



CONSORTIUM *of* SOCIAL SCIENCE ASSOCIATIONS

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July 27, 2023

Erwin Gianchandani, Ph.D., Assistant Director
Directorate for Technology, Innovation and Partnerships
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314

Re: RFI on Developing a Roadmap for the Directorate for Technology, Innovation, and Partnerships at the National Science Foundation

Dear Dr. Gianchandani:

Thank you for the opportunity to provide comments to inform the development of a roadmap for the Technology, Innovation, and Partnerships (TIP) Directorate for the next three years. On behalf of the Consortium of Social Science Associations (COSSA), I offer the enclosed comments for your consideration. I will discuss the many ways the social and behavioral sciences can be utilized to advance TIP's goals and further the impact of "use-inspired research."

COSSA (cossa.org) is a nonprofit organization representing the shared research and policy interests of the social and behavioral science research community. Across our disciplines—which include, but is not limited to anthropology, communication, demography, economics, geography, history, law, linguistics, political science, psychology, sociology, and statistics—social and behavioral scientists engage in the rigorous study of why and how humans behave as they do as individuals, groups and within institutions, organizations, and society. Maintaining U.S. leadership in emerging technologies and global competitiveness will require that NSF, and the TIP Directorate in particular, invest in and take full advantage of all expertise that can advance knowledge in critical areas.

I. General Comments

Whether an emerging crisis or a long-standing challenge, global or local in scope, geopolitically driven or naturally caused, leaders in this country and abroad find themselves in urgent need of solutions that are based on unbiased, sound, and reliable science and, just as importantly, expertise that puts the issue in context. **In short, scientific and technological innovation is only as good as its ability to improve people's lives. To be truly transformative, people must be at the center of research. The social sciences do this every day.**

COSSA offers the following general comments on ways TIP can utilize social and behavioral science research in service of its mission.

AMERICAN ANTHROPOLOGICAL ASSOCIATION • AMERICAN ASSOCIATION FOR PUBLIC OPINION RESEARCH • AMERICAN ECONOMIC ASSOCIATION
AMERICAN EDUCATIONAL RESEARCH ASSOCIATION • AMERICAN POLITICAL SCIENCE ASSOCIATION • AMERICAN PSYCHOLOGICAL ASSOCIATION
AMERICAN SOCIETY OF CRIMINOLOGY • AMERICAN SOCIOLOGICAL ASSOCIATION • AMERICAN STATISTICAL ASSOCIATION • LAW AND SOCIETY ASSOCIATION
LINGUISTIC SOCIETY OF AMERICA • MIDWEST POLITICAL SCIENCE ASSOCIATION • NATIONAL COMMUNICATION ASSOCIATION • POPULATION ASSOCIATION OF
AMERICA • SOCIETY FOR PERSONALITY AND SOCIAL PSYCHOLOGY • SOCIETY FOR RESEARCH IN CHILD DEVELOPMENT

Social and Behavioral Science as Part of the Team – People are at the heart of just about every major societal and technological challenge before us. As such, nearly all the Key Technology Focus Areas and Societal, National, and Geostrategic Challenges identified in the *CHIPS and Science Act* can benefit from insights from the social and behavioral sciences. However, too many multi- and interdisciplinary teams only think to incorporate social science at the tail end of a project, after most of the research has been completed. Success in meeting the goals set in the *CHIPS and Science Act* will require that physical and natural sciences and technological innovation work hand-in-hand with social and behavioral science.

For example, as technology continues to embed more deeply into our everyday lives (e.g., smart appliances, self-driving cars, automation in manufacturing, etc.), social science is needed to add layers of understanding around security, equality, ethics, privacy, and ensure safeguards for protecting our most vulnerable. As a computer science contributor to a COSSA publication observed in 2017:

“Social science is ... instrumental to computing not just to help answer the question of ‘what can we do?’, but also ‘what should we do?’ As algorithms and autonomous agents become increasingly part of daily life, the issue of algorithm bias, for example, requires much input from both social sciences and humanities. And as the world becomes ever more awash in digital data and as our technology becomes ever more adept at wading through it, social scientists are helping us understand the implications for privacy and offering ways to preserve it.”¹

Central to TIP’s success will be its ability to pull from and create partnerships among all fields of science and technology. Multidisciplinary research—needed to tackle the big, complex questions—is a strength of the social and behavioral sciences.

Advisory Committee – COSSA urges TIP leadership to establish an advisory committee for the directorate that pulls from the breadth of the science and technology enterprise, including the social and behavioral sciences. Social science expertise on such a committee should not be limited to topics like science communication or program evaluation, although both are vital areas. The Directorate would be well-served by advisors who can bring a wealth of knowledge from across the fields to assist with setting research directions and priority actions.

II. Key Technology Focus Areas

Below are a few examples of contributions the social and behavioral sciences already make to some of the key technology focus areas. Additional examples are included at the end of this document.

Artificial Intelligence, Machine Learning, Autonomy and Related Advances – Major leaps in emulating human mental capabilities in the fields of AI and machine learning have their roots in basic linguistic research. The recent explosion of AI development and application underscores just how much potential this technology holds across nearly every domain (industry, government, everyday life, etc.). However, as AI technology continues to advance, more questions will arise; answering them will require close collaboration with social and behavioral scientists.

Social and behavioral scientists are working to understand the ethical use of AI, including questions around how and what AI “learns” and subsequent decision-making that results, as well as bias in and

¹ <https://www.whysocialscience.com/blog/2017/9/12/because-it-makes-computing-work-for-people>

transparency of the algorithms. For example, emerging research suggests that AI is often thought to be less biased or discriminatory than humans, which can engender a heightened sense of trust in the technology. Additionally, behavioral scientists are looking at how children and adolescents' mental health and development is affected when they use technological advances like AI. To harness AI's benefits responsibly, understanding and mitigating algorithmic biases is essential.

High-Performance Computing – Increasingly sophisticated technology and computing power has enabled the development of new quantitative methods, allowing social scientists to collect large amounts of data and synthesize them into models and simulations. Such advancements are enhanced by the context provided by qualitative social science research that broadens our understanding of social interactions, systems, and processes. Taken together we get a deeper understanding about people and how to account for individual differences. In fact, moves toward greater use of “big data” across many different aspects of life come with greater demand for experts trained to analyze and interpret what the data means in the real world. Without that level of sophisticated analysis, “big data” lacks context and meaning, leading to missed opportunities to inform policy and guide action.

III. Societal, National, and Geostrategic Challenges

Below are examples of important contributions the social and behavioral sciences make to some of the societal, national, and geostrategic challenge areas.

United States National Security – The skills and knowledge at the heart of social science—analytical and critical thinking, historical awareness, and cultural literacy, among others—are the very skills sought after by national security decision makers. In addition to NSF, the Departments of Defense, Homeland Security, and State, among others, have for decades supported basic and applied research in the social and behavioral sciences to gain better understanding of strategically important regions of the world and the social, cultural, political, and behavioral forces present. Thanks to this support, we can begin to answer multifaceted questions such as how information is spread and risk is perceived; how and why individual people and entire communities move; how organizations change; and whether causal relationships exist between environmental stress or government corruption and national stability.

The social and behavioral sciences help to make sense of international relations. Warfare and peacekeeping are fundamentally social, human activities, and the resources at stake in both are also essentially social, whether physical resources for survival, political identity, institutional prestige and influence, or shared ideation and values.²

Of course, the world we live in today is becoming increasingly complex, and the concept of “national security” has come to encompass so much more than the traditional military or defense contexts. Issues around economic, environmental, and technological security, to name a few, pose threats to our safety and that of nations around the world. One such example is the increasing incidence of mis- and disinformation on topics ranging from the safety of vaccines to the validity of our national elections. Social scientists are studying the precipitous rise of misinformation, including sources of online misinformation and conspiracy theories and the impacts of “fake news” and intentional efforts to deceive on feelings of trust and psychological well-being.

² <https://www.whysocialscience.com/blog/2018/11/20/because-social-science-research-and-education-are-critical-for-national-security>

U.S. Manufacturing and Industrial Productivity – Findings from the social and behavioral sciences can assist with promoting safer workplaces by uncovering the human factors that lead to accidents and injury. For example, data suggests that some drivers are more likely to take risks when they are properly wearing their seatbelt, and some construction workers step closer to the edge of the roof because they are hooked to a fall-protection rope.

As social science research has uncovered, increased perceptions of safety make some people more likely to take risks. Research on “risk compensation” or “risk homeostasis” is showing that injury prevention devices and mandated workplace safety procedures are not enough. What is often missing is an understanding of the human dynamics that decreases one’s perception of risk or provides a false sense of invulnerability. Increased feelings of safety can have a direct correlation to actions such as taking shortcuts or working faster to complete a task. Technological advancements in industrial productivity should be coupled with investment in research to tackle questions like these.³

Climate Change and Environmental Sustainability – The need for social science expertise is undeniable when considering challenges such as the displacement of entire communities due to rising sea levels, diminishing access to basic necessities like food and water in certain parts of the world, or the urgent need for adaptation and mitigation strategies. Social scientists are addressing the climate crisis from all angles and, in some cases, uncovering potential impacts that may not come to light otherwise. For example, in addition to helping illuminate the human behaviors that are contributing to climate change, such as consumption and energy use, psychological scientists are learning about the psychosocial impacts climate change is having within the most vulnerable communities. Anthropologists and archeologists are showing us how ancient civilizations dealt with the challenges of changing climates, potentially providing insight to modern-day societies on ways to prepare and adapt to our changing climate. Economists have developed models that help us understand the long-term implications of inaction on climate change. Demographers are studying the impact of climate change on migration patterns and the resiliency of individuals and communities affected by natural disasters. And child development experts are looking at how children’s brains, behaviors, and development are impacted by extreme heat and natural disasters.

Inequitable Access to Education, Opportunity, or Other Services

While inequities in education and opportunity have long plagued our population, the COVID-19 pandemic underscored just how damaging this divide can be. NSF partnered with researchers at various universities to study the impacts of the lockdown on students of all ages. For some, remote learning offered opportunities to students, such as online activities intended to provide STEM learning for children at home. For others, remote learning presented new obstacles. Researchers at the University of Chicago found a digital divide between learners, citing that 1 in 6 students taking STEM courses online experienced technology difficulties, including lack of internet connectivity in their home.

Researchers at Montana State University discovered other challenges beyond technology, such as declining mental health of graduate students due to food and housing insecurity. In some cases, these obstacles resulted in dropouts or changes in career path. With students back in the classroom, it is essential to understand the challenges faced during remote learning to best help them recuperate lost learning opportunities.⁴

³ <https://www.whysocialscience.com/blog/2023/1/31/because-it-can-help-us-maintain-safer-workplaces>

⁴ <https://beta.nsf.gov/science-matters/education-researchers-assess-impacts-long-term>

Social and behavioral scientists can help elucidate the underlying factors hampering the equitable application of technology to educational achievement and other social institutions.

I hope the above examples helped to underscore the many opportunities for social and behavioral science research to assist TIP with meeting its mission. We look forward to our continued engagement as the directorate develops its research roadmap for the next three years. The COSSA community stands ready to assist. Do not hesitate to contact me at wnaus@coffa.org or (202) 842-3525.

Sincerely,

A handwritten signature in black ink that reads "Wendy A. Naus". The signature is written in a cursive, flowing style.

Wendy A. Naus
Executive Director
Consortium of Social Science Associations

Additional Social & Behavioral Science Contributions to Use-Inspired Research

KEY TECHNOLOGY FOCUS AREAS

Artificial Intelligence, Machine Learning, Autonomy & Related Advances

Mitigating Bias – To harness AI's benefits responsibly, understanding and mitigating algorithmic biases is essential. For example, algorithms used in the judicial system, though not designed around race, might indirectly propagate racial biases. Some jurisdictions use algorithms to help determine whether defendants are eligible for bail. These algorithms look at large datasets detailing things like which defendants have not reported for scheduled court dates, along with data elements such as income, zip code, family history, and criminal records. While race may not be explicitly included in the data used by the algorithm to predict defendants' likelihood to appear for court, social science tells us that systemic racial disparities in the United States mean these variables become a proxy for race, resulting in Black defendants having their bail requests denied at disproportionate rates to White defendants. [Social and behavioral scientists](#) can help elucidate some of the underlying factors that hamper the equitable application of AI technology across countless domains.

Robotics, Automation, & Advanced Manufacturing

Assessing the implications of making lifelike caregiving robots – The growing need and rising costs for eldercare have led designers to develop robots that assist the elderly, potentially offering reminders for medication and even companionship through lifelike interactions. However, making these caregiving robots more lifelike raises concerns about emotional attachments the elderly may form. An [MIT study](#) looked at the interactions of older adults with three robotic companions: Furby, AIBO, and My Real Baby Doll. The study revealed a spectrum of responses, from treating robots purely as objects to emotionally investing in them as if they were sentient beings. These interactions mirrored meaningful relationships the elderly had experienced, emphasizing that technology is not just a tool but has the potential to reshape perceptions and relationships.

Natural & Anthropogenic Disaster Prevention or Mitigation

Exploring the human side of climate change adaptation – A [University of Michigan study](#) looked at the need for communities to evaluate their “adaptive capacity” to climate change, not just in terms of emergency resources but also human factors such as socio-economic conditions and technology comprehension. Instead of focusing solely on traditional measures, findings suggest a holistic approach that includes both external threats and internal vulnerabilities. The research, spanning regions from Brazil to the U.S. Great Lakes, seeks to develop a global model for decision-makers to invest effectively in resilience against varied climate challenges.

Advanced Communications, Technology, & Immersive Technology

Flexibility in language processes and technology. An [NSF-funded research traineeship](#) at the University of Maryland, College Park equipped doctoral students with tools for advancing language technology and understanding human language learning. Combining insights from linguistics, computer science, and

neural sciences, the program helps trainees comprehend multi-scale language data. The program also supports the creation of a public digital tool, Langscape, aiding in global linguistic research. The primary research aim is to enhance language learning efficiency in humans and machines by optimizing the use of training data at multiple scales.

Biotechnology, Medical Technology, Genomics, & Synthetic Biology

Transforming robotics with biologically inspired learning models – The Neuromorphics Lab at Boston University, supported by NSF and Hewlett-Packard (HP) laboratories, is working on [groundbreaking research](#) to build biologically inspired learning models for robotics. Instead of relying on explicit programming for specific tasks, the lab aims to engineer robots that can learn autonomously. Their efforts center around creating a “brain on a chip,” simulating general mammalian-type intelligence. These neural models focus on “whole brain systems” that allow virtual and robotic agents to learn autonomously and interact with new environments, potentially revolutionizing fields like eldercare and space exploration. The ultimate objective is to create AI that can learn over a lifetime without requiring continual reprogramming, emphasizing the importance of effective training.

Data Storage, Data Management, Distributed Ledger Technologies, & Cybersecurity, Including Biometrics

Cybersecurity research guards networks from “insider threats” – In 2015, cybersecurity experts highlighted the vulnerabilities posed by “insider threats” to computer networks. [Researchers analyzed](#) how insiders access sensitive information within a system, using data from a partnered financial institution. Their study, funded by NSF, revealed instances where employees accessed unauthorized data due to system weaknesses. The aim of this research is to develop tools that prevent and detect unauthorized internal access, addressing a recognized but poorly understood cybersecurity challenge.

SOCIETAL, NATIONAL, AND GEOSTRATEGIC CHALLENGES

United States National Security

Computational modeling of grievances and political instability through global media – A [University of Maryland research project](#) aims to revolutionize our understanding of the relationship between grievances and political instability. Traditional methods, often caught off-guard by unforeseen events like the Arab Spring, are slow and costly. Leveraging the vast data from social media and global news outlets, this project seeks to measure micro-level perceptions of grievances in real-time, aiding in forecasting political turmoil. Ultimately, the goal is to guide policymakers in proactively addressing and preventing conflicts and refining national defense, diplomacy, and humanitarian strategies.

United States Workforce Development & Skills Gap

Designing future factory human-robot workflows to pre-skill workers – With [NSF support](#), Purdue University, Indiana University, and MIT are creating a Physical-Simulation Platform to assist manufacturers in adjusting to industry changes. This platform will mimic real-time interactions between humans, robots, and machinery in factories. The goal is to optimize worker abilities, increase productivity, and improve worker experience using AI and automation. The initiative will examine economic effects on workers, offer educational tools for the future workforce, and engage underserved youth.

Climate Change And Environmental Sustainability

Enlisting psychologists to address mental health effects and societal outcomes of climate change –

Psychologists can have a major role in [tackling climate change](#) by fostering public understanding and encouraging societal action. Mitigation involves introducing sustainable technologies and lifestyles; psychologists can aid in these efforts by developing intuitive energy-saving technologies, promoting eco-friendly behaviors, and assisting in policy formulation. Adaptation, on the other hand, focuses on minimizing climate change's current and future impacts. Here, psychological intervention can range from direct mental health support, aiding those grappling with the climate crisis's emotional toll, to enhancing resilience and aiding displaced populations. Psychologists can help improve public comprehension of climate change, craft effective communications to counteract misinformation, and advocate for impactful policies.