Statement of

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before the

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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 – familiarly 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 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

[1] The General Social Survey, http://www.norc.org/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/).

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

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. <u>How are awards made and how are funding priorities established?</u>

[3] NSF 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.

[4] David 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.

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 research 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

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[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 Ecomomic Sciences, *Social, Behavioral, and Economic Science in the Federal Context*, 2009. http://www.whitehouse.gov/galleries/NSTC%20Reports/SBE%20in%20the%20Federal%20Context%20(for%20NSTC)%204-21-09.pdf

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 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.

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[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

[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.

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.

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

[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.

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

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

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[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.

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 individual 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 Colorado[22] 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,

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[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.

[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.

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]

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

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[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; 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.

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.

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[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.