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Statement for the Record
of
Dr. Hillary Anger Elfenbein, Ph.D.
Associate Professor
Olin School of Business
Washington University in St. Louis

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Subcommittee on Research and Science Education
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***Oversight of the Need for Federal Investments and Priorities for Funding.*"**
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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 SBE 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," R01 MH071294-01, $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.

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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 for 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 videoclips 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 SBE sciences. Notably, we tend to get information from multiple converging sources—including words and context in addition to nonverbal behavior—without typically relying on any one 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 cancelling 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 any one 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 enhancing 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 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 NVC 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