HUMAN SOCIAL CULTURE BEHAVIOR MODELING PROGRAM

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SOCIOCULTURAL BEHAVIOR RESEARCH AND ENGINEERING IN THE DOD CONTEXT

On December 17, 2010, a Tunisian street vendor named Mohamed Bouazizi set himself on fire to protest police harassment, humiliation and the confiscation of the produce he was selling. With Facebook as a facilitating mechanism, his act was followed by unrest that quickly led to the resignation of the Tunisian President. From there more uprisings followed in nearby countries, including Egypt, where long-time President Hosni Mubarak was forced out of office. The "Arab Spring" was an example of nation-state instability, wherein long-standing pressures reach a tipping point that is rapidly followed by fundamental change in the power structure. Forecasting and, as appropriate, mitigating such instability is an increasingly important challenge for the U.S. military and its partners.

Features that characterize the kinds of instability observed in North Africa are common to a wide range of hard problems that impact U.S. strategic interests, including violent extremism, weapons of mass destruction (WMD), and cyber threats. Across these problem types, actors are increasingly likely to be small groups or even individuals, connected and perhaps driven by cultural or social factors. Typically, they will be highly distributed, perhaps only loosely affiliated, and embedded in general populations, using local networks, economies, and sympathetic governments for cover and support. They exhibit agile, adaptive behavior, including an emphasis on influencing general population sentiment through culturally-anchored communication. Due, in part, to all

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Welcome to the tenth edition of the HSCB newsletter. This edition focuses on several initiatives that span the HSCB Program and Department of Defense community for research and engineering on sociocultural behavior. A featured article, starting on page one, discusses the drivers for a DoD-wide sociocultural behavior capability and highlights success to date in achieving that capability. The article argues that the Department is at a point of tremendous opportunity, and offers a conceptual framework and broad recommendations for building on the innovative work that has been done or is underway.

Rigor is a vital consideration for the field of sociocultural behavior research and engineering (R&E). This edition includes an article that describes the HSCB Program's approach to ensuring rigor at all levels of its research efforts. The process for conducting technical performance evaluations of selected projects is described, along with the approach to defining Program-level measures of effectiveness.

Also in this edition of the HSCB Program newsletter is detailed information on a Broad Agency Announcement (BAA) supported by the Minerva Research Initiative, as well as a calendar of other upcoming events in the domain.

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ANNOUNCEMENT

FY 2012 Minerva Research Initiative Solicitation Underway

Twenty-first century national security challenges reflect the complexity of globalization, including rapidly shifting geopolitical dynamics, increased pace of communication, and unprecedented social change. From climate change to failed and failing states and the rise of violent extremism, from the rise of new powers to ethnic strife, disease, and poverty, the United States will be forced to grapple with a range of new and daunting challenges.

The Department of Defense Minerva Research Initiative was mentioned in the 2010 Quadrennial Defense Review as a key component toward meeting these challenges. Minerva is a social science basic research program launched by the Secretary of Defense in 2008 to improve the fundamental understanding of the social, cultural, behavioral, and political forces that shape regions of the world of strategic importance to the United States. By drawing upon the knowledge, ideas, and creativity of the nation's universities, research institutions, and individual scholars, Minerva aims to foster a new generation of engaged scholarship in the social sciences that will help us meet the challenges of the 21st century.

In 2009, seven large consortia and 17 smaller projects were awarded Minerva grants, with research currently underway. The new FY 2012 Minerva Research Initiative competition is currently open for submissions. White papers and full proposals are solicited which propose basic research on the following seven topics:

1. Strategic Impact of Religious and Cultural Changes
2. Terrorism and Terrorist Ideologies
3. Science, Technology and Military Transformations in China and Developing States
4. National Security Implications of Energy and Environmental Stress
5. New Theories of Cross-Domain Deterrence
6. Regime and Social Dynamics in Failed, Failing, and Fragile Authoritarian States
7. New Approaches to Understanding Dimensions of National Security, Conflict, and Cooperation

Proposals will be considered both for single-investigator awards as well as larger, multi-institution teams. For more information on the FY 2012 Minerva Research Initiative Broad Agency Announcement topics and process, visit http://minerva.dtic.mil/baa.html. Information about ongoing Minerva research efforts is available at http://minerva.dtic.mil/, or DoD employees with Common Access Card-enabled systems can visit Minerva's site on the Defense Analysis Community Wiki, at https://defensemetawiki.cape.osd.mil/DAC/index.php?title=The_Minerva_Initiative.

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FEATURE

Assessing the HSCB Modeling Program

By Gary L. Klein, John W. Bornmann, and Elizabeth A. Lyon

The HSCB Program has developed processes characterizing individual Program-funded performers and assessing how well the Program as a whole is addressing warfighters' needs. Each year, selected individual performers demonstrate the technical elements of their research and engineering (R&E) efforts and discuss them with a subject matter expert (SME) team at a technical performance evaluation (TPE). The purpose of a TPE is not to evaluate the goodness of a project, but rather to characterize systematically the performance status of more mature projects on a common set of dimensions. Separately, beginning this year, performers are also being selected to demonstrate the HSCB Program's ability to meet a set of Program-level metrics as part of an ongoing program metric assessment (PMA) process.

A TPE is a phased event, formally structured to include facilitated preparation, a 6- hour in-person evaluation, a 2-hour SME discussion, and a final report. Performers with research that has reached an appropriate level of maturity are selected to participate by program managers. The HSCB Program recently completed its fourth set of TPEs, involving six HSCB performers. In 2010, two TPE events occurred, one in May with three performers, and one in August with eight performers. In 2009, the inaugural TPE occurred in July where seven performers' projects were evaluated.

The SME team consists of social and behavioral scientists, computer scientists, modeling and simulation experts, operations analysts and others who are able to evaluate the disparate elements of a project in any of the research categories funded by the HSCB Program. In the preparation phase, the core SME team spends 8 - 10 hours reviewing specifically tailored theoretical and technical criteria with each participating performer. Performers must address a set of 10 core generic criteria, such as a demonstration of how their system interoperates with other systems. The evaluation team also helps performers select an additional set of criteria that address the domain of their project with more specificity. For example, for a project that is developing sentiment analysis tool, a criterion regarding how their system tracks shifts in changes in attitudes toward issues or groups could be selected. Seventy-six specific criteria have been defined across six technical program categories; the performers and SME team collaborate to select 10 - 14 criteria for each project.

The second phase of the TPE is a day-long collaborative event, during which performers demonstrate their research and engineering efforts with the SME team and answer questions about the technical and theoretical elements involved. Performers are given an uninterrupted hour to explain and demonstrate their project and brief the underlying elements to the SME team. The remainder of the day is spent discussing the project, evaluation criteria, and how the capability could transition to meet warfighters' needs. Performers receive constructive feedback on all aspects of their project including their applications of theories, technical implementation, and relevance to the operational environment. Questions posed by the SMEs are reflections of the questions that are often posed by operational and transition partners, thus serving to assist performers in their development process while also providing the TPE SMEs with valuable information about the project. At the conclusion of the day, the SME team meets without the performer to verify factual observations before each SME completes a final write-up that characterizes the project.

The final phase of the TPE involves condensing SME characterizations into an integrated report delivered to program leadership for review, with recommendations and suggestions for further research, development, and transition. The entire TPE process systematically provides indicators of progress for individual projects, allowing program management to further guide performers, ensuring that projects continue to be relevant, grounded, and are moving towards successful transition.

While the TPE process focuses on the performance of individual projects, the PMA process characterizes the entirety of the HSCB Program. Criteria and thresholds are defined to measure the progress and effectiveness of the Program. The purposes of the PMA process are to: identify gaps in the Program that will drive investment decisions; facilitate the transition process by demonstrating how the program meets warfighter needs; identify and characterize critical technical risks; and ultimately provide an overview of the Program within the Office of the Secretary of Defense.

To achieve these purposes, the Program has defined discrete measures of effectiveness for each year from 2011 through 2013, for each funding category (6.2, 6.3, and 6.4), and for each major technical area in the Program (data collection, data infrastructure, computational methods, visualization, and training). Ninety such metrics are defined, 21 for this year alone. For each metric, an objective measurement process was developed. As an example, to measure "accuracy" of a sentiment analysis tool, a body of text messages is needed where each message has been manually analyzed for sentiment. This "vetted corpus" can then be processed by a performer's system and the output of that processing compared to the manual analysis in terms of correctly identified, wrongly identified, and missed sentiments in the messages.

Both the TPE and the PMA processes entail significant investment of time and resources. The HSCB Program makes this investment to ensure that transition-ready resources are theoretically and technically sound. The payoff to the Program is an authoritative evaluation indicating individual performers are on a trajectory to meet their performance goals and the HSCB Program as whole is on a trajectory to deliver effective tools to the warfighter.

Sociocultural Behavior Research and Engineering in the DoD Context

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of the foregoing characteristics, major highly disruptive effects.[1]

These shared features indicate that to develop effective courses of action (COA) across this broad range of problem types, the U.S. military needs to be able to forecast behaviors of individuals and groups. This forecasting depends upon being able to detect relevant indicators amidst the baseline noise. The ability to detect those indicators can only be realized with a deep understanding of extant culture, social structure, history, and language. Altogether, these abilities represent a vision for DoD sociocultural behavior capability:

> ***Mastery of the social, cultural and cognitive factors that optimize our forces' ability to understand, forecast, and influence human behavior in the full range of military operations.***

This is an ambitious vision, calling for a capability with many distinguishing—and difficult to achieve—features. Per this vision, the national security community would have the ability to gather and process increasingly massive volumes of unstructured data, rapidly extract meaning and patterns, and make that processed data available on an appropriately wide scale to support agile decision-making. U.S. strategists and Military Information Support to Operations (MISO) personnel would be able to draw on theory and databases of cultural narratives to anticipate what kind of messaging would spread quickly, and in what patterns across dynamic social networks. U.S. forces would have the ability to adapt reliably and with agility to novel sociocultural environments, having some capability to understand and communicate in the native language, as well as cultural awareness and real-time access to essential sociocultural data. COA planners would have systems of integrated computational models to support simulations depicting first and higher order effects of kinetic and non-kinetic COA with some reliability, and across a range of outcomes of interest. In sum, "mastery" would mean that U.S. forces could: have the right data on indigenous populations; have the training to move and engage easily in those populations; see the parameters of culture and society and integrate those with conventional mapping of the physical terrain; detect and influence often complex and dynamic networks, where adversaries and civilian populations are intermingled; and have non-kinetic tools at their disposal, along with the ability to anticipate both near-term and long-term impacts of applying those tools.

This vision can best be realized and sustained with a coherent, innovative DoD-wide program of research and engineering (R&E) focused on behaviors that are driven by social structure, language, and culture. The DoD R&E community has recognized this need and moved aggressively to meet it. With leadership from the Assistant Secretary of Defense for Research and Engineering (ASD R&E), programs like Minerva and the Human Social Culture Behavior (HSCB) Modeling Program have established a strong science foundation and have successfully moved resources and tools into operational use. DoD's investment includes programs and initiatives from the Armed Services, the Defense Advanced Research Projects Agency (DARPA), the Combatant Commands, and other U.S. Government organizations, such as the Director of National Intelligence and Department of Homeland Security. National conferences sponsored by the HSCB Modeling Program have become a primary venue for showcasing the work of this expanding community and for specifying a long-term vision for the DoD in this area.[2]

With all of the innovative work underway, the DoD sociocultural behavior R&E community now finds itself at a point of transition and great opportunity. To date, there has been some outstanding work on very difficult problems. Most of the individual projects have proceeded more or less discretely, each attacking some part (or parts) of a given problem. The field of sociocultural behavior R&E has matured to the point where it is now bringing those discrete elements together, pursuing integration so that more end-to-end solutions can be offered. This represents a significant step forward, a step that will be greatly aided by the steady increase in requirements in this space. That step will also be aided by applying a framework for sociocultural behavior R&E that reflects end-to-end military operational needs. In addition to indicating technology transition paths, such a structure would help surface integration opportunities as well as gaps where further R&E is needed.

The HSCB Program is exploring the value of a relatively simple framework derived from familiar and widely applied concepts for military operations such as the Observe, Orient, Decide, Act (OODA) Loop,[3] the Joint Fires Targeting Cycle,[4] and the strategic communication process.[5] The Sociocultural Behavior Capability Areas Framework comprises four sets of capabilities, each set feeding into the next and forming a cycle.

Understand

Capabilities to support thorough perception and comprehension, grounded in social and behavioral science, of the sociocultural features and dynamics in an operational environment.

> The cycle begins with the need to scope the sociocultural structure and dynamics of behavior in a given operational context. To <u>understand</u> at this level means bringing sociocultural theory and

1. For further discussion of *rare events* and the importance of sociocultural variables, see Rare Events, a study requested by the Rapid Technology Office of what was then the Director Defense Research and Engineering. JSR-09-108. October, 2009.

2. Focus 2010 and Focus 2011 each attracted more than 600 participants from across the U.S. government, industry, academia, and from international organizations.

3. The decision cycle (Observe, Orient, Decide, Act) developed by John Boyd and incorporated in various doctrine, including Joint Publication 3-13.1, Joint Doctrine for Command and Control Warfare (Appendix A).

4. See Joint Publication 3-60.

5. These are the National Military Objectives as specified in the National Military Strategy of the United States 2011, and based on the QDR and National Security Strategy 2010.

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concepts to bear to identify the sociocultural features of the terrain that are important to monitor. Importantly, understanding is not a single event and the initially applied theories, concepts and consequent features may need to change based on the results from detecting, forecasting and mitigation.

Detect

Capabilities to discover, distinguish, and locate operationally relevant sociocultural signatures through the collection, processing, and analysis of sociocultural behavior data.

With an understanding of the defining features of the sociocultural setting, the next step is to develop a persistent capability to detect sociocultural behavior signals of interest amidst complexity and noise, and harvest data for analysis.

Forecast

Capabilities for tracking and forecasting change in entities and phenomena of interest along multiple dimensions (time, space, social networks, types of behavior...) through persistent sensing and modeling of the environment.

Armed with historical and real-time data, the next step is to forecast alternative plausible futures by extrapolating from the collected data. The goals are to represent the various paths that behaviors of interest could take including in response to possible COA, and to estimate the consequences of each for individuals, groups, and populations of interest.

Mitigate

Capabilities to develop, order/prioritize, execute, and measure COA grounded in the social and behavioral sciences that are intended to influence entities and phenomena of interest.

The final step in the cycle is to mitigate behaviors by developing and measuring the effects of alternative COA for achieving desired changes. This step builds on all the foregoing ones, and should assist in updating understanding of the sociocultural behavior terrain, thus continuing the cycle.

Figure 1. Sociocultural Behavior Capability Areas Framework

For each of these areas, there are varying needs for all the sociocultural behavior R&E building blocks: validated multidisciplinary theory, valid data collection methods and robust systems for using the data, accessible and theory-based computational models, and sophisticated training and education. Figure 2 (on page 6) presents the capability areas framework, showing its grounding in DoD mission areas and grand challenges.

Much of what is needed to close the gap between present and desired capabilities can be accomplished by continuing the quality work already underway through the HSCB Modeling Program and other programs. The proposed capability areas framework should help with identifying opportunities for connecting disparate theories, tools, and technologies into coherent capability packages, oriented to cross-cutting operational challenges. And it should help reveal remaining gaps in the DoD-wide R&E program. With all of the preceding in mind, some of the most important lines of opportunity are as follows:

- Conduct research and engineering to address all appropriate problem types, with particular emphasis on countering violent extremism and mitigating regional/nation-state instability
- Support the R&E needed to realize a global and persistent indications and warnings capability, consisting of technologies to sense, localize, and track perceptions, attitudes, beliefs and behaviors—a "social radar"
- Invest in development and validation of hybrid models, particularly for COA decision support and analysis
- Develop ontologies that facilitate data dissemination and sharing, to ensure the access to big data that is an imperative for a robust sociocultural behavior capability
- Prioritize research and development of technologies that will more fully exploit open source data across multiple streams and multiple media
- Emphasize the practice of exploratory modeling and support it through investment in research and education of analysts and decision-makers
- Strive for research and analytic rigor that is on par with the standards, methods, and metrics of the physical sciences
- Engage academia and industry with grand challenges that will focus national and international R&E efforts to develop solutions for complex problems

There are many DoD entities engaged in sociocultural behavior R&E. It is important to continue ensuring coherence across this enterprise while also delivering solutions tailored to the disparate needs

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of end user organizations. Scientific collaboration, rigorous scientific peer review processes, and information sharing within the sociocultural R&E enterprise play an important role in maintaining a well-organized DoD-wide sociocultural behavior R&E portfolio. These processes ensure that the DoD's investments have integrated reviewing, decision-making, and program management processes, and are primed to transition from one budget line to another. The DoD's sociocultural R&E programs rely on established scientific collaboration practices to bring about cross-pollination of ideas and the development of scientifically distinct research portfolios that anticipate and align with emergent research developments. Each program's efforts are coordinated and shared amongst the other sociocultural R&E programs through regular meetings, listserv emails, websites, and newsletter communications. In addition, the programs also participate in groups focused on information sharing and coordination between R&E and operationally oriented organizations, such as the Human Systems Community of Interest, Irregular Warfare Modeling and Simulation Senior Coordinating Group, the Defense Intelligence Socio-Cultural Capabilities Council, and the Defense Language Steering Committee.

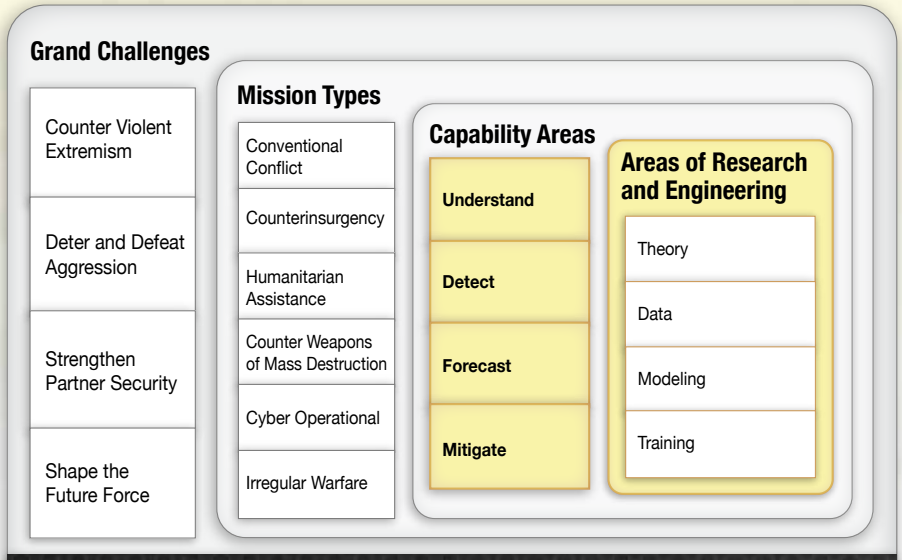

Figure 2. Framework for Sociocultural Behavior Research and Engineering

Conclusion

It is essential to recognize that sociocultural behavior R&E is exceedingly difficult. The complexity of human behavior in any discrete context defies easy understanding or reliable forecasting. In the context of irregular warfare, counterinsurgency, post-conflict recovery, or any other mission setting of the Armed Forces, that complexity is literally impossible to conceptualize. Thus, it is important to leverage technology, including computational models. However, as stressed herein, technology and models must be rooted in well-validated, inter-disciplinary theory. Moreover, they must be applied appropriately, with due attention to their strengths and limitations. Also there is much more that an effective program of sociocultural R&E can do than to build and transition tools; it must support development of resources, such as databases, deep analyses, validated theory, and methodologies. Ultimately, the test of the knowledge products, technologies, and models produced through DoD sociocultural behavior R&E will be how they contribute to development of the future force. Ideally, they will give analysts, warfighters, and leaders more time and opportunity to do what they do best: out-think and out-innovate adversaries by bringing all instruments of power to bear.

CALENDAR

Date	Event	Location	Website
July 9–14, 2011	Human Computer Interaction Conference	Hilton Orlando Bonnet Creek Orlando, Florida	www.hcii2011.org
October 9–12, 2011	Computational Social Science Society of America Conference	Bishops Lodge Santa Fe, New Mexico	http://computationalsocialscience.org/17-2
July 21–25, 2012	AHFE International 2012	Hilton San Francisco Union Square, San Francisco, California	http://www.ahfe2012.org/