abilities. Understanding them requires the SBE fields as much as it does physical and life sciences.

Finally, our capacity for language, our ability to form communities, and our susceptibility to breaking communities apart are at the center of this zone where social scientific investigation meets human biology. The NSF's program "Documenting Endangered Languages" is one way in which we rescue key knowledge in this area from historical oblivion.

I have ventured an answer to the first part of the first question, "Why are social, behavioral, and economic sciences important to the physical and life science communities?" But Chairman Brooks also asked why SBE sciences are important "to the Federal government, and to the American taxpayer?" Clearly some matters may be important in their own right but not important to the Federal government or to the taxpayer. The usual defense of the social, behavioral, and economic sciences is that they offer practical benefits. I am not going to pursue that argument any more than in my suggestion that seminal research—such as the research of Watson and Crick, Lewis Henry Morgan, or Adam Smith—often proves fruitful in the long term. The SBE sciences may indeed produce some shorter term practical benefits, but I don't think that is why the Federal Government should fund NSF programs in these areas or what the taxpayer should expect from research in SBE. If we wanted those practical benefits and are convinced that social science can deliver them, it would be better for Congress to appropriate funds specifically for *applied* social science.

The better reason to fund the SBE sciences through the NSF is to sustain scientific excellence. Science of course is not a single enterprise. Astronomers, chemists, biologists, physicists, geologists, etc. use dissimilar methods and count successes in different ways. Add in the SBE sciences and the picture is still more various. But behind all this variety is the shared quest to understand nature and our place in it. In that sense, we can have only one real standard. We need science that advances us towards seeing the world at every scale as it really is. A science that looks at only large things like galaxies or only at tiny things like DNA would be drastically incomplete. We need to keep humanity in the picture, and we fall far short of the mark if we treat the quest for understanding our own species as merely a hitchhiker on the physical sciences. We need excellence in the SBE sciences too. Without a national commitment to such excellence, we will end up with a hollow civilization: one that values knowledge of the mechanics of things disconnected from our knowledge of ourselves.

Moreover, a major retreat from the SBE sciences on the part of the NAS would simply accelerate the politicization of these fields. But I will have more to say on this below.

Chairman Brooks also put to me the questions, “Why is it in the American taxpayer’s interest for the Federal government to fund all disciplines within the SBE sciences? How should the Federal government prioritize funding for SBE research? How should NSF, specifically, prioritize funding for SBE research?”

By way of answer to all of these questions, I want to offer the six suggestions I alluded to before. But I want to be clear from the outset. I don’t believe that it is in the interest of the American taxpayer for the Federal government to fund *all* disciplines within the SBE sciences. We face the need for cuts and we have to find intelligent ways to make them. That may mean suspending funding in some disciplines.

First, Congress should pay attention to non-governmental sources of funding. Some areas of research already attract substantial financial support from international agencies, foundations, private-donors, and for-profit enterprises. There is no reason to think that these funding sources have been exhausted.

Scholars who work in the areas could, if faced with a decline in funding through the NSF, potentially find substitute sources of support.

Second, Congress should pay attention to the oversupply of SBE Ph.D.s in the labor force. Each year our universities award advanced degrees to many more people in these fields than there are opportunities for employment that require such credentials. One result of the surplus is that colleges and universities rely more and more on adjunct faculty members, part-timers who are typically paid extraordinarily low wages and whose relationship with students is transitory and transactional. The oversupply problem has a cascade of other negative social consequences, but I’ll limit myself to just one: producing this surplus of specialists is a tremendous waste of resources. And NSF is one of the culprits. It supports graduate students in SBE fields through its graduate fellowships, and again in grants to support the writing of Ph.D. dissertations. I would by no means recommend cutting these entirely, but it is clear that NSF currently incentivizes people to pursue careers in fields in which there are meager opportunities.

Third, Congress should pay attention to the rise of anti-scientific ideologies within SBE disciplines. In my field of anthropology, for example, a recent controversy has highlighted this division. The weekend before Thanksgiving, at the closing of the annual convention of the American Anthropological Association (AAA), the organization’s Executive Board discussed a long-range plan that would alter the AAA’s mission statement. The new mission statement deleted the idea that anthropology is a science. It also blurred the intellectual boundaries of the discipline and, ironically, inserted a stronger warrant for using anthropology to engage in public advocacy.

In the weeks and months that followed, as word reached the rank and file, a heated debate ensued. One section of the AAA, the Society for Anthropological Sciences, took strong objection to the jettisoning of “science” from the organization’s mission and many individual anthropologists seconded that dissent. The AAA’s leadership back peddled to a degree and declared that its purposes had been misunderstood. But the incident was not an innocent misunderstanding. A substantial number of anthropologists do not regard their discipline as a science. They see “science” itself as a label or at most one path to knowledge among many that anthropology should avail itself of.

The kerfuffle over the AAA’s mission statement has its counterparts in many other social sciences. We have lived through an era in higher education in which the social sciences have been profoundly influenced by ideological and philosophical developments that are at odds with science. Post-modernism brought into the social sciences the view that truth is just a social construct. Different people have different truths, and that claims that something is true mostly reflect efforts to dominate and to exercise power. This view is inimical to genuine scientific research but it lends itself handily to more free-form styles of investigation and it is comfortable with research tied to political goals.

I hasten to add that I am not saying that views such as these should be blocked or that the scholars who promote them don’t have the right to express their views. They of course enjoy academic and intellectual freedom. But academic and intellectual freedoms don’t come with a presumptive right to Federal funding.

Looking at actual awards granted by the NSF over the last few years, I would say NSF generally steers clear of funding research that openly embraces postmodernism or its equally anti-scientific variants. But it isn’t always easy to tell. Researchers who seek federal funding from a science agency usually know enough to present their work as scientific in spirit even if at a deeper level it is not.

For instance, I see that the NSF granted \$200,000 last year for a project titled, “Transnational Adoptees and Migrants: From Peru to Spain.” The awardee is looking at Peruvian immigrants to Spain, and Peruvian children adopted by Spanish families. The abstract of the study claims scientific merit in “bringing the two kinds of population movements into comparison with each other.” And the researcher will learn from this how “to elucidate common and differentiating factors in the countries of origin and destination; how the two may interact, particularly with regard to integration into the receiving country; and how the identities and experiences of young immigrants are affected by being either adopted or part of labor-migrant families.” The research is to be conducted through “participant-observation, semi-structured focus group interviews, and semi-structured interviews with individuals and families.”

I do not know the lead investigator, Dr. Jessaca B. Leinaweaver of Brown University, or anything more about the project than what NSF has posted. I can imagine that it has genuine scientific merit. Demography is an important field, and international population movements bear on a lot of issues we must deal with as a nation. But I must register a doubt. Though both involve people crossing international boundaries, transnational adoption and immigration of adults are pretty disparate topics. The connection between them as stated in the abstract seems entirely rhetorical, and the method of investigation unlikely to yield much beyond impressionistic interpretations.

Dr. Leinaweaver’s research is by no means outside the mainstream of contemporary cultural anthropology, but that may be a signal of the underlying problem. It has become much more difficult to distinguish scientific investigations in the social sciences from other forms of research. This is not to say those other forms of research always lack merit. If a researcher sets out on a program of historical, humanistic, or interpretive study, however, the NSF is probably not the best source of funding. Taxpayers of all points of view are being asked to subsidize the research of those with a particular point of view. If the particular point of view does not have special standing as a matter of science, it is hard to see why it should enjoy any special subsidy.

Fourth, Congress should cut funds wherever they are being used by NSF to advance non-science agendas. This is an area fraught with controversy that could distract from other points, so I will leave it as a general principle. The purpose of NSF is to advance science, not one or another person’s views of social justice.

I would, to start with, recommend de-funding the programs that support “transforming education” and “ethics.” These are not scientific endeavors. They are, fairly openly, political undertakings. For example, the NSF’s 2009 grant of \$299,000 for a project titled, “Engineering and Social Justice: Research and Education of (In)commensurable Fields of Practice,” is framed entirely within the perspective of advancing a politicized view of the field of engineering. To underscore this, I quote the project abstract in its entirety:

This project, supported by the Ethics Education in Science and Engineering Cross-NSF program, investigates the relationship between engineering and social justice. Given the global challenges of the 21st century, engineering educators are implementing innovative ways to prepare tomorrow’s engineers—including programs and courses in community service, sustainable development, and humanitarian engineering. That engineering students might be enacting various forms of social justice in these programs and courses raises important questions. How are engineering students interpreting social justice? How do those interpretations intersect with their education as engineers? What might engineering and social justice have in common? In which ways have these two fields of practice aligned, clashed, or interfaced in recent US history? How and why should relevant dimensions of social justice be effectively taught and disseminated throughout engineering curricula?

The main goal of this project is to research these questions and develop educational resources aimed at relevant connections between engineering and social justice, allowing for various interpretations of social justice. To achieve this goal, the project researches historical and ethical connections between engineers and social justice. Furthermore, given the surge in university programs related to community service and humanitarian engineering, the project contributes by developing relevant instructional case studies. The project will also result in a book about Engineering and Social Justice with chapters exploring the social-justice dimensions of engineering during the New Deal, radical and non-radical engineers in the 1960s, engineers of appropriate technology, engineers of sustainable development, and engineering to help. Primary project partners and audiences include engineering faculty and students, engineers in organizations

actively pursuing social-justice goals, and a growing network of engineering educators interested in social justice issues. This project stands to have a broad impact by increasing recruitment and retention among US engineering students, particularly women and underrepresented groups, as students become more concerned with the social relevance of their careers.

I imagine Congressmen can and will have differing views on the worthiness of this vision of education for engineers, but it seems plain that the project is in no way an effort to advance scientific understanding.

Fifth, Congress should beware funding for projects that slip too easily into contemporary policy debates. The projects need not be carrying a political ballast to fall into the realm of questionable places for the taxpayer to invest resources. The problem is that social science research all too easily gets dazzled by the prospect of practical application and researchers find themselves drawn to take sides in policy debates. Do we want social science that helps us hack through the thickets of data to clarify complicated social problems? I think we do—and the place for that research is in policy-oriented think tanks, commissions, and programs set up for specific purposes. An agency created to fund basic science is the wrong place through which to fund work that aims to contribute to public policy discourse.

I realize my view must sound very odd to some members of Congress who have abundant experience hearing from academic experts about the potential practical rewards of policy-oriented research. I must re-emphasize that such research is frequently worthwhile, but that locating it in the National Science Foundation is a mistake. It is mistake because it competes with and crowds out research that is more fundamentally important; it is a mistake because there are almost always interest groups willing to fund such research without using the taxpayer's dollar; and it is a mistake because the research itself is likely to be compromised along the way.

For example, in March of this year NSF awarded \$148,000 for a project titled, "Out From the Shadows: The Lives of Immigrants Before, During, and After Legalization." The project consists of "qualitative research to examine the experiences and outcomes of immigration legal status change among Mexican immigrants to the U.S." The researcher aims to "complement macro-level quantitative studies of new legal immigrants by contributing person-centered qualitative data on legal stages of naturalization from the point of view of immigrants themselves." And the study focuses on people selected from four categories: "immigrants who anticipate changing their legal status from undocumented to legal permanent resident, those who have recently changed their status, those who adjusted their status ten or more years ago, and naturalized U.S. citizens."

I don't see this research as necessarily politicized. The researcher has not openly declared a view on whether illegal immigrants to the U.S. should be granted legal status. The researcher herself, however, is explicit that the project is intended to be "a timely contribution to local and national policy debates about immigration programs." And the thin line between making a contribution to social scientific knowledge and advocating for an interest group gets even thinner: "This study can provide important information for organizations and agencies that provide support and resources to legalizing immigrants." What about taxpayers who don't want to "provide support and resources" for illegal immigrants? Regardless of one's views on that question, it is hard to see this research as disinterested. In fact, the research has very thin justification outside those policy debates. The researcher falls back on what amount to a series of social science clichés.

This project will advance research in an area that is of critical importance to wider considerations of nationhood, citizenship, transnational migration, and globalization. Furthermore, the research will document the challenges that immigrants face during and post-legalization, and how these challenges may be experienced with respect to characteristics such as gender, ethnicity, and class.

The slope is too slippery to bear more than momentary weight. When the NSF funds such policy-oriented research, it is on the road to making policy on its own—in fields far beyond science.

Sixth, Congress should consider the larger picture of the changing nature of American higher education. The lion's share of science funding from the Federal government goes to researchers who are faculty members at research universities. Another large share goes to graduate students at these universities. I have already pointed out that the nation has an over-abundance of Ph.D.s in the SBE sciences. We may also have other excesses. Undergraduate students in larger and larger numbers are opting to pursue post-secondary education in community colleges and online institutions that have no commitment to research, and undergraduate stu-

dents at four-year institutions have been steadily migrating to fields such as business, health, communication, and education. The nation's emphasis on university-based research in all of the sciences is, at the very least, vulnerable to recalibration. I would take it as a serious loss for the nation if we recalibrated ourselves all the way out of a serious commitment to SBE research, but I do think that we could make cuts that would leave room for the essential work to continue.

I appreciate having had this opportunity to address the committee.

Chairman BROOKS. Thank you, Dr. Wood.

The Chair now recognizes our final witness, Diana Furchtgott-Roth, Senior Fellow at the Hudson Institute.

**STATEMENT OF MS. DIANA FURCHTGOTT-ROTH, SENIOR
FELLOW, HUDSON INSTITUTE**

Ms. FURCHTGOTT-ROTH. Mr. Chairman, Members of the Committee, thank you so much for inviting me to testify here today. We have a spending crisis in America, and we should only spend when there is a compelling interest. We have universities that fund these disciplines, and it should not be the role of the government.

In my field economics, original seminal works were produced without government funds by Adam Smith, John Maynard Keynes, Frank Knight, Friedrich Hayek, even Karl Marx; they all produced their work without any government funding at all.

The social and behavioral scientists abound in the universities and private businesses, their research products always interesting and valuable, can be sold to journals and corporations. Successful SBE research is well supported by think tanks, private corporations, law firms, and foundations that can use the results. There are many private foundations that provide grants for social science research, including the Kauffman Foundation, the Smith Richardson Foundation, the MacArthur Foundation, the Bill and Melinda Gates Foundation just to name a few.

Even if one believes that the United States has an interest in producing social, behavioral, and economic research, it is not clear that the National Science Foundation is always the appropriate entity. In fiscal year 2010, the NSF spent 255 million on SBE research. NIH alone spent 4.1 billion on behavioral and social science research in fiscal year 2010, and why is there a need for NSF to do this funding?

As Dr. Wood just said, having a grant-making agency such as the NSF in charge of government research funding leads to a greater possibility of politicization and concentration in certain areas. This is true even under the Merit Review System where researchers have to show the scientific and broad effects of their work. There is a temptation for politics to enter into the allocation of funds and for research projects to be allocated with non-scientific criteria, including gender, ethnic, and geographic criteria rather than the merit of the research.

Note the comment earlier from Dr. Gutmann about how NSF funding funded the first woman Nobel economics prizewinner. Of course, politics enters into government agencies also, but the bias of politics is less likely to all be in one direction.

For the NSF to argue persuasively that it should continue funding research on SBE, NSF should demonstrate that the research is important and that it won't be funded by other sources. Perhaps these arguments are articulated somewhere, but they are hard to

find. They are not on the NSF website, they are not in annual reports prepared by NSF. Unless the agency can clearly make the arguments, there is little, if any, need for NSF funding to fund much SBE research.

During our time of shrinking Federal dollars when our debt is over 14 trillion and our deficit this year is projected to be 1.6 trillion, the NSF should focus on basic physical and life science research rather than research in SBE.

One exception, and well, one exception and just to draw a couple of parameters, might be longitudinal studies such as the University of Michigan panel study on income dynamics, a survey funded by NSF, which has followed 5,000 families since 1968. Perhaps these kinds of data sources should receive government funding, because there might be a public interest in having a continuous dataset, and a private foundation might be tempted to drop the funding. But this could also be funded by the Labor Department as the national longitudinal survey is, which began in the 1960s.

A couple of other parameters that I might consider suggesting if the NSF wants to fund research in my field, economics, to only support projects that create new data that are made publicly available to other researchers within five years. Second, only pay for data entry by research assistants and not by faculty, not faculty compensation, not computer hardware, not computer software. This would guarantee that NSF wasn't used to subsidize other purposes within the universities.

I understand that the Federal Government often has a need for research, the military as Dr. Elfenbein just mentioned, has a need for certain kinds of projects. But then the Department of Defense, Department of Homeland Security, they could put out a request for proposal and fund that research by itself.

Thank you very much for allowing me the privilege of testifying today.

[The prepared statement of Ms. Furchtgott-Roth follows:]

PREPARED STATEMENT OF MS. DIANA FURCHTGOTT-ROTH,
SENIOR FELLOW, HUDSON INSTITUTE

Mr. Chairman, Members of the Committee, I am honored to be invited to testify before you today on the subject of National Science Foundation funding for social, behavioral, and economic science research. I have been a senior fellow at the Hudson Institute since 2005. From 2003 until April 2005 I was chief economist at the U.S. Department of Labor. From 2001 until 2002 I served at the Council of Economic Advisers as chief of staff. Previously, I was a resident fellow at the American Enterprise Institute. I have served as Deputy Executive Secretary of the Domestic Policy Council under President George H.W. Bush and as an economist on the staff of President Reagan's Council of Economic Advisers.

Social, behavioral, and economic science research includes anthropology, archaeology, economics, geography, linguistics, history, neuroscience, political science, psychology, sociology, criminology and law. I am most familiar with economic research, having published books and articles in the area and having served as chief economist of the Department of Labor.

There is much outstanding work produced every year in the social, behavioral, and economic sciences. It fills journals and working papers and is presented at conferences. The question at issue is not the quality of this research, but whether the Federal Government should fund it. When research is funded by the government, should it be funded by the National Science Foundation, or by individual government agencies?

Economists have devoted much thought to the concept of public goods. Public goods are those for which the incentive to produce them is lacking because consumption is nonexcludable, and the producer cannot capture the returns. The most com-

mon example of a public good is national defense. No individual would have an incentive to set up a national defense system, because everyone would benefit. Another frequently-used example is street lighting. With street lighting, everyone driving on the street would benefit, and the person who put in the street lights would not be able to collect revenue.

It is generally accepted that the government has to provide public goods, raising the revenues through taxation.

The question is, does research in the social and behavioral sciences meet the definition of a public good? Then, if so, is the National Science Foundation the preferred mechanism for distributing the funding?

Social, behavioral, and economic sciences research does not fit the conditions that define it as a “public good.” Social and behavioral scientists abound in the universities and in private businesses; their research products, often interesting and valuable, can be sold to journals and corporations. Successful SBE research is well-supported by think tanks, private corporations, law firms, and foundations that can use the results.

There are many private foundations that provide grants for social science research. The Kauffman Foundation, the Smith Richardson Foundation, the Ford Foundation, the MacArthur Foundation, the Gates Foundation, the Pew Foundation, the Bradley Foundation, and many others fund research in the social and behavioral sciences. Just to give two examples: the MacArthur Foundation gave out almost \$300 million in total grants in 2009, and the Kauffman Foundation spends \$8 million per year on research into innovation and growth.

Even if one believes that the United States has an interest in producing social, behavioral, and economic research, it is not clear that the National Science Foundation is always the appropriate entity. In fiscal year 2010, NSF spent \$255 million on social, behavioral and economic research. Billions more are spent by the Departments of Education, Defense, Justice, Labor, Homeland Security, Energy, Housing and Urban Development, and Health and Human Services, particularly the National Institutes of Health. NSF estimates that almost \$3 billion was spent on federal basic and applied SBE research in fiscal year 2009, and individual agencies provide other grants for research in specific fields.

I was asked to comment on whether basic research in the social and behavioral sciences advances the physical and life sciences. In my opinion, it does not do so. Research in the physical and life sciences is separate from that in the social sciences and should be evaluated using different criteria.

There are many organizations doing research at government expense, and there does not appear to be coordination between them to avoid duplication of effort. One useful role for NSF might be to take a coordinating role in the funding of government research.

I was also asked to comment on whether research in the social, behavioral, and economic sciences serves the Federal Government. Such research does help the Federal Government make decisions about a wide range of issues ranging from capture of terrorists to the right level of energy taxes to preservation of archaeological artifacts.

Within the economics field, the Federal Government is constantly faced with questions about the allocation of scarce resources, the distributional effects of social programs, and the optimal system of taxation. Currently Congress and the administration are discussing corporate and individual tax reform, the housing market, energy policy, immigration reform, among others, and economics research can shed light on such policy questions.

However, it does not mean that the Federal Government or the National Science Foundation has to fund the research. The government could examine the existing body of research, and invite researchers for consultation. If this is not sufficient, individual agencies could commission new research. If the government is interested in how to organize housing assistance, the Department of Housing and Urban Development could structure a grant.

The general population is undoubtedly better off with an efficient system of government with low taxes and efficient provision of entitlements. It is not clear how NSF funding of social, behavioral, and economic sciences contributes to that goal.

Having a grant-making agency such as the NSF in charge of government research funding leads to a greater possibility of politicization and concentration in certain areas. This is true even under the merit review system, where researchers have to show the scientific and broader effects of their work. For example, global warming might receive priority funding one year, electric cars another. There is temptation for politics to enter into the allocation of funds, and for research projects to be allocated with non-scientific criteria—including gender, ethnic, and geographic—in mind, rather than the merit of the research.

Of course, politics enters in other government agencies as well, but the bias of politics is less likely to be all in the same direction. Private foundations and corporations are not immune from politics either, but in the private sector these political biases are more likely to cancel each other out, and they would not directly affect the taxpayers' dollars.

It is in American taxpayers' interest for Federal Government spending to be as low and as efficient as possible, including research on social, economic, and behavioral sciences. If an individual government agency needs an answer on a particular social or economic question, that agency can issue a request for a research proposal and can hire appropriate researchers. In the field of economics, agencies have a chief economist with a staff which can recommend researchers. In other fields, such as archaeology, linguistics, and neuroscience, where a federal agency might have no capability, it could consult with the NSF for recommendations as to experts.

For the NSF to argue persuasively that it should continue funding research on social, economic, and behavioral sciences, NSF should demonstrate that the research is important, and that it will not be funded by other sources. Perhaps those arguments are articulated somewhere, but they are hard to find. They are not on the NSF Web site. They are not in annual reports prepared by NSF. Unless the agency can clearly make these arguments, and I am skeptical that it can, there is little if any need for the National Science Foundation to fund much if any social, economic, and behavioral research.

During this time of shrinking federal dollars, when our debt is over \$14 trillion and our deficit this year is projected at \$1.6 trillion, the NSF should focus on basic physical and life sciences research rather than research in the social, economic and behavioral science.

One exception might be longitudinal studies such as the University of Michigan Panel Study on Income Dynamics, a survey funded by the NSF, which has followed 5,000 families since 1968. Perhaps these should receive government funding, because there is a public interest in having a continuous series of data. But this could be funded by the Labor Department, as is the National Longitudinal Survey, which began in the 1960s.

Congress could facilitate SBE research without direct funding by making it easier for researchers to use federal and state government data bases, after removing personal identifiers. Governments data collection includes administrative data on educational records, tax returns, injuries associated with different occupations, and earnings. Currently, it is difficult for researchers to use these data due to privacy considerations, even though such data are a treasure trove of information. If Congress were to modify some of the privacy regulations it would be easier for researchers to work with these large databases, saving time and cutting costs.

Thank you for giving me the opportunity of testifying today. I would be glad to answer any questions you might have.

Chairman BROOKS. Thank you, Ms. Furchtgott-Roth.

Dr. Gutmann, inasmuch as Ms. Furchtgott-Roth mentioned some of your prior remarks, would you like to make any response in a general sense to hers, or should we go into our normal question session?

Dr. GUTMANN. I think you could go into your general question session. Thank you.

Chairman BROOKS. All right. Thank you. Well, I thank the panel for their testimony.

Reminding Members that Committee rules limit questioning to five minutes, the Chair will at this point open the round of questions. Normally the Chair recognizes himself for questions, but inasmuch as we have a birthday boy here, celebrating his 85th birthday, the Chair at this point defers to my elder statesman, Mr. Bartlett.

Mr. BARTLETT. Thank you very much.

Our country faces some huge challenges in the economic sector, in the energy sector. They, of course, are related, and the—how we respond to those challenges is going to be enormously important, and obviously the social and behavioral sciences are going to be front and center here in how we respond to these challenges.

I would like to ask Dr. Gutmann, do you think that our research, our understanding of the behavioral social sciences is ahead of or behind our knowledge in the hard sciences?

Dr. GUTMANN. Thank you very much for the question, Mr. Bartlett. It is very interesting. I think that we are on par with what is happening in other sciences. I am not sure I am always comfortable with the term hard science and soft science. That is a discussion we could have, but I think that our progress is interesting and commendable, and we are in the areas you are describing, for example, in making progress on energy, we are looking forward to making significant investments in research that will help understand how to best arrive at an appropriate future for energy use.

Mr. BARTLETT. Thank you. Dr. Elfenbein, 70 percent of all communication is non-verbal, and you referenced this phenomenon. Is this an international language, which means that if you can't speak the other guy's language at all, if you really understand body language and the non-verbal part of communications, you can understand 70 percent of what he is trying to tell you?

Dr. ELFENBEIN. Thank you for the question. As far as scientists know, yes, communication being non-verbal cues is a largely universal language. It does have—and the work that I have done that has been funded by the NSF shows that although much of the signal goes—makes it through cultural boundaries, some of the signal does get lost along the way, but I think our intuitions are—do serve us well in this case that we can watch foreign films in a different language and maintain much of the original meaning or communicate across species boundaries, for example, with pets and maintain much of the meaning of non-verbal communication, but something does get lost along the way.

And for this reason misunderstandings are potentially more dangerous in the case of non-verbal behavior because if we were speaking a different verbal language, we would realize that and get a translator. But if we are—if we have different meanings involved and viewed into the cues that we use on a non-verbal basis, we may not realize that, and we may have a misunderstanding that doesn't get feedback, that doesn't get corrected.

Mr. BARTLETT. Dr. Wood, you mentioned foundations. I regret that a huge percentage of research is funded by the Federal Government. In some institutions, medical particularly, more than 90 percent of all research is funded by the Federal Government.

The Federal Government can be very arbitrary and capricious, and I think we put at risk our research, our basic research if it is funded by the Federal Government. But lamentably we have forcibly taken money from you, and we have not given you the option of you using your money to support basic research and then giving you a tax credit for doing that.

And so here we are, and my question is in the behavioral sciences, which I think are going to become increasingly important in the future as we face these crises in our country, is there really enough support, non-governmental support, for these basic sciences that we could responsibly, drastically reduce our funding for NSF in this area?

Dr. WOOD. Well, I wouldn't favor drastically reducing funding for the NSF in this area, but I do think that significant cuts will be

made. Will the private sector foundations be able to pick that up? I believe so, that the social science research that has real depth and real grip is appealing to a lot of people besides government agencies.

Now, of course, the transition will be hard, and it will mean that there probably will be worthy projects that go unfunded. As my colleague Dr. Furchtgott-Roth has just pointed out, some of the most fundamental research in the social sciences going back in her field economics Adam Smith in mind to the American founder of anthropology, Louis Henry Morgan, took place without any government funding at all. It was pursued as a form of research by impassioned amateurs, and there is a lot of really important research that doesn't actually take a great deal of funding.

Done strategically and carefully a lot can be done without really in-depth federal support or even with that much support from the foundations.

So I am optimistic that, yes, the really important stuff will get done even if we have to take some lamentable cuts in Federal funding.

Mr. BARTLETT. If you will indulge me just a moment, Mr. Chairman, our fourth witness I am old enough to have known Herman Conn. Did your stay there overlap his?

Ms. FURCHTGOTT-ROTH. Unfortunately, it did not. No, but we remember him very fondly and read his work.

Mr. BARTLETT. Thank you. Thank you, Mr. Chairman.

Chairman BROOKS. Thank you, Mr. Bartlett.

The Chair next recognizes the Ranking Member, Mr. Lipinski, for five minutes.

Mr. LIPINSKI. Thank you, Mr. Chairman.

I will start out by asking Dr. Gutmann to sort of follow up on the—Dr. Bartlett's question there about if there were significant cuts, drastic cuts in SBE funding through NSF what would the—what do you see the impact as being? Do you think that this would be picked up by others?

Dr. GUTMANN. I think there are really two questions raised here, and I am happy to briefly answer both of them, Mr. Lipinski. One question is is it likely that a private sources could replace a substantial amount of funding that is currently devoted to the social and behavioral and economic sciences, and I think the answer to that is no.

The great foundations that have been mentioned earlier are largely interested in solving relatively specific problems. The Gates Foundation is very rich. They largely are interested in certain areas of educational achievement and improving health, global health. Those are extremely important topics. But their approach to them is very applied. It is very directed towards solving the problem today and making investments today. They are much less interested in the basic science that organizations like NSF support, and so I don't think, in fact, that there is a reasonable chance that private foundations are going to invest more than they are investing today.

The second question that you ask is a question about what would happen if government support for social and behavioral sciences through NSF or other agencies would be significantly reduced, and

I think that would have a very serious affect. We all recognize the budgetary needs today, and we understand that in these times we may have to accept reductions in what we spend. That is the reality that we face, and we are not averse to understanding that reality.

But significant reductions in SBE funding are going to deprive our society of the kind of basic research that Dr. Elfenbein talked about. Where we go into problems not knowing the outcome and where the long-term chain of research developments really transform our view of the world, and that is a significant risk. So I don't think that is a good idea, and I think it will have undue and severe consequences for the American people.

Mr. LIPINSKI. Thank you, Dr. Gutmann. There are a lot of things that Dr. Wood has stated, and I think in general that we would find some agreement on those. This question of whether or not if funding would be picked up, I think I agree. A lot of good research is—does not need much or any funding, but a lot of—but there is a lot of research that does need the funding to be able to be done.

I can't at all disagree that there is an oversupply of Ph.D.s having gone through that whole process myself and having been an assistant professor, but my experience is usually those who do have NSF funding are people who do wind up getting jobs, and NSF, the whole process seems to be a good almost weeding out of choosing those who are doing good research and those who are able to work with professors who are doing good research.

One thing I wanted to get back to Dr. Gutmann on is I understand that the NSF has signed an MOU with the Department of Defense to do SBE research, and then after one year of funding both NSF and DOD putting in the funding level, DOD had then backed out of that and said NSF should just be funding this research.

Can you give a little background on that?

Dr. GUTMANN. Most of those discussions occurred before I got to NSF, but I have been part of the process since, and my understanding is that the Department of Defense has felt that their resources could be better deployed elsewhere. And so we did have one cycle of making awards. Those awards were made about a year and a half ago, and those awards have been very successful. We have had a first PI meeting. There is a lot of interesting research that is being done in this joint program between NSF and the Department of Defense in the area of national security.

But at this time the Department of Defense doesn't seem to have the resources to commit to it further.

Mr. LIPINSKI. Thank you, and I just want to—my time is almost up. I just wanted to also say I agree, I think, with what Dr. Gutmann had just said, you know. We know these are difficult times for the budget, and there are certainly things that we can all find problems with maybe in some research that receives funding, but the bottom line is what is the overall contribution that this research makes, and is it worth the funding. And I think we generally, you know, that is the question we want to address, and I think that we have a lot of evidence that it is worth, the funding is worthwhile, but that doesn't mean that we shouldn't be looking at it.

So I thank you again. I will yield back.

Chairman BROOKS. Thank you, Mr. Lipinski.

The Chair next recognizes Dr. Harris.

Mr. HARRIS. Thank you very much, Mr. Chairman, and thank you very much to everyone on the panel for sharing your morning with us.

Dr. Gutmann, let me ask you a question. As we look through the fiscal year 2012 budget, SBE budget, there is the science, engineering, education, and education for sustainability portfolio, which got a 174 percent increase over last year, and now it is nearly a quarter of the SBE, entire SBE budget request.

What falls under that portfolio? Science, engineering, and education for sustainability portfolio.

Dr. GUTMANN. I respectfully, Mr. Harris, thank you for asking the question. I respectfully think that that budget is not as large as that, but it is—

Mr. HARRIS. The fiscal year 2012 request?

Dr. GUTMANN. The fiscal year 2012 request, but it is significant. I won't deny that. I think it is about, maybe about 15 or 18 percent of our budget, but in any event, it is a significant investment, and I recognize that.

These are—in this broad area we have a portfolio of research that involves the geographic and spatial sciences, studies that link environmental, environment and society and studies that bring our—explore the relationship between consumers and producers of energy and energy technology. So in this, for example, is our proposed investment in an NSF-wide initiative to understand how to make the best use of energy in the future and what are the roles, the research that would be SBE related would be research that is part of a broad inter-disciplinary teams that considers markets for energy, consumption of energy, and how people think about energy use in order to make the most effective use of our resources.

Mr. HARRIS. That, you know, just looking at all the testimony about how basic research, you know, the SBE research is kind of basic research and not politically motivated, shouldn't be politically motivated, my first question, why wouldn't the Department of Energy be funding something that so fundamentally looks at energy? Why is it stuck in a basic science area of research funding? Why not the Department of Energy?

Aren't you wondering into somebody else's bailey with perhaps a politically-motivated reason? I mean, who made the decision to increase it by 174 percent, the request by 174 percent?

Dr. GUTMANN. Again—

Mr. HARRIS. Well, you can get back to me.

Dr. GUTMANN. —with respect to by increasing it by whatever it is increased by—

Mr. HARRIS. That is fine. You can get back to me on the exact number.

Dr. GUTMANN. We will get back to you on the exact number.

Mr. HARRIS. If you can get that answer to me, I would appreciate that.

Dr. GUTMANN. Yeah, but may I continue with my response?

Mr. HARRIS. Well, I am sorry. I only have two more minutes.

Dr. GUTMANN. Okay.

Mr. HARRIS. I am going to go onto the next question for you here, and this is in a similar vein. In a brief review of the SBE Rapid Grants, and you are familiar with those, the ones that don't undergo peer review process, a great deal of funding seems to have been spent on evaluating the results and effectiveness of stimulus programs and funding.

Now, I got to tell you, I mean, most people would look at the stimulus and said, you know, unemployment was lower than it is now, before we spent all that money I am not sure we need a big expensive grant to figure out what it is. We just have to watch the unemployment figures and the national economic indicators.

But can you tell me how much the taxpayers invested in this and what the results of the—any of this information is? I mean, I assume since it was a Rapid Grant, you already have results because that is why you put it through a process that didn't require a peer review so you could get rapid results I would take it.

Dr. GUTMANN. I will have to respond later to you about the details of that. I don't have that directly in front of me.

Mr. HARRIS. But is that true? I mean, were there Rapid Grants truly awarded to look on evaluating the results and effectiveness of stimulus programs and funding?

Dr. GUTMANN. Yes, there were.

Mr. HARRIS. And you consider that basic science?

Dr. GUTMANN. Those research—that research was done under the Rapid mechanism because certain research had to be done—

Mr. HARRIS. Is that basic science?

Dr. GUTMANN. Yes, I do believe so.

Mr. HARRIS. You think that it is basic science that couldn't be done, couldn't be looked at in other, in more conventional means that would require bypassing peer review?

Dr. GUTMANN. There is a process of review that is undertaken for those, sir.

Mr. HARRIS. Okay, and I have got the numbers here in front of me. The SES fiscal year 2012 request is \$56.98 million, \$57 million, 174 percent increase over last year's request. Do you know where that increase originated?

Dr. GUTMANN. These decisions were made in the leadership of the National Science Foundation.

Mr. HARRIS. Do you agree with those decisions?

Dr. GUTMANN. Yes, I do.

Mr. HARRIS. So you think we need to spend, in an era where we have a \$1.6 trillion deficit, we should be increasing the funding to that particular segment by 174 percent so that we can somehow engage in some study of education for sustainability.

Dr. GUTMANN. Well, the parts of that that are within our directorate are broadly conceived, and I believe that whatever the number is it is an appropriate investment.

Mr. HARRIS. Well, it is \$56.98 million. I mean—

Dr. GUTMANN. Yes.

Mr. HARRIS. —do you disagree with that number? I mean—

Dr. GUTMANN. No.

Mr. HARRIS. —I am assuming it is written in a budget. So let's not pretend that it is some made up—it is \$56.98 million, 174 percent increase. You think that is appropriate?

Dr. GUTMANN. It is the 174 percent that I am questioning.

Mr. HARRIS. That is what?

Dr. GUTMANN. It is the 174 percent.

Mr. HARRIS. Well, can you get a written response back to me about exactly what the percent is of the increase?

Dr. GUTMANN. I would be happy to do so.

Mr. HARRIS. Thank you very much, Doctor.

Dr. GUTMANN. Thank you.

Mr. HARRIS. Thank you very much, Mr. Chairman.

Chairman BROOKS. Thank you, Dr. Harris, and Dr. Gutmann, if you had any other questions that were submitted just then that you want to supplement your answers to, feel free to submit them to the Committee.

Dr. GUTMANN. We will be glad to do that, sir. Thank you.

Chairman BROOKS. Next we have Mr. Clarke.

Mr. CLARKE. Thank you, Mr. Chair. Appreciate you giving me the opportunity to address this panel. First of all, I want to thank Dr. Gutmann for your outstanding work at the University of Michigan. I am a lifelong Detroit, and I appreciate your contributions.

Ms. Furchtgott-Roth, I do hear your reservations about SBE research funding through NSF, but I do acknowledge your recognition of the value of longitudinal studies conducted at University of Michigan.

Dr. Gutmann, I am on the Homeland Security Committee, and you know, we are concerned about, you know, the risks of terrorist attack, especially in the area that I represent, metro Detroit, and then also our country's ability to help prepare and respond to disasters.

How does NSF ensure that its research that is related to national security and to disaster response is communicated to not only Federal officials but state and local government officials? And that is so important because the first line of defense in an emergency, whether it is a national—a natural disaster or a terroristic attack is our first responders that are hired by our state and local governments.

Dr. GUTMANN. So, Mr. Clarke, thank you very much for the interesting question. I appreciate your comments. Our first expectation, of course, in the area of basic research is that researchers are going to communicate through the standard channels of scholarly communication. That is most of what—that is our first understanding, but I know in terms of the work that I did in providing data in various times in my career to the state and local and federal policy community and that they read those, that literature assiduously and follow that.

But NSF works hard to get the word out in other ways. We require our researchers to provide project outcome reports that are written in a way that a broad audience can understand them. We highlight in various ways our most important findings, and I work personally very hard to participate in multi-agency working groups, the Committee on Science, I co-chair the Committee of Science, Subcommittee on Social, Behavioral, and Economic Sciences. We work together in the area of hazards, very closely with NOAA on hazard communications so that they can get that out. We work

with the National Institute of Justice in various ways on those topics.

So I think what we try to do is a mix of things that encourage researchers to communicate directly through scholarly communications and other communications, and we encourage and we work ourselves to make sure that the most important findings that we learn about communicate to the policy area.

Mr. CLARKE. Thank you. This is just a follow up on a different issue to either you, Dr. Gutmann or Dr. Elfenbein, and this deals with the value of SBE research in terms of overturning many times our conventional thinking about certain types of behavior or decision making process.

Can you outline some examples about the potential value of these findings as a result of this research?

Dr. GUTMANN. Okay. Thank you. That is a great question. We always get asked the question, isn't social and behavioral science research obvious when we see it? And the answer is, no, it is not. A lot of behavioral research really doesn't, as Dr. Elfenbein highlighted in her testimony, a lot of those things are really not known. I mean, the work that I cited that had to do with how auctions operate that led to this enormous production of income to the U.S. Treasury, much more than SBE has ever cost the U.S. Government, came about when researchers discovered that, theoretical researchers discovered that auctions and bargaining were very similar mathematically, and that if you did that and looked at them carefully, you could combine auctions and bargaining in ways that produced both better products for people to use and more income for the United States Government.

I don't know if Dr. Elfenbein wants to add something to that.

Dr. ELFENBEIN. Just that I think that the critique that researchers are often studying pieces that just satisfy their own curiosity on a related note, I think that when we find these applications, we don't, often the basic research has already been done, and it is difficult, I think, to start in the other direction so we can think about basic research that had transformative results, but we couldn't start with the question that needs transformation and then step backwards and say, let me go ahead and commission basic research that hasn't already been done.

And just in my own experience the work that the Army took an interest in, if they had said, oh, well, we have this problem now with our soldiers serving overseas, let me go back and get some basic science to help solve this problem, the work that I had done that they were interested in had started ten years prior to that point.

And so I want to just make a point around the unpredictability of this process so we can look at wonderful case studies of work that has had transformative impact, but we can—but as the Monday morning quarterback we can look back at that work, but in terms of funding that work from now forward, basic research is a very unpredictable process, and I think it is important for us to think about this portfolio of projects that we fund because we can't always predict when an insight will lead to some kind of application.

Thank you.

Chairman BROOKS. Thank you, Mr. Clarke.

The Chair next recognizes Dr. Benishek.

Mr. BENISHEK. Thank you, Mr. Chairman, and thanks to the panel for your testimony. I just have a few questions.

We have people coming before us all the time, you know, asking for money, and we are spending, for every dollar the government spends, we have to borrow 40 cents, and everybody thinks that their project is worthy. I don't really see how we can be increasing your budget 18 percent in a time of this fiscal crisis. I think we need to streamline the situation.

I looked at some of the things that disturbed me as a physician is really the Rapid Grants where there is, you know, not peer reviewed, and I kind of feel for the minority when they were saying you can't judge the research projects by its title, but it concerns me. I am quoting, yes, Dr. Wood's testimony, he quotes a project with a title like, what is it here? Engineering and social justice; research and education of (in)commensurable fields of practice is a \$300,000 grant to study the field of engineering and its, you know, the education of engineers and their relationship to social justice, and it has a title, and it has an abstract, and I just don't see how this is a project that is worthy of funding in a tight economy like we have.

How do you justify an 18 percent increase in your funding when we have a situation like this, and I am looking at grant proposals and an abstract that seems to me like a waste of money.

Dr. GUTMANN. All of our projects are subject to considerable review. You asked the question about the Rapid Awards. We made roughly 1,100 awards in fiscal 2010. There were 23 Rapid Awards. They were largely devoted to issues like the earthquakes in Haiti and elsewhere in response to immediate circumstances that required researchers to talk with people soon after the event.

In the case of the Ethics Program Award that you describe, this is a program designed to increase knowledge about how ethical processes emerge across all areas of science. It was made in a competition we have in this area, and it was peer reviewed. I can't go beyond what you said about it in any specific way, but I think that it is very hard for—just as it is hard for you to understand how we make the award, it is hard for me to criticize the whole program based on a single project.

Mr. BENISHEK. Well, I understand that. It is just that we end up talking about millions of dollars with the sum of all these projects and I think there has to be some sort of a prioritizing of spending, and I just don't see how an 18 percent increase is justified when I see, you know, examples like this.

Dr. GUTMANN. But I could show you many more projects that I think we would agree have great value in terms of basic science.

Mr. BENISHEK. Well, that may be true. It is just that there is no money, and everybody says, well, cut everything else but don't cut mine. And believe me, we need to fix the budget, so I think everybody is going to end up taking a cut, and I just think it is unrealistic to make this request.

Dr. Elfenbein.

Dr. ELFENBEIN. If I could be recognized, I think that to justify an increase in funds at a time of fiscal crisis, you have to believe that this is an investment, not an expense.

Mr. BENISHEK. Everything is an investment. Okay. I mean, everybody comes to me with the same answer, and they all, every department wants everybody else cut but my department is an investment. So who should we cut to, you know, to make sure that you get your extra money? That is just unrealistic.

So I think you have an unrealistic expectation as to what is happening here, and you have to streamline your research.

I yield back.

Chairman BROOKS. Thank you, Dr. Benishek.

Next the Chair recognizes Mr. Hultgren.

Mr. HULTGREN. Thank you, Mr. Chairman, and thank you all for being here.

Following up, I mean, I think we all recognize clearly that these are challenging times that we are in, and so much of the challenge I think we face is there is a lot of good things out there, but what are the best things? What are the things that we have to do?

And so I want to just talk a little bit about prioritization and I would ask each of you, I guess I would start with Dr. Wood, if I could, and then if each of you could make a comment, where do you draw the line between national need and priority research, transformational research, and research that is simply interesting and intriguing but probably not really game-changing research? How do we draw that line? Because I think that is really some of the decisions we need to make.

Dr. WOOD. Well, I would draw the line between basic research and applied research. That would be one line. I would also draw lines between basic research and research that has fairly self-evidently an appeal to the passions of the moment. In my written testimony I mentioned some other things like a study of—titled, “Out of the Shadows,” \$148,000 spent on looking at the lives of illegal immigrants before, during, and after legalization. That is not basic research. That is appealing to something that is going on in the policy arena, and I think that one should look at the NSF funding with the question of whether that kind of thing really falls into the category that Dr. Elfenbein was talking about where we are likely to get insights that lead to applications down the road. Well, no, we are really just sort of flattering ourselves that we can use social science to fill in pictures for us that are a little bit vague or feed advocacy groups with data that looks scientific.

That is the sort of thing that I think that the Congress should be aware of in this sort of funding, and it is not that the NSF does that all the time, but if you look through those 1,100 awards, you can probably find a segment of them that seem to be more driven by identity politics by policy debates rather than basic science.

Is there some sort of linguistic formulation where you could absolutely draw the line so that the NSF administrators knew we were going to do this and not that, I think that is very difficult, but it is certainly possible to push hard in the direction that what we want out of NSF is true basic science, not all kinds of politicized stuff dressed up as basic science.

Ms. FURCHTGOTT-ROTH. I guess I would answer the question by saying is this the role of government to do, and Dr. Gutmann just mentioned a big project they had, how to make the best use of energy in the future. We have companies that are producing energy, we have consumers who are buying energy, we don't need the government to figure out how to make the best use of energy in the future. We just see what consumers are buying and what they are not buying.

If we think there is a social cost of using certain kinds of energy such as, gee, we shouldn't be using so much oil. We can put a tax on oil to encourage consumers to purchase less of it. This isn't something that we need to devote government funds to doing.

Now, there are other areas where perhaps we are falling behind, not in the social sciences, perhaps in the physical sciences. You see physics graduates of leading universities, they go off to investment banks on Wall Street rather than studying physics. There is probably a greater role for NSF grants in the physics, chemistry, those hard sciences where graduates don't get jobs.

In my field, economics, corporations, banks, the Federal Reserve, other government agencies employ economists. There are no shortages of jobs for economists whether private and other government sectors pay for this research.

Dr. ELFENBEIN. In prioritizing research I want to emphasize the importance of peer review over political review. I think that it is difficult to see sometimes the value of projects when looked at out of context, but the science—but scientific, the scientific method is such that scientists often take large problems that are difficult to solve and break them into smaller problems that can be solved, and when looked at out of context, those smaller problems might seem silly from the outside. They might seem like the—they might seem like ideas to ridicule publicly but when seen from the eyes of people who have expertise in that area, their value can be known.

And so I want to distinguish the importance of having those with expertise involved in the process and rather than strictly political review of grants and their value.

But in addition I want to emphasize the lack of predictability from the time of basic research being done to know just how valuable and how applicable it is going to be and the difficulty of taking a look and going through a portfolio of projects by saying what do you think now is going to be transformative later. Very often we just don't have that ability to look into the crystal ball and what we need to think about as portfolios of projects.

Thank you.

Dr. GUTMANN. Is there still time for me to speak?

Chairman BROOKS. Go ahead.

Mr. HULTGREN. Mr. Brooks? Thank you.

Dr. GUTMANN. Thank you. I think these are very important questions, and the National Science Foundation I assure you recognizes the financial challenges, the fiscal challenges that the U.S. Government faces. It is—I think it is fundamental, though, to say that we feel very strongly, and I feel very strongly that basic science in the social and behavioral sciences meets the definition and economics of a public good. There aren't rivals for it. It is not excludable to

use the formal definitions, and the basic science we support is really critical to develop over the long term.

We recognize that we are going to have to make choices, and we believe that our combination of inter-agency discussions, leadership discussions with NSF, and the peer review process give us an opportunity where we are going to have to make some priority decisions, to make good priority decisions in the ways that Dr. Elfenbein and Dr. Wood discussed that drive us towards fundamental understandings.

Mr. HULTGREN. Thank you. I yield back.

Chairman BROOKS. Thank you. My opportunity now to ask questions.

And I know I might be beating a dead horse to some degree, but I do want to emphasize the precarious situation that the Federal Government's finances are in. Our presenter, Ms. Furchtgott-Roth, being an economist probably has the best understanding of anyone in this room, but on the chance that it might be beneficial, 58 percent. That is how much we have revenue for out of every dollar that we spend. The other 42 cents, give or take a penny or two, is borrowed money.

We are looking at a debt ceiling issue short term. If that is not raised and if the Secretary of Treasurer's estimate is correct that we run out of credit on August the 2nd, then all of the sudden we are having to operate the Federal Government on 58 cents of every dollar, if that results in across-the-board cuts, and I don't think that it will, but if it did, that would be—everyone is having to absorb 42 cents or 42 percent cuts like that.

Long term we are risking a Federal Government bankruptcy or insolvency if we continue with this string of unsustainable budget deficits as Admiral Mullen, a former chairman of the Joint Chiefs of Staff, testified earlier this year to the Armed Services Committee, America's greatest threat is our national debt, not Al-Queda, not the Taliban, not any number of nations you want to name.

In that context we as a Committee, we are going to have to prioritize. Now, within Congress you have got a lot of different attitudes and approaches on how to handle this financial situation. You have got some who want to say grow the economy. Well, everybody wants to do that. But then you have got a group that wants to focus primarily on spending cuts. You have got another group that wants to focus primarily on tax increases. You have got another group that wants to have a hodge podge of spending cuts or tax increases. You have got another group that just wishes it would go away and doesn't want to deal with the problem.

And I think you have got a little bit of each in the United States Congress in different amounts, and so we are going to be charged with, worse case scenario, is trying to prioritize, and we understand how each of you have done a good job of justifying your own field, but this is for each of you to answer probably to a lesser degree than Dr. Wood because his remarks focused on prioritization.

But if we are forced to prioritize and if we are forced to reduce spending 42 percent and assuming we are not going to do it across the board, that there is going to be some agencies that don't do as

well as others do, but within the NSF framework, how would you all prioritize cutting 42 percent of what we are now spending?

You know, if the debt ceiling is not raised and we don't have the credit, if our credit—if the debt ceiling is raised and our creditors just decide they don't want to loan us anymore money, we have to limit our spending to that 58 cents on the dollar because that is all the money we have to spend.

So each of you if you would volunteer how you would prioritize within the NSF framework what ought to be cut, and if you recommend across the board, if you just want to do across the board, I understand that. Say everybody gets reduced 42 percent if that is the framework you believe, or if you believe you want to prioritize, what are your criteria?

Ms. FURCHTGOTT-ROTH, how would you guide us?

Ms. FURCHTGOTT-ROTH. Well, in times like this when we have a fiscal crisis, the role of the government is to have a safety net for the most vulnerable and to protect our country in terms of national defense. We have researchers who are definitely not the most vulnerable among us. We are giving money to Ph.D.s, many foreign, many who cannot get visas and then go home afterwards, and I don't think that this should be a priority. Any SBE funding should be a priority for Congress.

I would say if you have to prioritize you should only support projects that create new data that is made publicly available within five years and only pay for data entry by research assistants. Don't pay for faculty compensation, don't pay for computer hardware or software.

Chairman BROOKS. Thank you. Dr. Elfenbein.

Dr. ELFENBEIN. I would yield my time to Dr. Gutmann.

Chairman BROOKS. Dr. Gutmann.

Dr. GUTMANN. I don't—I have a hard time dealing with hypotheticals, Mr. Brooks. I apologize, so I think I am going to defer on this one. I really don't—

Chairman BROOKS. Well, it is not a hypothetical, Dr. Gutmann. We are going to face spending cuts. Now, the question—it might not be 42 percent, it might be 10, 20, 30 percent, but it is not a hypothetical. It will happen, and I think, Ms. Furchtgott-Roth, do you think it is going to happen that there will be spending cuts?

Ms. FURCHTGOTT-ROTH. Well, I very much hope for the sake of the United States that we don't become like Greece. There will be spending cuts, and you should consider zeroing out the whole of the SBE NSF budget in favor of other kinds of—

Chairman BROOKS. Yes. I am really disappointed if you are going to claim that this is a hypothetical. The exact number may be hypothetical, it might be 45 percent or 40 percent or 35 percent, but if you—and I also have a degree in economics. It is an absolute certainty that there will be spending cuts. It will either be voluntary, or it will be forced upon us by the economic circumstances that we face as a Nation.

And maybe you are right, and maybe I am wrong, and I hope you are right, and there aren't spending cuts, that it is a hypothetical, but don't you think we need to plan for that possibility so that we can have some foresight, some thought given into it, and thereby

make wiser decisions instead of it being forced upon us where we have to make snap judgments.

Dr. GUTMANN. So obviously I am in favor of planning, sir, and I understand your point. I think that NSF has a good record of using our merit review process to identify the most important basic science that needs to—that is available to us to be done that presents itself. And I suspect that I know that our first goals will be to protect those things that we do that are in the broad service of the government. For example, our statistical activities but also that will use the merit review process to ensure that the most meritorious, whatever our budget is, the most meritorious projects in basic science are supported.

Chairman BROOKS. Well, are you suggesting then that we should have across the board cuts and that if 42 percent happens to be the magical number, that we should do that for NSF and let NSF decide within its own hierarchy how to allocate that, or should we as policymakers be involved in that decision?

Dr. GUTMANN. I think you have as policymakers have a responsibility to help to make—to help us make wise decisions about government expenditure, and I think—obviously I am here to represent the strong need for the social and behavioral sciences to be supported in NSF. We are the smallest of the directorates, and we obviously have important research which I and others have described to you that needs to be done, that must be done, and it must be sustained over the long term, I mean, because if we don't do that, it is a form of eating our seed corn. There is some of this research that is really going to carry us forward.

Chairman BROOKS. Dr. Elfenbein or Dr. Wood, would you all like to add anything before I recognize Mr. Sarbanes?

Dr. WOOD. I would like to add something to that. I would not favor across-the-board cuts. I would favor zeroing out particular parts of the NSF budget if that is what it came to. Not that this would be eliminating just bad work. There is good work that would be cut, but I think sustainability is mainly an ideology in this country and not a scientific enterprise. It is questionable as a scientific enterprise, and that should be cut.

Economics as my colleague has been saying is a field in which almost all basic research can be done with funding from alternate sources. The dissertation support is not a major part of the NSF budget, but it is almost endlessly deferrable. If you are a graduate student finishing a dissertation, you can get a job and work on your dissertation. That is how I did mine.

There are parts of this program that selectively fund programs for women and minorities. That really has no justification in basic science. That is a politicization of the NSF.

And finally, the use of NSF funds for these Rapid Grants is almost always a mistake. There is not basic science being done under that provision. That is rushing in to fill in political stop gaps, and that could probably be cut with no damage to the basic enterprise.

Chairman BROOKS. Dr. Elfenbein, did you want to—

Dr. ELFENBEIN. I would look to the peer review system to help identify specific grants rather than have external review, and I would take issue with the idea that we could look at areas within

the NSF based on whether there were outside funding agencies that would fund them.

The NSF is the source for basic research funding. We cannot count on corporations to fund anything that doesn't have immediate clear commercialization as an impact, and what we care about in basic research is for everybody to have access, and for us to take whole areas and say that because other, commercial interests may find these areas of interest, that we should leave funding to those commercial interests, risks having our basic research be not available for other scientists to use as a basis.

So I would not cut NSF funding on an area-by-area basis in terms of whether there are other sources, other commercial interests, whether they be companies or foundations.

Thank you.

Chairman BROOKS. All right. Thank you. Next I am going to recognize Mr. Sarbanes, but before I do I am going to make this one note.

If anyone wants to engage in a second round of questions, they will certainly have that opportunity.

Mr. Sarbanes.

Mr. SARBANES. Thank you very much, Mr. Chairman. Thank you all for being here and for your testimony.

Dr. Elfenbein, I am glad you made that last point because I was actually going to ask a question to that effect in terms of the NSF's role in conducting basic research and the notion that that cannot be replaced by other entities or funding sources out there, however much they might be interested in doing this kind of work.

They may, you know, they may be focused on a different agenda or set of objectives, and you would leave by the side of the road some important research that needs to be done.

I wanted to ask both you and Dr. Gutmann along those lines to speak to the role that these—this basic research can play in sort of leveraging broader attention to the subjects that are being researched.

So speak to that kind of foundational role that is played, the leveraging dimension of it. I think you, Dr. Elfenbein, alluded to this notion that if you rely solely on outside groups, many of whom are going to be commercially driven and that is fair, that the horizons that they are looking at are shorter and that what the NSF funding can assure is that you are getting a broader perspective and a longer horizon, and sometimes that is the most critical thing you can have to think we stumble on the right kinds of discoveries going forward.

So if you could speak a little bit more into that, I would appreciate it.

Dr. ELFENBEIN. Thank you for the question, and I do believe that that sciences, all of the sciences including the life sciences and the physical sciences, leverage the basic research done across fields particularly in the social and behavioral areas, and one example I would use is medicine because ultimately any kind of medical treatment involves the compliance of the patient to be a part of that treatment, and so we see physicians looking to behavioral research.

And in my case another example is the importance of understanding the fundamental science of emotions in order to understand emotional disorders, and this is an area of particular importance now that mental illness is being recognized for healthcare coverage at the same level as conventional medical illness. There is now a need more than ever to have cost effectiveness in the treatment of mental illness.

Thank you.

Dr. GUTMANN. So I will only add a few words. Thank you very much for that question.

One way to look at the investments that we make in science is to think about them in a very direct way about you get money back or jobs back, and very often the investment by businesses and research, which has been substantial in the history of the United States, is really directed mostly towards that, but a lot of what we support basic science research in the National Science Foundation for has a value that is non-monetary. Dr. Elfenbein's work on recognition of emotions has a non-monetary value even as it has been converted to practical use by the military.

We have done a lot of—we supported a lot of work that has been very successful on detecting deception. A lot of that has to do with how interrogations, criminal interrogations and other interrogations are done, and those have value to society that are broader and longer term. The kidney matching examples that I talked about. Those are healthcare examples that come from basic science research.

Work that we have been supporting recently and using a Rapid Award for it was a research project done last year that did experiments with trying to—using modern technology to see, to understand the transmission of the H1N1 virus when it was just happening. These are exactly things that we are using. What they were using was contact, understanding how ideas and physical presence converge to understand how something as important as an epidemic is transformed.

So there is a lot of ways that it happens. It takes a long time, and even if there is financial value, it might be far in the future, but very often it has societal value that goes to health or security or justice.

Mr. SARBANES. I appreciate that answer, and I have just five seconds left here, but also Dr. Elfenbein, I appreciate your alluding to the issue of mental health, and it would be a shame if at a point in time I think when the society is finally turning and embracing, you know, how do we address issues of mental health, that we started to pull away from some of the basic research that can help us in that area as well.

And I apologize for mispronouncing your name earlier, Dr. Elfenbein.

I yield back my time. Thanks.

Chairman BROOKS. Thank you, Mr. Sarbanes.

Does anyone wish to engage in a second round of questions?

Mr. LIPINSKI. Mr. Chairman.

Chairman BROOKS. The Chairman recognizes Minority Leader, Mr. Lipinski.

Mr. LIPINSKI. Thank you, Mr. Chairman.

Chairman BROOKS. Excuse me. Ranking Member.

Mr. LIPINSKI. I was just going to let that one go.

A couple of quick questions for Dr. Gutmann just so that we understand a little better some of the things that NSF does. First of all, the grants are I presume awarded for, generally for new data to be compiled, and is this data, is there a requirement that it is made publicly available?

Dr. GUTMANN. NSF policy requires that all data be shared. There are limitations on that that have to do with questions of privacy, confidentiality, and security, but NSF policy requires that all data be shared. As of earlier this year NSF policy has shifted a little bit in order to require in addition to the data sharing that every proposal we receive includes a two-page data management plan that shows how the researcher is going to manage their data and how they are going to make them available to other researchers.

Mr. LIPINSKI. I think that is a very good addition there having done research myself, and I think it is good to have a plan beforehand about how it is going to be made available.

The other thing I just wanted you to clarify, you said there aren't that many of these grants done in the RAPID fashion, but why are they done, why are a few done that way?

Dr. GUTMANN. We make a few of those awards every year. Again, this is an area where we don't—it is not our strategy to make very many. There were, I think, 23 or 24 of them in the fiscal year that ended last September 30, but our goal is to understand that there are times when you have to gather data quickly, gather information quickly.

Most of those tend to be when there is a physical emergency, for example, the Deep Water Horizon spill, and we needed—researchers wanted to get out and talk to people in communities while the memory was fresh about what was happening to them. And those are things that you can't do otherwise, and, again, I just want to remind you how few of these there are. They are not very big awards, and we don't make very many of them, and we are extremely careful about how we make them.

There is a special set of documents that are required in the process when we submit our recommendation, when program officers submit a recommendation to management of NSF, both inside the directorate and outside within NSF, a special set of documents that are required that document the timeliness of the award. It is really about timeliness.

So we are very careful, and we make them only when there is a very pressing need, and this arose out of requests from Congress and others that we have the capacity to respond to emergencies.

Mr. LIPINSKI. Thank you. In my last two minutes I can do my Dr. Ehlers' impersonation of when I was Chair of this Committee last time, and Dr. Ehlers sat in this chair. I will not be nearly as wise as Dr. Ehlers, but he would like to sometimes end by imparting some wisdom from his experience. I think listening to all the witnesses, I think we can all agree, first of all, that these are very difficult budget situations that we are in, and that we not be funding specific agenda driven, whether it is political agenda, whatever, other agenda. That kind of research, that is not the role of the NSF.

But what we do is we have the NSF so that we have what we hopefully believe is objective research being done. Now we could all debate on, you know, each individual grant on some of those things I am sure, but that is the idea there, and I know that in—I brought up before about some of my background, my Master's degree. I got an engineering economic systems at Stanford. It is now management sciences and engineering.

And what I was looking at at the time and a lot of others in the program were looking at was to be business consultants. So we studied economics, and then some mathematical ways of helping make decisions, optimization. So it was sort of a highly-technical business degree in some ways.

We also looked at this—how people make decisions, decision analysis to help businesses make decisions. And so one of the things that I did, many of us did was went to the psychology department, took a class with Amos Tversky, who is a famous psychologist, so that we could better understand how people make decisions and mistakes that people make in what they are thinking. I remember a paper that he did about the hot hand and basketball players don't really know if—although I don't know if I—still don't know if I agree with that, but that is all part of helping to make better decisions, and it should help us to better understand.

We want to know the policies that we put in place also, how are people going to react to that, and that takes better understanding of human behavior, and it is best to have as much of an objective view of that as possible, and I think that is where the NSF comes in, and there is a lot of great research done by other organizations.

But some of that is agenda driven. Much of that is agenda driven, and that is what we are trying to get away from with the NSF, and I think NSF has done a very good job with that, and it doesn't mean that there aren't issues that do come up, but I think NSF has done a good job of dealing with a lot of those.

But as I said before, I think it is our role here and I know the Chairman agrees with this, to take a look at this, and so I thank the Chairman for this hearing.

I yield back.

Chairman BROOKS. Thank you, Mr. Lipinski.

Any other Member—well, I see there is only one now. Mr. Clarke, do you want a second round?

Mr. CLARKE. Yes.

Chairman BROOKS. All right. The Chair recognizes Mr. Clarke.

Mr. CLARKE. Thank you, Mr. Chair.

I have a statement, and I welcome any comments on this. A couple days ago I happened to meet with the CEO of Ford Motor Company, and the reason why I mention this is because the auto industry is ruthlessly competitive, and Mr. Mulally shared with other freshmen members of Congress how he was able to—he and his management team was able to turn Ford Motor Company around.

You know, the bottom line is very different in a corporate company. You know, here in this country as the other side likes to underscore, we can borrow money to spend money than we receive in revenues. However, Ford did a couple things. They dramatically reduced their costs by streamlining their operations, but also and to paraphrase Mr. Mulally, Ford could not succeed by cutting alone.

At the same time they heavily invested in safety engineering, in fuel efficiency.

When it comes to the federal budget, we know why we are spending too much money. We know what the main driver of our deficit is, and I will tell you one thing, it is not SBE research. It is healthcare costs because of demographics, because of the increase in rise of the rate of—the cost of medical technology, because we don't coordinate care, especially when we are treating those who are chronically ill.

Essentially it is this. It is because our healthcare system really is a system of disease management, and it doesn't promote wellness. Your research into healthcare will help transform the incentives right now that we are using to compensate health providers. What you are doing is actually helping us bring down our debt and deficit, and I wanted to underscore that fact.

And I welcome any of you who disagree with this, but, you know, the bottom line point is this. I know Subcommittee Chair and the Chair, they talked about their academic backgrounds. Let me tell you about mine. I am trained as a visual artist, as a painter. I have a Bachelor of Fine Arts degree in painting. It may not lend me to an obvious understanding and appreciation of your line of work, but I will tell you what does.

I am a son of a man who risked everything to come to this country. He was an immigrant just like many of your ancestors. He came here willingly, though. My mother's people, they were brought here against their will from Africa, but needless to say, this country is extraordinary, and it is not because we do things on the cheap. It is because we recognize the value of contributions from diverse sources from around the world, and we give them in the preamble of our Declaration of Independence the God-given right to liberty, to be able to express our views.

Now, we are not the unchallenged superpower of the world. China is right there. They understand the value of investing in research, and they are doing that heavily. But here is something what we do have different as a democracy. Because we value liberty and we value individual freedom, your work, our funding of your work is absolutely essential. We have got to promote the intellectual capacity and growth of this country. That is why we are great. We can't cut back right now. We have got to do more of that. We have got these countries all around the world who are competing, but we are the only one in my opinion that has a true vibrant democracy.

I just don't want you to feel apologetic for asking for funding. You are helping to ensure the American dream.

I welcome any comments.

Ms. FURCHTGOTT-ROTH. Well, as an immigrant myself I would say this is my, well, adopted country. I am an immigrant myself. I received my citizenship in 1987, and I say this is a wonderful country. This is the land of promise, but it is not because of government spending. It is because of the opportunities individuals have.

And I have been very fortunate to get grants for my research from the Kauffman Foundation, the Pew Foundation, the Bill and Melinda Gates Foundation, the Ford Foundation in my field, economics. It is not just corporations that fund research. There is fed-

eral reserve banks, there is foundations, and I would—there are, I think, better uses for government funds than the funding of SBE research, which isn't to say that it is not good research. It is great research, it is objective, but just because, for example, a Cadillac is a good product, it doesn't mean the Federal Government should be buying Cadillacs for everybody.

It is a question of what is the role of the government and what is the role of the private sector.

Chairman BROOKS. The gentleman's time has expired, but if he would like an extra amount of time to respond, that would be fine. Otherwise, we will move to Mr. Tonko.

Mr. CLARKE. Well, you know, I just want to say, I mean, throughout our history we have supported private enterprise in terms of even though we were the first in flight when France looked like that they were going to really take over the airplane industry, we helped, you know, subsidize airmail routes. The semiconductor industry was because of the military support of that industry that we have been able to grow and innovate.

No, I make no apologies. Look, we are great because we bring our tax dollars together to support our people, to support our intellectual capacity. We shouldn't shirk that responsibility, and we shouldn't be ashamed of that. That is what has made this country strong.

Look, I understand we have the right to disagree on this issue. This is the taxpayers' money. When we leverage it right, when we are efficient, we can actually make a difference in the world, and that is what you are doing every day. I just don't want us to leave this Committee meeting with the role that the only way that America can make it is that we have to do it on the cheap. We have to cut, cut, cut.

No. Government has a vital role in our society, and you know, Mr. Chair, I think I really said enough here. These people are doing outstanding research. Their research is not the cause of our debt and deficit. Actually, it is going to help bring down our overspending in healthcare and help better secure our people here in terms of our national security, goals, and interests.

Chairman BROOKS. Mr. Clarke, thank you for your passionate remarks.

The Chair next recognizes Mr. Tonko. I don't know if you are familiar with where we are. We are on our second round, but it is all yours.

Mr. TONKO. Thank you, Mr. Chair, and I apologize for joining you late in progress, but it is one of those days of many conflicts going.

To our panelists, thank you for presenting this morning. Let me share with you a thought. I worry that political attacks on scientific research sends a chilling message to young, aspiring scientists. As an engineer there was a lot of encouragement in my day and age when I was in high school to look at engineering and science because of the global race on space.

But lately there are some chilling messages that impact young, aspiring scientists, I believe, including some of the potentially best and brightest, for example, those who developed the Spectrum Auction Methodology or Geographic Information Systems.

Just your thoughts on that. Do you share that type of concern, or do you think that is—we are moving along quite well? Dr. Gutmann.

Dr. GUTMANN. So I will just say a word or two and then perhaps see if Dr. Elfenbein wants to contribute something since she is at the moment closer to the community, in the research community than I am right now.

I think that there is always in my—I have been getting grants, I came out, I am still a university faculty member, I am on leave and assigned to the University, the NSF. I have been getting grants for, you know, for 30 years now, and my experience as a researcher is that my colleagues take very seriously the message that they get from funding agencies and from the public officials more broadly, and that the pace of entry into scientific fields and the level at which people try to dream up new ideas is definitely responsive to the public messages that people get.

And so I would be concerned about that. I think we see a flow when there is encouragement, we see a flow of more proposals, we see a flow of more ideas, people are dreaming up new things, and what we see is especially the notion in the support we have for our youngest scholars, which is where in my view as an older guy, the real future lies, we really want to—it often isn't very expensive to make those small awards that we make to support dissertations, our famous career awards or graduate research fellowships as I think Mr. Lipinski was a recipient of in the beginning of his career.

It doesn't take very much to do that, but we send a message by doing those things that encourages people to have the kind of big ideas that down the road lead to important contributions to our society.

Mr. TONKO. Uh-huh. Dr. Elfenbein.

Dr. ELFENBEIN. Thank you. I do feel our funding priorities send clear messages to young people who are considering careers in science. I finished my undergraduate degrees in physics and Sanskrit actually at the time that the super conductor, super collider project was cancelled and saw many classmates rip up their Ph.D. applications in physics.

Now, clearly priorities change, and we can't help those changing priorities, but I think what is especially chilling is when we send a message to scientists that there can be political review of their work because I think that leads to censorship, and in my own case the idea that I was doing work that the military had taken an interest in and that it was singled out as potentially worthy of being de-funded because of some kind of view from the outside that didn't take into consideration the works potential relevance I think was chilling and is chilling to those who seek federal funding.

And I think there is—

Mr. TONKO. Was that—let me just interrupt you. Was that in the 2007 action—

Dr. ELFENBEIN. It was.

Mr. TONKO. —on the Floor with the amendment?

Dr. ELFENBEIN. It was.

Mr. TONKO. What was the lesson learned coming out of that experience?

Dr. ELFENBEIN. Well, for me the lesson learned I think was to pay a lot more attention to the titles of grants. I think that the lesson learned I think for the member who made that proposal was maybe read the abstract as well. I would have to defer to him. I think, though, actually, for me the lesson along the lines of titles is that I think that scientists do need to learn how to communicate more clearly to the public and to the taxpayers who fund our work and to express not only our gratefulness but to help them to see the work, and we know our work, and we I think need to learn how to take a perspective of looking at it as if from the outside to understand how it is seen from the outside so that we can explain it from the inside out.

But I think it is a particular, it is particularly chilling to me if we are sending messages about the value of science, the value of research because I see our university, our basic research based university system as one of the jewels of the United States. We enjoy a lot of prosperity that is hard to put into dollar terms because the best from all over the world want to come and be a part of our university system.

You can look at how many world leaders have U.S. university degrees, how many world leaders send their children, how many people send their children, send the best people in their communities to the U.S. for degrees, and it is because of our university system, but it has not only financial impact, it has a huge diplomatic benefit to us as we think about the relationships we have with countries all over the world that have this cultural connection to the U.S. through our university system.

Mr. TONKO. Uh-huh. Thank you.

Ms. FURCHTGOTT-ROTH. And the subject of the hearing was funding in the social and behavioral sciences, and that is what my testimony is about. If it were the physical and life sciences, my testimony would be very different. I think we need such funding to keep it competitive.

I would also say that this funding should go to either U.S. citizens or people who intend to stay here. We shouldn't be funding as we are now even physical degrees in the physics and life sciences for people who then go abroad and go back to their countries and compete against us. But we definitely do need more funding in the physical and life sciences.

Mr. TONKO. Thank you, Mr. Chair.

Chairman BROOKS. Thank you, Mr. Tonko.

I would like to thank Dr. Gutmann, Dr. Elfenbein, Dr. Wood, and Ms. Furchtgott-Roth for your testimony today and the Members for their questions.

The Members of the Subcommittee may have additional questions for the witnesses, and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments from the Members.

The witnesses are excused, and this hearing is adjourned.

[Whereupon, at 11:45 a.m., the Subcommittee was adjourned.]

Appendix I:

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Myron Gutmann, Assistant Director, Directorate for Social, Behavioral, and Economics Sciences, National Science Foundation

Questions submitted by Chairman Mo Brooks

Q1. The 2009 NSTC Report, Social, Behavioral, and Economic Research in the Federal Context, noted that not all social, behavioral, or economic sciences “require or are even appropriate for government support.” Please identify which of the sciences, in your opinion, do not require or are even appropriate for government support, and which of these sciences NSF does not provide funding for?

A1. The 2009 NSTC report addressed social, behavioral, and economic research in the Federal context, that is to say, SBE research that is conducted throughout all of the federal agencies, which differ in their mission and in the mechanisms they employ for sponsoring research or conducting it themselves, either internally or through contract vehicles. This phrase is part of the first sentence of the second paragraph of the introduction to Chapter II of this report, “Federal Context.” The passage reads, in full, as follows:

It may be noted that not all the SBE sciences require or are even appropriate for government support. For example, consumer behavior and the successes and failure of commercial marketing campaign are major targets of SBE research but are well funded through industry support. What, then, is the role of the Federal Government in support of the human sciences? What does and should it support and what are the potential benefits of this support to citizens and institutions?

“There are human dimensions of every policy matter, and today’s societal challenges demand that Federal agencies utilize the human sciences for insights to achieve their missions efficiently and effectively.”

NSF’s mission is to promote transformative fundamental science on behalf of the American people. NSF/SBE’s goal at the directorate level is to examine fundamental aspects of human behavior at multiple levels, scales, and contexts. NSF/SBE supports a broad range of high-quality fundamental research, and the results can have practical implications. Unlike the market research supported by industry, targeted toward specific results for specific products or companies, the research funded by NSF/SBE and other Federal agencies leads to publicly available results that can be used by many sectors of society. In my response to Ranking Member Lipinski’s question, I also provide examples of areas in which NSF supports fundamental research but does not support applied and translational research, because other Federal agencies support the applied and translational research to translate NSF-supported fundamental knowledge to agency-relevant mission capabilities.

A2. The FY 12 SBE budget for the Science, Engineering, and Education for Sustainability (SEES) portfolio is \$57 million, a 174 percent increase over last year and nearly a quarter of the entire SBE budget request. What is the national urgency and transformational qualities of this additionally needed work, and who determined this research to be a priority? If this research is so critical to our nation, why isn’t the Department of Energy Funding? You mention SBE research on functional magnetic resonance imaging research that may help with autism, matching markets and kidney transplants, and “understanding regional conflicts and local cultural values” in the context of national security, to name a few. What happens to this type of research if SBE is not funded at the FY 12 request? Will they suffer so that SEES can remain a priority?

Science, Engineering, and Education for Sustainability (SEES) is a Foundation-wide effort to undertake fundamental research addressing our advancement toward reliable and sustainable energy resources that will not degrade essential ecosystems and environmental services, will not lead to unacceptable social or economic consequences, and will prepare society to adopt them responsibly. Thus, the SBE sciences are knit into understanding reliable and sustainable energy uses. Precisely because energy and environmental issues require an integrated understanding, NSF/SBE, which is unique in its portfolio covering basic research across all of the SBE sciences, plays an essential and coordinative role. We note further that DOE’s basic research portfolio does not include the SBE sciences, making NSF/SBE’s role an important one. Consequently, slightly less than \$57 million has been requested in FY 2012 to build new infrastructure in the directorate’s research divisions and Office of Multidisciplinary Activities (SMA) and to support relevant research in SMA and through the standing programs in Social and Economic Sciences (SES)

and Behavioral and Cognitive Sciences (BCS). It is important to note that the 2009 NSTC Report, Social, Behavioral, and Economic Research in the Federal Context that was referenced in the first question lists “Energy, Environment and Human Dynamics” as one of six priority areas for increased emphasis due to its importance in addressing society’s fundamental challenges.

The eventual balance between activities undertaken within the framework of SEES and the rest of SBE’s portfolio will be achieved in accordance with funding levels in 2012 appropriations and priorities set by the Congress and the Administration. We expect that future decisions on funding allocations with NSF and SBE will also reflect the advice we obtain from the National Science Board and our own science advisory committees. Actual awards will be made through the merit review process.

Q3. *RAPID grants are not peer reviewed grants, but grant decisions NSF staff can make in order to get needed funding to the field more quickly, usually when time not allow for peer-review like in the case of a natural disaster. You mention several in your testimony related to Katrina, Chile and the oil spill in the Gulf. The ability to use these grants when urgency is of essence is useful and important. However, there are several other active grants that seem questionable on the surface as being of national importance and urgency. Could you please explain why the federal government should be spending \$197,000 on “Bridging the Gap: Musical Training and Literacy in Underserved Adolescents,” \$215,000 on “Affective and Deliberative Processes Motivating Charitable Decisions,” \$200,000 on “Documenting the Mechanisms of Belief and Attitude Change on Controversial Issues: The case of Global Warming and Trust in Scientists,” or \$89,000 on “What Makes Lay/Expert Scientific Collaborations Succeed” on non-peer-reviewed research? Why were those deemed timely and urgent, and who made the decision to approve and fund them without the merit-review process?*

A3. RAPIDs are subject to rigorous internal scrutiny and review by the appropriate program officers and require approvals by the cognizant division directors as well as by other units within the Foundation (e.g., DGA). A statement of need, documenting the time-criticality of the request, is required to justify any award made. The research may be urgent because of the need for, availability of, or access to, data, facilities, and specialized equipment, including quick-response research to natural or human disasters and unanticipated events. These substantive and procedural requirements were met in each of cases mentioned in the request:

- (1) Bridging the Gap: Musical Training and Literacy in Underserved Adolescents (Award No. 1015615)

Prior research in neurocognitive functioning, speech, language, and literacy abilities in youth suggests that musical training and literacy might be an avenue for remediation for students of low as well as high income socio-economic background. Conducting research in schools can be challenging, given the requirements of the academic year. As stated in the proposal (Section II), where the request for RAPID funding is explicitly justified, the investigators need to test the participating students within their first year of high school, and the cooperation of two schools in Chicago, who serve families of low socioeconomic status and who volunteered to participate in the work, offered an “uncommon opportunity” not only in access to students but also in the potential to support a full four years of longitudinal study if the work were launched early in the students’ high school careers. Thus, funding to proceed with the research was time critical.

- (2) Documenting the Mechanisms of Belief and Attitude Change on Controversial Issues (Award No. 1042938)

This is a public opinion research study. Prior work had indicated that public opinion on political issues changes slowly; sudden shifts are rare and typically in response to a dramatic event. Public opinion on climate change, however, seems to defy that model, seeming to shift quite rapidly in about two years. The project seeks to examine both the apparent shift and the underlying theory through two new surveys, one of which would take place in the summer in order to gauge the extent to which experience of weather affects attitudes toward climate change. Thus, the data are necessarily time sensitive and ephemeral because the investigator needs to capture the information as quickly as possible after the weather event(s). Hence the criteria for a RAPID award were met and the justification fully documented both in the request for funding and the review analysis.

- (3) What Makes Lay/Expert Scientific Collaborations Succeed (Awards No. 1049782 and No. 1049807)

This is a collaborative award to two institutions (Tulane University and Washington State University) to study collaborations between laymen and experts among environmental scientists, social scientists, and a community of Vietnamese-Amer-

ican fishermen in Louisiana in response to the Gulf of Mexico oil disaster. The urgency of the research is justified in the proposal and documented in the review analysis: As the contaminants disperse, either into more protected Gulf wetlands or further inland, community impacts would be differentially experienced and existing hardships intensified, compelling residents to leave the area. Key sources of experiential knowledge would thus be lost and a rare opportunity to collect evanescent social and environmental data would be lost. The urgency arises from both the fragile and changing nature of the environmental effects together with the social and demographic responses, potentially resulting in depopulation and loss of the community.

A question has also been raised about a fourth award, \$215,000 for “Affective and Deliberative Processes Motivating Charitable Decisions” (Award No. 1024808). The research mentioned in the question has not been funded as a RAPID award. The amount is the first year of a larger award, which was evaluated through the full merit review process. The proposal received thorough, full panel review, with seven expert reviewers from outside NSF. The fully-documented award was approved by the Program Director and the Division Director.

Q4. In your testimony you state that “These partnerships [with other NSF directorates]” are critical to understanding science in its human context and to developing effective new technologies that will be used by Americans and will contribute to jobs and economic development.” What is the role of industry in understanding science in its human context and developing new technologies? Is industry doing some of this work? Can and should they be doing more?

A4. We see little interest in industry in conducting basic research in the SBE sciences. Understandably and appropriately, their focus is on social, economic, and cultural issues surrounding aspects of their product development, market research, and public relations and communication. Moreover, their findings are typically proprietary. Absent transparency and peer reviewed publication in accepted professional outlets, their activities do not contribute to advancing scientific research broadly nor are their objectives necessarily directed toward addressing shared challenges in areas such as public safety, disaster response and mitigation, and law enforcement and national security. Thus, it is essential for the Federal government to sustain its leading role in basic research in the SBE sciences.

Q5. NSF is essentially the only federal agency that historically does not receive earmarks. It prides itself on the merit-review process which, while not perfect, is currently the best we have. Given its imperfections and the reality that some less than stellar grants are funded in ALL scientific disciplines, how would you recommend that it be improved?

A5. The NSF merit review process lies at the heart of the agency’s strategy for accomplishing its overall mission and vision. As such, NSF is continuously striving to maintain and improve the quality and transparency of the process. As is noted in the most recent annual Report to the National Science Board on NSF’s Merit Review Process (<http://www.nsf.gov/nsb/publications/2011/nsb1141.pdf>), during FY 2010, NSF received and reviewed over 55,000 proposals. The vast majority of the proposals received at NSF (96%) are subject to both external peer review by members of the scientific community and internal merit review by NSF program officers. To ensure that they have substantive reviews from a variety of perspectives, the program officers reach out to a broad range of people for input-in FY 2010, over 46,000 external reviewers provided expert advice to the Foundation. The program officers (who are subject matter experts in their own right) synthesize all of the external advice in the context of the overall program portfolio when developing their award recommendations.

Currently, the National Science Board is reviewing the two Merit Review Criteria that are used to evaluate every proposal that is submitted to the Foundation. As part of this process, NSF and the Board have reached out to a wide range of stakeholder groups for their input on the strengths and weaknesses of the criteria, and how they might be improved. Informed by the external input as well as data derived from reports of Committees of Visitors (external bodies who review all of NSF’s programs for the integrity of the process) and an analysis of submitted proposals, the Task Force on Merit Review developed a proposed revision of the criteria. The NSB and NSF have invited comment from the NSF community (both internal and external) on the proposed revisions. NSF has already begun internal discussions on how best to implement revised criteria, which will include a robust plan for providing guidance to PIs, reviewers, and program officers on how to use the criteria during the review and decision-making processes.

Q6. In this testimony, Dr. Wood mentioned an oversupply of SBE Ph.D.s in the labor force. Do you agree with his statement, and if so, why does NSF currently continue to financially support and encourage SBE graduate students? Wouldn't this be a good opportunity for savings, particularly in our current economy?

A6. The health and composition of the educational pipeline for future scientists is of profound importance to the competitiveness of the nation and is of particular interest to the Foundation and its leadership. In keeping with its mission as a statistical research unit that provides neutral and reliable data for use by others and in support of the Foundation's role in maintaining a robust scientific research enterprise, the National Center for Science and Engineering Statistics (NCSES), which is housed within the SBE directorate, conducts two relevant surveys: (1) Survey of Earned Doctorates that provides the production of doctorates by field annually (<http://www.nsf.gov/statistics/doctorates/>); and (2) Survey of Doctoral Recipients (<http://www.nsf.gov/statistics/doctoratework/>) that provides data on career patterns. Preliminary analysis of the most recent (2009) Survey of Earned Doctorates (SED) suggests that the proportion of 2009 doctorate recipients with employment prospects in the coming year was about the same as reported in 2007, the year before the advent of the recession; the proportion of SBE doctorate recipients with definite employment commitments increased from 72.9 percent in 2008 to 73.5 percent in 2009 (<http://www.nsf.gov/statistics/infbrief/nsf11305/>, Table 3). In general, unemployment among scientists and engineers with doctoral degrees in the SBE sciences remained slightly below the national average for all Ph.D. scientists in 2008, the year of the most recent data. That year, the unemployment rate among those who hold U.S. doctorates in social sciences was 1.3 percent; the unemployment rate across all fields of science, engineering, and health was 1.7 percent (<http://www.nsf.gov/statistics/infbrief/nsf11308/>, Table 1).

Many factors enter into analyses of employment and career decisions and paths. Some of the issues relating to definitions and patterns of employment in higher education and in other sectors are laid out in Science and Engineering Indicators: 2010 (see especially sections of Chapter 3, Science and Engineering Labor Force, Scope of the S&E Workforce, <http://www.nsf.gov/statistics/seind10/c3/c3s1.htm>, and Employment Patterns, <http://www.nsf.gov/statistics/seind10/c3/c3s2.htm>). Research supported by our Science of Science and Innovation Policy program suggests that there are strategies during graduate training to encourage future scientists to identify careers in industry as well as in higher education and advanced research. The directorate, through NCSES and the research divisions will, therefore, continue to support continued analysis of this important topic.

Q7. You have mentioned the report being drafted by the NSF's Advisory Committee on Social, Behavioral, and Economic Sciences on the future areas of scientific development in SBE sciences. Can you tell us more about this report? Why is it being drafted? How are the future areas of scientific development being identified? I understand that it will not be released until the fall but can you tell us anything about what we can expect from the report?

A7. In June 2010, the NSF/SBE directorate launched a series of planning activities that have included contributions from the Program Officers and consultation with SBE researchers. As part of this effort, members of the SBE Advisory Committee decided to write a report based on their perspectives as senior scholars. This report would set forth the key research issues facing the SBE sciences over the next 10-to-20 years. It is an advisory report and is one source for establishing programmatic priorities. The structure of this collaborative document has undergone several iterations and the document is now anticipated for release later this year.

Questions Submitted by Ranking Member Daniel Lipinski

Q1. During the June 2 hearing, some expressed concern about potential duplication of efforts across agencies, as well as about NSF encroaching on the purview of other agencies. For example, one Member expressed concern that NSF should not be funding social, behavioral, and economics (SBE) research that is known to have relevance our nation's energy challenge, because that should be the role of the Department of Energy (DOE) alone; one witness suggested that SBE research relevant to national security should be the responsibility of the Department of Defense (DOD) alone; and so on. Currently, DOE does not support any SBE research, but DOD does support some through the Army Research Institute.

The current budget challenge compels us all to seek opportunities to reduce waste in government, including through reduction of duplication. How is NSF's support

for SBE sciences unique from that of all other federal agencies? Why can't, or why don't mission agencies such as DOE and DOD assume responsibility for funding all SBE research relevant to their respective missions, from basic to applied? If they do currently support SBE research (or were to establish new programs in the SBE sciences), how is the research they support different from the research that NSF supports? In addition to any general responses to these questions, please provide specific responses to the examples of energy and national security discussed above.

A1. NSF is unique in that it supports research across all of the social, behavioral, and economic sciences, which allows the directorate to identify research that may not fall easily into a single, well-defined program or discipline and to foster cross-fertilization of ideas within the directorate and across the Foundation. The work that we have sponsored in detecting deception is a case in point. There is a core body of research in the neurological, cognitive, and behavioral dimensions of deception, deceptive speech, and its detection. However, deceptive speech and behaviors occur among many different combinations of individuals and in many settings. For example, the conversation between a teacher and a student who may be trying to explain his or her behavior is quite different from the interview between a foreign service officer at a consulate and an applicant for visa, and both differ from the exchange between a TSA agent and a possibly suspicious airline passenger. Each of these applications requires substantial translational research that might enable the teacher, foreign service officer, or TSA agent to make a good decision, but that research rests on a shared core of basic research about deception that can be explored through controlled laboratory studies and other kinds of systematic scientific research.

Over the past decade, the SBE Directorate has funded a host of studies that tested and developed basic social and cognitive psychological theories of human (interpersonal) deception. Such studies have also advanced our understanding of factors that distinguish liars and truth-tellers across various social contexts. Relevant awards have been sponsored by a variety of programs, including Law and Social Sciences, Social Psychology, Cognitive Neuroscience, Developmental and Learning Sciences, Physical Anthropology, and Cultural Anthropology. Studies sponsored by these programs have examined the complexity of verbal and nonverbal behavior in dynamic interpersonal communications that involve deception, the role of social motivation and cognitions in discriminating lies and truths, and the neural bases of deception. This basic, theoretical research has been used by other mission agencies for translational and applied purposes—including the Department of Justice, the Department of Defense, the Department of Homeland Security, and the Intelligence Community. Examples of translational and applied research from such agencies would include the Screening of Passengers by Observation Techniques (SPOT) and Future Attribute Screening Technology (FAST) programs within the Department of Homeland Security, and related research supported by the National Center for Credibility Assessment within the Department of Defense.

Thus the NSF's basic research programs allow the mission agencies to focus on their missions. Burdening them with developing the basic research could result in duplication, redundancy and possible waste. Indeed, NSF cooperates with other agencies precisely to foster the flow of information across agency boundaries. This rich history of NSF's funding the basic research that mission agencies rely upon for translational and applied research is a powerful tool for the nation and one that we will continue to rely upon to fuel the nation's engine of innovation.

In the following list, we lay out some specific examples of cooperative work where NSF sponsored the basic research and the mission agencies provided translational research and feedback. We note further that DOE's basic research portfolio does not currently include the SBE sciences. However, we have cooperated with DOE and the final bullet summarizes our work with this and other agencies.

1. Basic Research in Forensic Science

The National Science Foundation has a rich history of funding basic research that is relevant to the practice of forensic science. Such awards span a variety of disciplines, including biology, chemistry, cyberinfrastructure, engineering, statistics, and the social, behavioral, and economic sciences. This research generally seeks to provide a theoretical foundation for the development of forensic science methods, including (for the SBE Directorate) the influence of human perception, judgment, and decision-making in this context. This basic research would not be funded by mission agencies, such as the National Institute of Justice or the National Institute of

Standards and Technology, though these agencies have relied upon basic research findings supported by the NSF in translational and applied research.

Dr. Mark Weiss is currently co-chair of the Research, Development, Testing, and Evaluation Inter-Agency Working Group for the Subcommittee on Forensic Science (National Science and Technology Council), and Dr. Christian Meissner also participates as a member of the IWG. The IWG is charged with identifying the foundational science that underlies forensic science applications, and NSF staff have assisted in the identification of basic research that underlies forensic science.

A recent Workshop supported by the Division of Behavioral and Cognitive Sciences (see Award No. 1048484) examined the potential role of cognitive/perceptual biases in the forensic evaluation process. This issue received much attention in a report published by the National Academies of Science entitled, *Strengthening Forensic Science in the United States: A Path Forward*. The workshop brought together basic researchers in perception, judgment, and decision-making to discuss the various psychological factors that may influence forensic pattern recognition. The workshop led to suggestions for basic research in this area that would address concerns raised by the National Academies report. This research, given its basic, theoretical focus, is unlikely to be supported by mission agencies within the federal government, though findings from such research would likely lead to the development of interventions and modifications to training that would be further assessed in translational or applied research contexts.

2. Theories of Spatial Pattern Detection, Geospatial Technologies, and Crime Mapping

The SBE Directorate has supported basic research on theories of spatial pattern detection, as well as human interaction with geospatial technologies in the criminological and epidemiological contexts. For example, funded research has extended theories and methods of spatial pattern detection from the detection of prior events to the monitoring and detection of on-going events (see Award No. 9905900), as well as developed geospatial theories of crime that account for a variety of sociological and criminological factors (see Awards No. 0528232, No. 9601764, No. 0080091). This basic, theoretical research has been used for translational and applied purposes by the National Institute of Justice's Geospatial Technology program, a program that seeks to translate geospatial technologies and research to aid various criminal justice agencies.

3. Social and Behavioral Dimensions of National Security, Conflict, and Cooperation (NSCC)

This competition was the NSF side of the Minerva initiative in the Department of Defense. DoD provided NSF with funds (\$8,000,000) and NSF/SBE ran a competition on topics that were of mutual interest. We understand that DoD was very pleased with our review process and our selection of proposals to support. There are two important differences between DoD funded research and that funded by NSF. First, NSF funds basic research while DoD funds research that tends to be tailored specifically to their mission. Our funded research, at times, provides the basis for their funded research. Second, the results of NSF-funded research is in the public domain. This is not always the case for the DoD. As such, researchers funded by NSF provide information that can be used to advance science. Work done for DoD, even in the social and behavioral sciences, is frequently classified. This means that other scientists are unable to use that work to advance our understanding of social and behavioral processes. While many of the NSCC projects are in their early stages and no results have been reported, there have been significant results in the areas of conflict over fresh water, the processes by which terrorist organizations develop, the fundamental nature of conflict, and the characteristics of authoritarian regimes. This basic research, supported in partnership with the Department of Defense, promises to produce promising outcomes for U.S. security interests.

4. Applications to energy usage and examples of cooperation with DOE.

NSF/SBE funds research on basic behaviors and motivations, which can be applied to numerous areas of decision-making, including adopting new technologies (sustainable or otherwise), building human capital and subsequent labor market decisions, financial decision-making, and reactions to natural disasters, among others. In addition, NSF/SBE has established a cooperative relationship with DOE through DOE's work in integrated assessment modeling (IAM). The DOE program has inserted language in its IAM solicitation to encourage applicants to work with NSF's Decision Making Under Uncertainty (DMUU) centers and the urban Long-term Ecological Research (LTER) sites. In addition and in cooperation with NOAA, DOE and NSF

have supported a National Academy workshop (Award No. 1003678, Support for a Workshop on Socioeconomic Scenarios for Climate Change Impact and Response Assessments).

*Responses by Dr. Hillary Anger Elfenbein, Ph.D., Associate Professor,
Olin School of Business, Washington University in St. Louis*

Questions submitted by Chairman Mo Brooks

Q1. NSF is essentially the only federal agency that historically does not receive earmarks. It prides itself on the merit-review process which, while not perfect, is currently the best we have. Given its imperfections and the reality that some less than stellar grants are funded in ALL scientific disciplines, how would you recommend that it be improved?

A1. In responding to this question, I would like to highlight four guiding principles:

1. Peer review, not political review
2. Maintain cross-disciplinary reviews
3. Take a portfolio approach
4. Limit misunderstandings through researcher communication

1. Peer review, not political review

Let me start by echoing strongly the sentiment in the question that the NSF's current merit-based review process, "while not perfect, is currently the best we have." As I mentioned in my earlier written testimony, when thinking about peer review one is reminded of Winston Churchill's famous quote, "Democracy is the worst form of government, except all the others that have been tried."

Like members of Congress, scientists are committed to democracy. The NSF's process is already deeply participatory—with literally tens of thousands of scientists providing reviews of grant proposals for the agency. Like any democracy, the output of the voting process doesn't always please everyone, but there is no viable option to democracy.

The alternative—that is, the political review of science—is chilling, whether we consider it as a replacement or as a supplement to peer review.

Political review is big government

Moving from peer review to political review is chilling first because it represents the worst kind of big government intervention to have politicians and bureaucrats attempt to dictate from the top what constitutes good science. Specific research projects should be judged on their merits only by people qualified to understand them thoroughly.

Otherwise, we run the risk of a politicized process fueled by ignorance of the underlying science. This is not merely speculation—as I discussed during my earlier testimony, in 2007 a member of Congress proposed rescinding my NSF grant at the same time that the Army took the initiative to declare this research valuable for the warfighter. We do not want a political review process that runs the risk of judging books by their cover—however well-intentioned the process.

Political review makes us lose the very most talented and early-stage scientists

A second chilling aspect is that the political review of research would cause us to lose the most talented and creative scientific minds. The very most brilliant scientists choose to be paid literally a fraction of what they could earn in the private sector—and they make this unusual choice for their love of intellectual freedom. Robbing them of this freedom through a politicized scientific process would hurt the U.S. economy. The most creative and curious scientific minds are particularly chilled by big government constraints on their work, and they are the most likely to respond to the loss of freedom by 'voting with their feet'—that is, taking higher-paying jobs on Wall Street and elsewhere. Losing these scientists is a loss for society. It is the best people who typically have the best options outside of academic employment. Political review also sends a particularly chilling message to early-stage scientists, who are young enough to have their career alternatives salient and open to them. However, these early-career scientists are often the sources of the most innovative ideas, which are needed to move science forward.

It is worth noting, in case anyone believes that rescinding one or two grants will affect only one or two research teams, that the people who leave sciences may not be the ones directly affected by political review. Instead, those departing may 'see the writing on the wall' and merely speculate that the same treatment could happen to them.

Political review would unravel the cost-effective volunteer review system

A third source of chill would be for the peer review process itself. It is worth noting—although participants of in-person panels at the NSF are paid an honorarium

for their time—that tens of thousands of scientists around the world contribute review reports without being paid. To emphasize, it is strictly on a volunteer basis that scientists each offer several hours of their time nearly whenever asked. At least in my own case, out of appreciation for the NSF, upon receiving an invitation I typically drop whatever else I am working on to spend about half a day volunteering as a reviewer. Even with conservative assumptions about hourly rates, one can estimate that getting these peer reviews at no cost currently saves millions of dollars for the U.S. taxpayer.

This volunteer system works because scientists believe that they are serving the democratic process. Their time feels well spent for having a voice in the future of the field. But this volunteer system would be jeopardized if scientists believed that their voices could be just as easily overturned by politicians and bureaucrats. As a metaphor, I used to spend Thanksgiving and Christmas mornings as a volunteer to cook and serve food at a homeless shelter—and imagine what it would have been like if someone showed up every now and then to toss out some of the food. Presumably, people would have stopped volunteering.

No one minds being given guidelines for their reviews, and ideas about these guidelines are discussed below in the response to Question 2. In the metaphor of the homeless shelter, no one would have minded being told that we needed more side dishes or less salt. However, once the criteria are described clearly and these criteria are followed in good faith, after that it is not possible to discard volunteers' hard work without undermining the volunteer system.

2. Maintain cross-disciplinary reviews

In limiting the amount of “less than stellar” grants being funded, it is important to maintain the NSF's current commitment to including reviewers across multiple scientific disciplines.

As a democracy, peer review is best when it includes perspectives from different walks-of-life. If research is proposed that is seen as important only by small groups of people, then such work will presumably be reviewed less favorably by scientists outside of those cliques.

This diversity of perspectives could be further enhanced by making additional peer review invitations to academically qualified individuals outside of university settings. This includes people holding Ph.D.s in the relevant field who are now employed in industry, non-profit, educational, and government settings. This could be accomplished readily with two caveats. First, when including professionals from applied settings, an emphasis must be made that they are still reviewing basic research—not applied research. Second, even while seeking diverse representation, it is crucial to ensure that each reviewer has the proper research-based academic qualifications. To allow anyone with less than a doctoral degree to provide peer reviews would be like allowing Canadians to vote in the U.S. elections.

3. Take a portfolio approach

I want to take a stand and say that we need to take seriously the metaphor that the NSF holds a ‘portfolio’ of research investments. It is simply not possible to avoid entirely “the reality that some less than stellar grants are funded in ALL scientific disciplines”. Successful investors in the stock market know that you need to take some risks in order to earn a good return.

As I discussed during my earlier testimony, we do not have the ability to look into a crystal ball and predict with certainty where each project will lead. This information becomes revealed over many years. It is tempting to play ‘Monday morning quarterback,’ and to imagine that we could have known in advance the return on investments. However, we all know that this does not work for the stock market, and neither could it work for the NSF.

How do equity investors account for the reality that some stocks are less than stellar? They fine-tune their selection process with a sense of acceptance that there is some unpredictability. Investing is inherently speculative. If you do not want to speculate—and prefer, instead, safe investments—then you need to stick with bonds or other instruments that have far lower rates of return. But successful investors do not look back at their portfolios while ruminating and punishing themselves for not anticipating the demise of some stocks and the promise of others. The efficiency of the markets is such that—if all of this were predictable—then the returns to investors would be low. The returns are high precisely because we do not know in advance exactly which investments will succeed.

So what do successful equity investors do to account for this inherent risk? They hedge the risk by diversifying their portfolios. The flip side of having some “less than stellar” grants is having some grants that succeed beyond all imagination. Perhaps there are some people who had the foresight to know that NSF grants for

teaching machines how to recognize the thickness of lines would lead to the invention of barcodes, or others who knew that NSF grants for digital libraries would lead to the founding of Google. But, more often, science proceeds with the likes of Pasteur studying spoiled milk and Mendel studying garden peas. As with the stock market or a hedge fund, one expects the portfolio as a whole to yield good returns because these runaway successes more than make up for the flops.

Taking seriously the notion that the NSF's investments are like a portfolio, we will not dwell as much on the lack of a crystal ball to predict the success of individual grants. Imperfect predictability is woven into the process. We need to follow the same good practices that stockbrokers use in managing long-term portfolios by casting a wide net, diversifying our investments, and encouraging risk rather than punishing it.

4. Limit misunderstandings through researcher communication

Surely it must be true—as implied by the question—that there are at least some “less than stellar grants” funded in all of the sciences. However, we also know that many examples of the public trivialization of government-funded research are instead a matter of misunderstanding.

Again, to speak again from my own experience, my NSF-funded research was singled out for ridicule by a member of Congress at the same time that the Army declared this research valuable for the warfighter. Likewise, and as I also mentioned in the earlier testimony, the Coburn Report provided many examples of misjudging books by their covers. Scientists typically break down large problems into lots of smaller problems and, viewed out of context, these smaller problems may seem like poor uses of our nation's scarce resources. This appears to be what happened with the two entries in the Coburn Report that received the most press coverage: shrimp running on a treadmill and robots folding laundry.

Further, the Coburn Report relied on many news articles written about NSF-funded research projects, rather than information directly from the researchers.

If my hypothesis is true—namely, that much of the concern about “less than stellar” grants comes from miscommunication rather than poor science—then one way to increase the apparent value of scientific research is by communicating effectively about the work and its importance to the U.S. taxpayer.

Along these lines, the NSF might experiment with enhancing the mechanisms by which researchers communicate directly with the public. The question could be posed to each federally-funded investigator: Given the scarcity of taxpayer dollars, why is your work an important use of this money?

Currently, after grants are approved, each researcher revises a one-page abstract that is published on the NSF's website. Other features could be added. Perhaps one could be a brief video made cooperatively with the investigator, something like 5–10 minutes responding to the key question, “Why should the U.S. taxpayer fund this research?” A second feature could be a set of links updated over time pointing to relevant sources of information that highlight what is valuable about the work. These could include blogs, journal articles, and other resources accessible via the Internet, using language that the interested public could readily understand.

Providing researchers systematically with the opportunity to make their best case to the public should prevent other people from making this case—and trivializing it—without them. We could have a good faith request that any politician who questions the value of a grant at least to watch the brief video before making a public critique. This would allow the scientist proactively to provide input into the debate. Certainly, reasonable people can still disagree about the value of a research project, but at least the disagreement would be informed and could proceed on the merits.

If we created resources like this, I firmly believe that well-intentioned politicians would change dramatically their estimates of the amount of government-funded research that can be called “waste.”

Q2. In your testimony, you state that “Agencies like the NSF are in the best position to prioritize federal funding for SBE research . . .” Besides highlighting “transformative” research, how else can NSF prioritize research? Are there other elements that you would suggest focusing on to guide prioritization?

A2. In responding to this question, I would like to highlight one guiding principle: Set universal criteria for impact and value, but do not weaken science by setting specifics.

Let me start by emphasizing what we should not be doing: as discussed above, we should not attempt to dictate from the top what constitutes good science. The history of science suggests that one cannot predict in advance exactly what agenda scientists should follow—any more than the planned economies of the former Communist block could have resulted in flourishing business sectors.

In the sciences, curious minds make connections that can seem ridiculous to everyone else-until these ideas are proven brilliant, often much later. After all, outside of the scientific community, who would have told Pasteur to study spoiled milk? Further, much of innovation results from mistakes, such as the mold growing on a laboratory dish that led to the discovery of penicillin.

Accordingly, we need funding for the basic sciences that allows researchers to develop fundamental principles to understand the world around us. Any attempt to use a big government approach to impose specific fields, topics, or other narrow criteria is bound to be the subject of intense political debate-and to become outdated as the issues pressing to our nation change over time. Perhaps more importantly, external constraints can ruin the innovation process, because the best minds value their intellectual freedom the most, and they use it to travel in the most creative directions.

Of course, there is also a place for topic-driven research, but to be clear that is the definition of applied rather than basic science. NSF is the government source for basic science. As such, any move towards specifying topics would represent a change to the fundamental mandate of this agency and its distinct role within the federal government. However, for applied research-which focuses on specific topics and specific problems facing the US-researchers can readily approach the private sector, foundations, and other government agencies.

So what kinds of elements are appropriate in guiding priorities at the NSF?

As discussed in my earlier testimony, I strongly support the recent attempts by the NSF to focus on research that is transformative. Along these lines, there are a number of criteria that often indicate when work is particularly likely to be transformative-and examples of these are detailed below. Focusing on research that has at least some of these criteria is likely to improve innovation in basic science and to increase the return-on-investment to the American taxpayer:

- Encourage interdisciplinary research
Creativity often happens when path-breakers cross over the boundaries of traditional academic fields. They bring existing solutions from one area to solve the problems faced by another area. (For example, Edison's early light bulbs kept falling out of their sockets until a lab assistant 'borrowed' the solution of screw-top caps from the makers of kerosene.)
- Encourage early-stage researchers
Creativity is enhanced with fresh perspectives from people with new ideas and new energy. They are less influenced by habits about how things have always been done.
- 'Spread the wealth'
Take seriously the idea that NSF investments are like a portfolio-a winning strategy for high returns is to hedge one's bets by investing in many different ideas. You never know for certain where the next big discovery will begin. One strategy for casting a wider net is to increase the number of smaller grants, and to reduce the turnaround time to review small grants.
- Encourage risk-taking
Again, portfolio managers seek out risky ideas, with the logic of 'high-risk-high-return'. One way to take calculated risks is to provide riskier ventures with smaller grants, or with grants that are administered in stages pending milestones.
- Look for cross-disciplinary impact
The pattern of scholarly citations can indicate when researcher's ideas are influential across fields and subfields-regardless of whether the research team itself draws from multiple disciplines. This criterion could be applied most easily to senior researchers.
- Encourage adversarial collaboration
When researchers disagree with each other, an innovative solution that has emerged is for them to conduct a study together. Typically a mutually respected third-party acts as an arbitrator. Resolving key scientific debates can help to direct future efforts in the most productive directions.

Note that what distinguishes these kinds of helpful criteria from the dangerous specifics is that they are universally applicable across topics of study.

Even while emphasizing transformative science, the NSF still needs room to fund normal science that fills the gaps in our understanding of important research questions. Again, using the metaphor that grants funded by the NSF are an investment portfolio, every well-balanced portfolio needs to have some secure investments, such as bonds or money market accounts.

Responses by Dr. Peter Wood, President, National Association of Scholars

Questions submitted by Chairman Mo Brooks

Q1. NSF is essentially the only federal agency that historically does not receive earmarks. It prides itself on the merit-review process which, while not perfect, is currently the best we have. Given its imperfections and the reality that some less than stellar grants are funded in ALL scientific disciplines, how would you recommend that it be improved?

A8. The NSF's commitment to merit review is commendable, but it leaves room for improvement. Merit review in general is subject to a variety of pressures that can thwart good intentions. Among these are "group think"—the tendency of people to adjust their opinions to those around them—; faddish enthusiasm—the tendency of people to overvalue an idea that has recently received acclaim or an unusual degree of positive attention—; and intellectual timidity—the tendency of people to stick with the familiar and to prefer safe, incremental approaches to what look like long shots.

Reviewers are not immune to group think, fads, and timidity. And since there is no way to repeal human nature, we have to look for checks and balances that will keep these ordinary human tendencies from compromising merit review. The best safeguard against group think is to make sure that "peer review" isn't drawn too narrowly. Proposals should indeed be reviewed by some experts who understand the researcher's specialization, but also by people in other fields, including some who possess authority as "generalists," and who are specifically tasked to give reviews from perspectives outside the field. And these outsider perspectives should be given significant weight.

The best safeguard against faddish enthusiasm is due deliberation. The NAS should be wary of funding topics that have burst on the scene or ones that come pre-labeled as having "scientific consensus" behind them. The rush to fund "sustainability" research is a good example of a "consensus" being proclaimed where there really is none. Of course, faced with ardent enthusiasm, deliberation all by itself might not be enough to prevent expensive over-allocation of funds. Perhaps another safeguard would be to insist that, when it comes to ideas that are being pressed as "urgent," the NSF should be restricted to a set and relatively small amount of funding. "Urgent" ideas seldom prove to be really so. And if they are truly urgent, the research will be funded by the private sector.

The best safeguard against intellectual timidity is to weed out the reviewers who habitually play it too safe. The NSF ought to score its reviewers by matching the results of funding research projects with the recommendations that initially favored them. Patterns will inevitably emerge. Reviewers who prove themselves able to spot genuinely promising research should be encouraged—and perhaps rewarded. Those who, on the contrary, have a record of recommending h0-hum research should be excused from further service. The same goes for NSF administrators. We don't an NSF that takes wild gambles with public money, but NSF's mission is to advance basic science and that requires some degree of boldness.

Questions submitted by Ranking Member Daniel Lipinski

Q2. Dr. Wood: In your testimony, you proposed that NSF eliminate its grant-making mechanism for rapid response research, also known as RAPID. According to NSF, "the RAPID funding mechanism is used for proposals having a severe urgency with regard to availability of, or access to data, facilities or specialized equipment, including quick-response research on natural or anthropogenic disasters and similar unanticipated events." The typical review and processing time for a standard grant is six-seven months; in the case of RAPID grants, it may be as little as 30 days. RAPID grants are made across all of NSF's research directorates, and account for less than one percent of total research grant support at the Foundation. In recent years, NSF has made RAPID grant awards in response to the recent tornadoes, the Japan earthquake, tsunami and nuclear disaster; the Deepwater Horizon Gulf Oil Spill; the 2010 earthquake in Haiti; Hurricane Katrina; and the September 11, 2001 terrorist attacks in New York and Washington DC, to name a few. Some SBE and other examples of the research funded in response to these particular events include:

- Analysis of risk perception and communication in multiple socioeconomic groups where severe damage occurred during the April 27, 2011 EF-4 tornado events in Tuscaloosa, Alabama in order to understand the way people think about, and understand, the risk they face during well-forecasted severe weather events (SBE)

- Documentation of the variability in acute responses to a community trauma (in this case, the Columbine High School shooting and the 9/11 terrorist attack) among both adolescents and adults, in an effort to identify early predictors of long-term adjustment to trauma (SBE)
- Collection and analysis of perishable data from the New Orleans levees immediately following Hurricane Katrina in order to make a final determination of what caused the levees to fail and how such failures could be avoided in the future (ENG)
- Collection and analysis of data on the impact of the massive release of oil and methane on deep sea microbes in order to understand the effect the spill with have on the ecology of the Gulf (GEO).
- Do you believe that any of these research proposals should have waited the standard 6–7 months instead of 30 days? Do you believe it is in the nation's interest to address scientific questions of human, environmental, and other impacts in the immediate aftermath of disasters such as those listed here? If not, why not? If so, do you believe that NSF should have the ability to respond with urgency to these disasters? If not, why not?

A2. I believe that the first two examples you cite of RAPID grant awards represent inappropriate expenditures of National Science Foundation funds. The projects may have served some humanitarian purpose, but that is not the purpose for which NSF exists. They sound like social work interventions and are far removed from the work of basic science. the third and fourth examples you cite could have a valid scientific purpose, though surely not one germane to the social, behavioral and economic section of the NSF. In any case, they do not appear to be basic research in any meaningful sense. As applied research, they could easily have been funded and executed by agencies of the federal government, such as the Army Corps of Engineers in the case of the New Orleans levees, or the Department of Energy in the case of the Gulf oil spill, that are tasked with work in those areas.

Do I believe that it is “in the nation's interests to address scientific questions of human, environmental, and other impacts in the immediate aftermath of disasters such as those listed here?” Sometimes. It depends. Calling an intervention a matter of addressing “scientific questions” doesn't necessarily make it so. Often that's just a matter of political rhetoric serving the need of public authorities to be able to say they are doing something useful, when the scientific merits of the project are tenuous. Ont he whole, I believe the NSF should stick to basic science and let other agencies deal with the humanitarian needs that follow a disaster. Chasing disasters makes for very doubtful science and ends up compromising the quality of scientific programs and undermining public trust in the NSF.

Responses by Ms. Diana Furchtgott-Roth, Senior Fellow, Hudson Institute

Question Submitted by Chairman Mo Brooks

1. NSF is essentially the only federal agency that historically does not receive earmarks. It prides itself on the merit-review process which, while not perfect, is currently the best we have. Given its imperfections and the reality that some less than stellar grants are funded in ALL scientific disciplines, how would you recommend that it be improved?

A1.

In addition to merit reviews, I recommend that NSF focus on those areas where private-sector funding is not available. Few research funds are available, for instance, in basic science research in the fields of physics and chemistry. But there are many economics researchers at the 12 regional Federal Reserve Banks, the Board of Governors of the Federal Reserve, practically all government agencies, commercial banks, and many corporations.

The role of the government is to provide funding for socially-worthy projects *for which there is no private-sector support*. Economics majors graduate from college with a multitude of job possibilities to do research in their field. In contrast, talented physics majors go to Wall Street, where they draw in lucrative salaries in the finance world. It is in America's interest to keep some of these physicists in the scientific research world.

In the field of economics, I recommend that NSF funding be limited to creation of data sets that can be made available to other researchers within five years. No funds should be spent on academic salaries, computer hardware, or computer software.