DEPUTY UNDER SECRETARY OF DEFENSE FOR SCIENCE AND TECHNOLOGY

HSCB

HUMAN SOCIAL CULTURE BEHAVIOR MODELING PROGRAM

HSCB FOCUS 2010 CONFERENCE OVERVIEW

The Human Social Culture Behavior (HSCB) Modeling Program: Focus 2010 conference was held August 5–7, 2009 at the Westfields Marriot in Virginia. Hosted by the Office of the Secretary of Defense (OSD) HSCB Modeling Program, the conference brought together leading scientific and technical experts from both inside the Department of Defense and other government agencies who showcased their work in the HSCB modeling arena. Focus 2010 drew over 600 attendees from the Department of Defense, other government organizations, industry, and academia and with backgrounds ranging from sociology and anthropology to computer science and engineering.

The conference opened with remarks by Dr. Ivy Estabrooke, Technical Chair of the conference and the HSCB Program Manager (Office of Naval Research), who spoke on Operational Requirements Informing HSCB Research and Development. Mr. Al Shaffer, Principal Deputy, Defense Research and Engineering (DDR&E) and Dr. Robert Foster, BioSystems Director, DDR&E followed with their respective presentations. The opening morning was then followed with remarks by Mr. George Solhan (ONR), Mr. Al Grasso (MITRE's CEO), and Dr. Sean O'Brien (DARPA). CDR Dylan Schmorrow, PhD, Director of the HSCB Modeling Program, BioSystems Associate Director, DDR&E, concluded the opening session with an overview of the OSD HSCB Program. Over the next three days, numerous speakers engaged the attendees. These included distinguished individuals from government agencies, academia, and industry.

In addition, both the Services and represented agencies presented on the direction HSCB is taking within their particular organization. The *Focus 2010* conference also focused on seven multi-disciplinary tracks that included: Understanding Human Behavior; Social-cultural Data Acquisition, Extraction, and Management; Social-cultural Modeling in Support of Intelligence Analysis; Mission Rehearsal and Training; Model Validation and Verification; Advancing Analytics in Irregular Warfare; Visualization and Geo-spatial Analysis.

Welcome

Welcome to the third issue of the HSCB newsletter. This edition follows on the heels of our successful Technical Exchange Meeting, OSD HSCB Focus 2010. This edition of the newsletter provides a description of the highlights of the meeting. The overwhelming response to this conference reaffirms the importance and currency of this topic; a sincere thank you to all who participated in the meeting.

OSD HSCB Focus 2010 was truly a first of its kind event. The nearly 600 attendees participating in the conference came from a wide range of organizations across industry, academia, and government. The diverse scientific and technical disciplines represented in this gathering, including anthropology, sociology, linguistics, political science, economics, criminology, psychology, cognitive sciences, mathematics, statistics and neuroscience, led to interesting conversations and the start of new collaborations. The research efforts in this program are by necessity cross-disciplinary and will require the best and brightest research talent our nation has to offer. The intellect of the those of you involved with this program as well as your dedication to the effort is simply awe-inspiring and provides ample hope that significant progress can and will be made.

Also included in this edition are several articles that highlight the outstanding work and talent of our current performers. Their work truly showcases the breadth of the HSCB program. The performers highlighted span the breadth and depth of the program, multiple disciplines, and varying levels of scientific and technical maturity.

It is truly an exciting and important time for the social science and computational modeling science and technology communities. There exist significant challenges facing the world and the US military requires a huge leap in our ability to understand the dynamic environment of complex behavior around us. I believe that we will someday look back on this program and quite possibly the HSCB Focus 2010 conference and realize that we have reached an inflection point in our understanding of human dynamics and influences in asymmetric and irregular warfare environments. I am confident that the cutting edge research that you are conducting today will some day transform the way U.S. Forces train, plan for and conduct military operations.

Dylan Schmorrow
Director, OSD HSCB Modeling Program
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Alexander (Ted) Woodcock, Ph.D.
Alexander (Ted) Woodcock, Ph.D. is a member of the Synthesis Team for the HSCB Workshops and is involved in producing reports, papers, and presentations of Workshop Materials. Dr. Woodcock is a consultant to several US government entities and an Affiliate Professor at George Mason University. He was Chief Scientist and Vice President at BAE Systems-Portal Solutions (formerly Synectics Corporation). He led development of DEXES and STRATMAS®. He is a Foreign Member of the Royal Swedish Academy of War Sciences and a Fellow of the Royal Society of Medicine.

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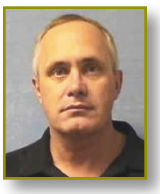
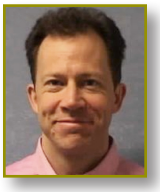


Mr. Barry Costa
Mr. Barry Costa joined MITRE in 1984 and has worked on a variety of projects for multiple research and operational customers across the Department of Defense. Mr. Costa is currently the project leader of several MITRE projects to include OSD Human Social Culture Behavior (HSCB) Modeling project as well as other projects that are focused on the research and transition of socio-cultural understanding and modeling techniques and on the development of data analysis and visualization systems.



John Boiney, Ph.D.
Dr. John Boiney is a Lead Information Systems Engineer with the MITRE Corporation. He provides strategic analysis and technical support to the HSCB program's director. He also leads MITRE's assessment of projects focused on influence operations. Dr. Boiney also conducts research on strategic communication and supports MITRE's Smart Power corporate initiative. Dr. Boiney holds a M.A. and Ph.D. in Political Science from Duke University, and a B.A. in Psychology from Dartmouth College.

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Rob Hartman, Ph.D.
Dr. Rob Hartman joined the MITRE Corporation and the HSCB program in May 2009. He supports the HSCB program in the technical assessment of HSCB-funded projects and in identifying potential connections between those projects and the requirements of DoD Programs of Record. In addition to his HSCB work, Dr. Hartman provides direct support to other MITRE programs in the area of assessment and questionnaire design. Dr. Hartman holds a PhD in Psychology from Ohio State University.

Gary L. Klein, Ph.D.
Dr. Gary L. Klein received his BA in Psychology and his PhD in cognitive social psychology. His work has focused on modeling how people acquire and use information. Currently, he leads a number of projects on using simulation models to improve decision makers' "option awareness" under deep uncertainty. On the HSCB program, he co-leads the technical assessment team. He is the Senior Principal Scientist in cognitive science and artificial intelligence in the C2 Center at The MITRE Corporation.

Jennifer Mathieu, Ph.D.
Dr. Jennifer Mathieu is a Lead Multi-Disciplinary Systems Engineer for The MITRE Corporation. She supports the HSCB program in the technical assessment of funded projects with an emphasis on modeling and simulation. Dr. Mathieu currently leads various efforts with a focus on hybrid modeling, including Pandemic Influenza Response Modeling and Cyber Threat Emulation/Simulation Testbed. Dr. Mathieu holds a PhD in Biological Systems Engineering from Cornell University.

Mr. Stuart Schwark
Mr. Stuart Schwark assists the HSCB modeling program by providing focused support to enable the government's research and development efforts to transition to programs of record. Having a long record of service in national to tactical special operations and intelligence communities, Mr. Schwark is well versed in the systems and uses that HSCB will grapple with. He currently assists Dr. Jim Frank as the Deputy of the Transition and User Work Group.

TECHNICAL SESSIONS SUMMARIES

FEATURE ARTICLE

Socio-cultural data acquisition, extraction, and management

Chair: Jeff Morrison

During *Focus 2010*, challenges, issues and prospective solutions were explored in connection with the Socio-Cultural Data Acquisition, Extraction and Management domain. Useful models need good, reliable, data. Much of this data may not yet exist, and what does exist is in different forms, and spread across disparate communities. The HSCB program will need to take a leadership position in helping the operational community find an organizational home for the data needed for modeling, analysis, and end users.

There are numerous technical challenges for the HSCB community. The research arm of the community must focus on data access, use, and sharing. Data collection will take time, and will occur concurrently with model development. One user's model will become another user's data. A research and development approach must evolve that allows them to stay in sync with each other, and ahead of operational needs.

The HSCB community has urgent data needs, including a scheme for performing "verification and validation". Further, mechanisms are needed to update local and national data, with appropriate periodicity capturing such factors as: data on environment, attitudes and values in many dimensions. HSCB will also need to work with government users to assess the needs for, and define the use of, a general HSCB Data Repository Framework.

HSCB data and models are often developed as "silos" that are shaped by the communities and requirements they derive from. The levels of detail these communities examine vary and have a wide range of subject domains. HSCB must examine how these data and communities relate to and influence each other.

The state of HSCB data is a major challenge for modeling. Existing HSCB data sets are diffused, difficult to find and access, and live in different security enclaves. At *Focus 2010*, the HSCB community recognized challenges ahead and stepped up to address them.

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PROGRAM SUMMARIES

By John Boiney, Ph.D.

Phase one of the HSCB program has focused on establishing the program, which includes planning the technical objectives, building a management and operations infrastructure, growing a portfolio of research and development (R&D) efforts, and facilitating exchange within the community of HSCB stakeholders.

The technical objectives emerged from careful review of socio-cultural behavior research efforts across the Department of Defense, along with extended dialogue with representatives from both research and end-user communities. The latter included a 2008 workshop conducted by the National Defense University. Eventually, a set of objectives was specified for the six-year program that spans three levels of development: basic research, applied research, and testing and transition. With this foundation, an HSCB program management team was established to provide the Program Director with technical input and assist in overall management of the program. The team is anchored by the two organizations responsible for contracting with R&D performers: the Combating Terrorism Technical Support Office (CTTSO) and the Office of Naval Research (ONR). Much of the phase one effort has focused on developing Broad Agency Announcements (BAAs) to solicit R&D proposals, selecting proposals to support, establishing contracts, and initiating work. To date, four BAAs have been released, two each from CTTSO and ONR. Technical work began in earnest early in FY09; by mid-year, the program was sponsoring more than 40 active efforts. As the research program was gathering momentum, program leaders were also working actively to facilitate exchange among HSCB program stakeholders, to continue identifying critical gaps and foster greater coordination and integration of research across the defense community.

Phase one culminated in an August conference, *Focus 2010*, which was attended by over 600 individuals from multiple government agencies, industry, and academia. *Focus 2010* represented a critical milestone for the HSCB program. For most of the sponsored projects, it was an opportunity to demonstrate progress. *Focus 2010* was also a venue to exchange information and ideas between program leadership and members of both the user community and other stakeholder interests. Altogether, the event gave the program leadership vital feedback on the overall direction and success of the HSCB program.

Based in part on the *Focus 2010* experience, the HSCB program is moving into a second phase in its evolution. In phase two, the HSCB Modeling program will vigorously pursue opportunities for transition of emerging technologies, especially to Department of Defense Programs of Record. The program has identified a number of promising transition partners across the areas of intelligence analysis, operations planning, influence operations, and training. Part of this transition thrust will include multiple assessment, demonstration and integration events in FY10 and FY11. The program will also look for one or more opportunities to make HSCB technologies part of a joint exercise. Transition is essential if technology is to be maintained and used long-term. However, the program will also emphasize development and delivery of tools that can offer more immediate help to the warfighter in Afghanistan and other arenas. At the same time, the HSCB program will continue to monitor for critical gaps that can be gainfully filled through research and development.

BAA SUMMARIES

ONR Broad Agency Announcement (BAA) - Human Social Culture Behavior Modeling (BAA 09-026)

ONR's recent solicitation on the Human Social Culture Behavior sciences officially closed on August 25th. The BAA was highly successful, attracting 79 different proposal submissions from across industry and academia. ONR sought proposals in three basic research thrusts, each recognized as gaps within the HSCB community: Tools for HSCB data dissemination and use across the DoD user environment, Visualization and related tools for translating model outputs to decision-support products, and System to assess and select socio-cultural behavior models. Projects awarded under this BAA will be integrated into a program already underway using as feedstock the data and models being developed by current research efforts.

**By Steven R. Corman, Ph.D.
Angela Trethewey, and
H. L. (Bud) Goodall, Jr.**

Two years ago we wrote a widely circulated paper called *A 21st Century Model for Communication in the Global War of Ideas* (Corman, Trethewey, & Goodall, 2007). It makes the case that the model of communication used by most branches of the United States Government (USG) is drawn from thinking that was state-of-the-art during the Eisenhower administration. Contemporary theory and research in the field of communication favors a new complex systems view, which we describe in the paper.

Our intended audience was, and is, practitioners in strategic communication, public affairs, information operations, public diplomacy, and those personnel who carry out similar communication functions in the USG. Our ideas have implications for how—and how not—to model communication processes in HSCB domains. This article reviews some of these ideas and their modeling implications.

The reigning model of communication in the USG is the *message influence model*. It is based on ideas developed in the 1940s by Bell Telephone engineer Claude Shannon, who was trying to explain failures in telephone systems (Shannon & Weaver, 1949; see Figure 1). In this model, there is an information source (the person doing the talking) who inputs a message (voice) into a transmitter (telephone) which then encodes the message as an electrical signal. That signal is sent out over the channel (transmission system) where it can be impacted by noise. It arrives at the receiver (other phone) where the (possibly degraded) signal is decoded into sound, which hits the ear of the receiver (listener).

In the late 1950s, David Berlo developed a model of person-to-person communication which he used in training programs for the USG. It defines the components of communication as:

- Source: A person with attributes like communication skills, attitudes, knowledge, social system membership, and culture;
- Message: A coded symbolic expression with features like content, treatment, and structure;
- Channel: A method of transmission like seeing, hearing, touching, smelling, and tasting, which might influence the nature of the message; and
- Receiver: a person with the same kinds of attributes as the source, which might interact with the message as well.

Berlo's model was based on Shannon's ideas about telephone systems, and was the basis for a popular textbook (Berlo, 1960) that was widely used in college classrooms for two decades. It became the conventional wisdom in fields such as communication, mass media, public relations, and advertising. It inspired a number of variations by others who proposed their own models, all of which retain Shannon's basic schema and logic.

The message influence model has implications for how we think about communication. First, communication is fundamentally about the successful transmission of a message which carries meaning from person A to person B, influencing person B. Second, a source is only communicating when it has intentionally sent a message. Third, faithful transmission of meaning is expected, and failures result, from some kind of interference (like noise) in the process, or possibly malfunction of the components. Finally, certain techniques can mitigate the chances of interference: A simple message, controlled distribution, message redundancy, and careful audience analysis and targeting help insure that messages "get through" as intended.

Since the 1960s theory and research in our field has moved toward a *pragmatic complexity* view of the communication process. Communication is no longer conceptualized as a transmission process, but as a context-dependent, mutually interdependent system of influence and meaning. Communication is, thus, a property of a complex system that is characterized by what theorist Niklas Luhmann (1995) calls *double contingency*: The success of A's behavior depends not only on external conditions, but moreover on what B does and thinks. Yet what B does and thinks is influenced by A's behavior as well as B's expectations, interpretations, and attributions with respect to A. There is no receiver in steady state waiting to be

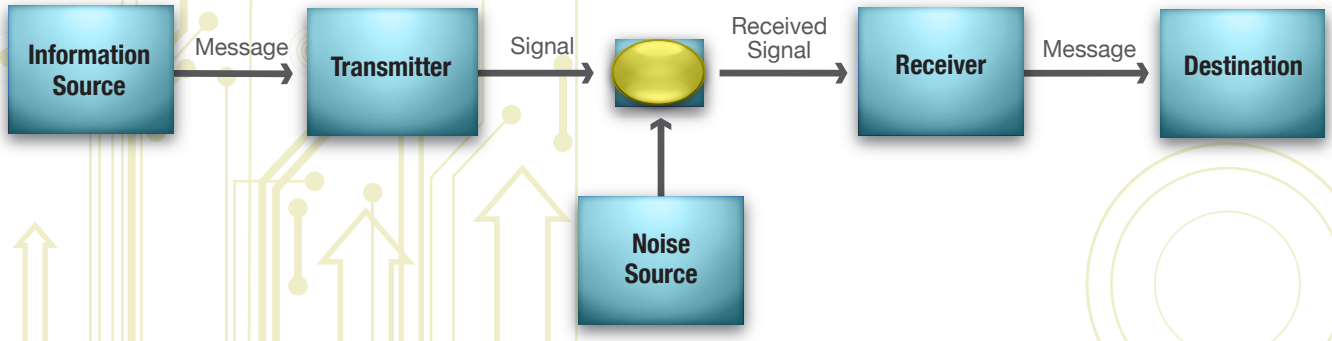

Figure 1. Shannon's Model of Communication (adapted from Shannon & Weaver, 1949)

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FEATURE ARTICLE

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impacted by a complete message, as the old model had it. Both parties are simultaneously influenced by the communication process *as it is taking place*.

Nor are A and B acting in isolation. They are part of a system of other communicators with emergent properties that can't be reduced to the known attributes and actions of individuals. What A and B do matter, but so do the actions of the system *as a whole*. For example, communication systems can develop *inertia*, becoming locked into patterns of negative and relatively fixed interpretations that individuals can disrupt only with great difficulty, if at all. We believe this pattern of inertia describes the situation currently faced by the USG in its attempts to influence leaders and citizens in the Muslim world.

Another implication of the new thinking is that *every action* is subject to interpretation and attribution by the complex system just described. New communication technologies make actions more visible than ever before. So explicit messages of a "source" can easily be undermined by its actions, even when this is not the source's intention. In the most recent issue of *Joint Force Quarterly*, Admiral Mullen (2009) contends that this is the root of our image problems in Southwest Asia. Put simply, no matter what we try to communicate, our credibility is dependent on the local interpretations of our actions.

This shift in thinking toward pragmatic complexity has implications not just for strategic communication but also for best practices in modeling communication under the HSCB program. First, any model that treats communication as a simple transfer or transmission of data, as in Figure 1, is not a realistic representation of the process. Communication rarely, if ever, operates like an exchange of data across an electronic network, because joint processes of interpretation are involved.

Second, these processes of interpretation don't only involve the "message" being communicated, or just depend upon properties of the receiver. All actions of the parties involved have communication value. More realistic models would also allow for interaction between parties via indirect observation of their states and attributes. In particular, allowances for contradictions between messages and actions, and both local and global reactions to these contradictions, would contribute significantly to the realism of models. Likewise, attributes of individual agents should not be the only influence on the communication process. Collective-level influences on attributes and states of agents (for example, cultural sense-making narratives) would yield models that are more realistic and valid.

Finally, HSCB models should make efforts to capture the operation of the double contingency described above. Formulation, transmission, reception, and interpretation of messages are not necessarily discrete events. The interpretations of person B might change dynamically while person A is communicating. Party A might realize this change and alter the message given "on the fly." Hybrid agent-based (AB) and systems dynamics (SD) models would seem to be a good choice for representing such a situation, with the SD component modeling the interpretive systems of the communicators. Schieritz and Größler (2003) used this technique successfully in modeling supply chain structures, and their approach may offer some insights for how best to apply the technique in HSCB efforts.

Using any of these techniques will make models more realistic, but also more complex. Bonini's Paradox (Dutton & Starbuck, 1971) limits the extent to which this kind of complexity is practical in modeling. At the same time, we believe there is room for change in modeling practices to more accurately reflect 21st century ideas about communication.

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Drs. Steven R. Corman, Angela Trethewey, and H. L. (Bud) Goodall, Jr. are members of the Consortium for Strategic Communication at Arizona State University and editors of Weapons of Mass Persuasion: Strategic Communication to Combat Violent Extremism. They are currently engaged in an ONR sponsored project entitled "Identifying Terrorist Narratives and Counter-Narratives: Embedding Story Analysts in Expeditionary Units." You can learn more about their take on communication as it relates to counterterrorism, public diplomacy, and national security at http://comops.org

By Richard Pei

A primary objective of the HSCB program is to facilitate the transition of HSCB technologies and products to the warfighter for use in current and future operations. This article discusses the process and efforts in regard to transitioning to the Intel Pillar user communities and in particular, to the Distributed Common Ground System – Army (DCGS-A).

Overview of DCGS-A

The Distributed Common Ground System-Army (DCGS-A) is the U.S. Army's primary system for tasking, processing, correlating, integrating, exploiting, and disseminating intelligence, surveillance, and reconnaissance (ISR) assets. DCGS-A also provides the Army with fully integrated and timely intelligence and interfaces across multiple security levels. The system performs true multi-intelligence processing with information received from multiple sensors used from the tactical, theater, and national levels, and publishes information through a Service-Oriented Architecture for multi-intelligence analysis. DCGS-A assists in creating the common operational picture and enhances situational understanding, supporting the commander's ability to execute battle commands, synchronize fires and effects, rapidly shift battle focus, and protect the force. DCGS-A emphasizes the use of reach and split-based operations to improve data access, reduce forward footprint, and increase interoperability via a network-enabled modular, tailorable system in fixed, mobile.

The DCGS program establishes the core framework for a worldwide distributed, network centric, system-of-systems architecture that conducts collaborative intelligence operations and production. DCGS-A interfaces provide the Army with fully integrated and timely intelligence on the joint battlefield, and through the DCGS Integration Backbone (DIB), DCGS-A is able to interface with other DCGS nodes.

The DCGS-A consolidates the functions of the following legacy programs into an integrated ISR capability:

- All Source Analysis System-Light (ASAS-L)
- Analysis and Control Team-Enclave (ACT-E)
- Block II Analysis and Control Element (ACE)
- Common Ground Station (CGS)
- Counter-and Human-Intelligence Management System (CHIMS)
- Prophet Control
- Integrated Meteorological and Environmental Terrain System Light (IMETS-L)
- Digital Topographic Support System-Light (DTSS-L)
- Guardrail/Guardrail Information Node (GRIFN)
- Tactical Exploitation System (TES)
- Ground Control System (GCS)

When the Army refocused from conventional warfare to irregular warfare, the Intel collection and analysis process also got a much needed update to include the collection, processing and exploitation of social-cultural dynamics information and understanding. The Joint doctrine for Intel Analysis and specifically, Intelligence Preparation of the Battlefield (IPB) has now been replaced with the new Joint Intelligence Preparation of the Operational Environment (JIPOE) process. The key change was adding the consideration of all aspects of the "Total" Operational Environment which, in addition to the traditional battlefield, now include the assessment of the Political, Military, Economic, Social, Information and Infrastructure (PMESII) and (SCD) components as part of the Intel Analysis and Assessment process. As such, new HSCB & SCD related requirements for major Intel Enterprise programs of record (POR) like DCGS-A are being highlighted.

Transition Process for Intel Pillar & DCGS-A

The process or methodology, if you will, for transitioning of HSCB products to Intel Pillar users and in particular, DCGS-A can be depicted with Figure 1.

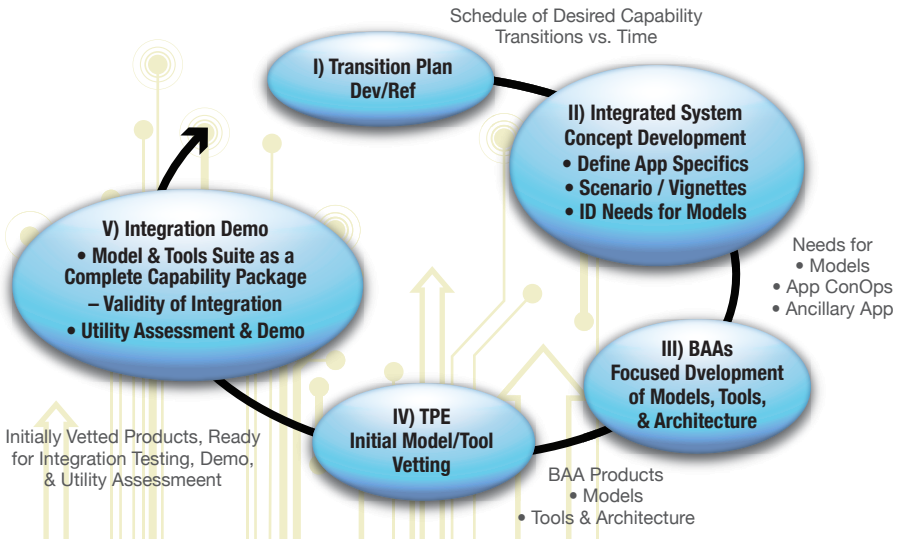

Figure 1. Transition Process for Intel Pillar & DCGS-A

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Model validation and verification

Chair: Gary Klein

This track focused on model validation and verification (V&V) methodologies for sociocultural behavioral models, which is a significant technical challenge in the HSCB modeling domain. Presentations and discussion focused on risks, strategies, and techniques available as of now as well as the technical challenges that must be overcome in order to develop V&V methods for HSCB models. Sessions looked at things from empirical verification and validation of HSCB models to what can be done about advancing computational social science for real-world global security applications. Other sessions looked at a theory for characterizing analytic methods and at another at developing an MMOG as a data source and test bed for social and behavioral models.

Architecture for socio-cultural modeling

Chair: Richard Pei

The Architecture Track at *Focus 2010* brought together representatives from academia, industry and government to exchange ideas about the common infrastructure needed to help military decision-makers operate more efficiently and effectively in the human, social, cultural and behavioral (HSCB) domains. In order for the HSCB program to succeed, it must have an architecture that allows a wide variety of HSCB models to interoperate with each other and with a broad variety of data sources and supporting applications. The HSCB architecture must provide the foundation for a scalable and reconfigurable end-to-end capability that incorporates social, cultural, political, military, economics, information and infrastructure considerations into command-level intelligence analysis, planning, and operations decision processes. The briefings and discussions in the Architecture Track covered a wide range of efforts, both ongoing and new, that addressed this requirement. Presentations at the conference discussed the limitations of existing architectures, challenges in architectures under development, and requirements for new architectures that can support integration of multiple types of computational models. Several different HSCB modeling architecture efforts were revealed and each has its own unique approach to achieve interoperability, scalability, and plug-n-play capabilities. Technical challenges that were addressed include how to implement service oriented architectures suited for this domain, integrate existing tools to form new HSCB services, facilitate model interoperability, and design user interfaces to maximize analysis support capabilities. The insights gleaned from this technical exchange will be invaluable in helping the HSCB program implement an object architecture that meets its challenging requirements.

Operational influence modeling and decision support

Chair: COL Jeffrey Appleget

Presentations in this technical session spanned a huge breadth of material and revealed a vast amount of basic and applied research being conducted. Because "Influence Operations" is not officially defined, the definition from a recent RAND monograph [Larson, et al, 2009] was adopted: "*Influence operations are the coordinated, integrated, and synchronized application of national diplomatic, informational, military, economic, and other capabilities in peacetime, crisis, conflict, and post-conflict to foster attitudes, behaviors, or decisions by foreign target audiences that further U.S. interests and objectives.*"

This technical group had three tasks implied in its purpose: 1) Collect and extract measures that allow assessment of the effects of influence operations and identify trends in civilian population support; 2) [Commanders] develop courses of action (COAs) that integrate non-kinetic methods and consider non-kinetic effects; 3) Forecast 2nd and 3rd order effects.

The group found surveys useful but difficult to conduct; therefore other rapid assessment tools are needed. Assessing and correlating internet, broadcast and print media and other open source information, while useful, is typically not the primary data needed for the commander dealing with mud-hut villages. For the second task, causal relationships for non-kinetic effects are not well-understood and require more research and "What-if" tools for COA analysis are not currently available. Finally, five key tenets emerged: Warfighter engagement is required to provide refining guidance and assessment of HSCB products; Applications developed should be applicable to any potential area of operations; There is a need to understand data requirements and pursue data collection vigorously; Synergy: teams need to form from competing but similar efforts; and the need for open and usable solutions. HSCB should pursue transparent, non-proprietary solutions, that can be run by DoD employees, and that do not require expensive site licenses.

Mission rehearsal and training

Chair: Allison Abbe

Technical sessions on Training and Mission Rehearsal included presentations from a variety of projects funded by the Office of the Secretary of Defense and by the Services. Two presentations focused on developing models of the learner, including one effort to conceptualize the developmental progression of acquiring cross-cultural competence and another to develop models to support dynamic tailoring for individualized training.

Other presenters discussed training tools that offer simulation of intercultural interactions, which target tactical- or interpersonal-level skills. Several of

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these presentations described efforts to improve the cultural or social fidelity of avatars or virtual environments, whereas others focused more on the kinds of tasks and scenarios that can be problematic in intercultural interactions. Other presentations included the development of game-based training for cultural skills and a web-based platform for providing games, simulations, and tutoring for both culture and language skills.

Other presentations focused on the development of training tools and technologies. Some of these targeted the development of cultural understanding at a group or societal level. Other presenters discussed training tools that offer simulation of intercultural interactions, which target tactical- or interpersonal-level skills. Several of these presentations described efforts to improve the fidelity of virtual humans or environments, whereas others focused more on intercultural tasks and scenarios. Game- and web-based training for cultural and language skills were also presented.

As a group, work presented in these sessions reflects recent advances in improving representations of cultural values and beliefs and culturally-based nonverbal behavior in virtual environments, as well as advances in our understanding of the situations and missions in which cultural differences are likely to present challenges for military personnel. However, there are continuing gaps in both front-end analysis of the competencies needed and the development of cultural expertise as well as in methods and metrics for content validation and training evaluation. Other themes included the continuing challenge of insuring that learning transfers beyond a specific country or mission. Training design must not only continue to improve the fidelity of content to real-world missions and cultural contexts, but must also make instructional utility the central focus.

Visualization and geo-spatial analysis

Chair: Joseph Watts

Geospatial visualization and analysis (GVA) are core HSCB requirements. With the evolution and maturation of geospatial software and computing power, Geographic Information Systems (GIS) are rapidly being deployed at enterprise and tactical levels within the US military. An HSCB program gap analysis revealed that these requirements are not currently being fully met. The Visualization and Geospatial Analysis technical session at *Focus 2010* was convened to address these gaps using current approaches to visualizing socio-cultural data, information and model outputs, as well as to foster an understanding of how these can be made useful for a variety of end users.

The session had four papers, each highlighting GVA as it fits into the overall HSCB mission. One focused on military requirements for GVA; a second presented a food deficiency model for a Columbian city. The final two addressed data mining technologies. These papers addressed a wide range of technology challenges and requirements for tools and displays that make data useful to users at the tactical, operational, and strategic levels working in both forward deployed areas of operation and reach back cells.

The ability to provide socio-cultural knowledge in the form of geospatial visualizations and analysis is a key enabler. In order to harness the momentum gathered with this session, the Army Geospatial Center (AGC) will be holding a workshop in November 2009 to develop an HSCB action plan for implementing advances in GVA. This workshop will build on the knowledge presented during the technical session, and will result in a more robust understanding of how we can use GVA to support strategic, operational, and tactical decision making that will assist modern day commanders and warfighters.

Social network analysis

Chair: Lisa Costa

Dr. Lisa Costa, Division Chief Scientist at The MITRE Corporation, led the HSCB Focus 2010 session on Social Network Analysis (SNA). The state of the practice in DoD usage of SNA is such that: (1) technology and tools are spreading rapidly leaving a significant gap between practice and theory, (2) stand alone capabilities dominate, and (3) the result is little if any integration or fusion of SNA results with standard analytic tradecraft.

Decision makers want SNA return on investment and metrics that simply don't currently exist. The SNA value proposition is not yet well-defined or described. Frameworks for evaluating SNA tools, algorithms, and analysis products are immature. It is difficult to gain consensus on meaningful evaluation methods or measures. Such evaluations tend to be tool or technology specific. But significant participation and investments by DoD in social network analysis capabilities are evidence that considerable value is perceived by a broad spectrum of users.

Part of that value proposition will need to develop a common lexicon as inconsistent terminology causes confusion for many decision makers when trying to match capabilities to use cases. For example, the trade space for SNA capabilities across a broad range of relevant communications modes, media types, and transport and presentation protocols and standards needs to be clear and straightforward so that capabilities can be evaluated in a consistent manner.

Lastly, inconsistencies and differences in data often limit the accuracy of SNA tools, techniques, and procedures. Understanding data sources and their associated attributes such as expressive richness, persistence, intended audience, genre, latency and reliability, network size, language, modality (e.g., written versus spoken, printed versus handwritten), context, etc. are critical

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FEATURE ARTICLE TECHNICAL SESSION SUMMARIES

not only to the analyst but the decision maker who will act upon such data.

Understanding human behavior

Chair: Susan Numrich

The track at *Focus 2010* dealing with understanding human behavior exhibited the breadth inherent in the topic itself. Researchers brought before the audience such diverse topics as the measurement of pre-cognitive neuro-physiological responses to culturally specific messaging; the ability to extract from opinion surveys changes in cultural values as harbingers of political unrest; performance in strategy games as a key to recognizing traits of decision makers; and the behavior of crowds seen in computer simulations and instrumented laboratory measurements.

The variety of topics and the different disciplines from which they emerged gave evidence that the understanding of human behavior is and will remain for a long time a broadly, multi-disciplinary endeavor. Creating an inter-disciplinary approach to understanding human behavior and decision making from this multi-disciplinary approach would be highly useful if we are to provide the military with readily usable, culturally sensitive products.

Among the factors that hamper the creation of an inter-disciplinary approach are the following: different vocabularies, different interpretation of events, and divergent approaches to measurement, data and modeling. The availability and completeness of data emerged as a common problem. However, satisfying all data needs will be an unending task of gargantuan proportions unless the problem can be reduced in scope by defining the aspects of human behavior critical to the performance of specific military missions and developing data collection methodologies consistent with those operations. The military has long used engineering and physics-based models, but lacks experience with and confidence in social science models. Thus, the ability of the research community to clearly explain the capabilities and reliability of social science models must grow apace with the ability to create these models if culturally-sensitive models are to penetrate the military tool market.

Focus 2010 proved that while the challenges are many, the social science community stands ready to build upon emerging capabilities to provide new products tuned to irregular warfare and stability operations.

Advancing analytics in irregular warfare

Chair: Leroy Jackson

"...today's threat is complex, ambiguous, dynamic and multifaceted making it impossible to describe through a single model." –David Kilcullen, **The Accidental Guerilla**.

The Advancing Analytics in Irregular Warfare (IW) technical track sessions conducted at *Focus 2010* provided a range of fascinating presentations and identified many analytic challenges.

The Department of Defense (DoD) lacks a robust capability to represent, account for, and analyze the Irregular Warfare (IW) environment across the range of tactical, operational, and strategic levels of warfare. The proposed vision is that the DoD will have the necessary range of expertise, data, models, and tools to conduct analysis for planning, programming, acquisition, concept development, experimentation, training, and operations.

This is important because it is necessary to meet operational capability requirements and inform continuous transformation. Analytics are necessary to underpin the data, scenarios, models, and analysis; to understand complex systems; to establish metrics and conduct assessment; and to support validation. Without appropriate and rigorous analytics there is a loss of credibility that endangers all DoD HSCB models.

The current status of analytics for IW is mixed. There are natural obstacles to model integration, skepticism and resistance in a significant minority of the IW analytics community, insufficient foundation to describe some phenomena, and a lack of empirical data to inform and validate modeling efforts. Technical challenges exist with data, scenario, knowledge, modeling and analysis. However, there have been tremendous and rapid improvements in recent years and many top tier academic and research institutions are interested, energized, and participating in addressing the issues. Suggested lines of effort as we move forward include knowledge development; methods, models and tools; data development and use case scenario development.

Transitioning HSCB tools

Chair: James Frank

Transition, for the HSCB Modeling program, includes both support for current operations as well as transition to Programs of Record, which are directed, funded efforts in response to approved needs that allow new technologies to be integrated into operations and sustained.

The track on Transitioning HSCB Tools at *Focus 2010* was interactive and included representatives from academia, small business, and government who discussed their perspectives on transition. A major theme supported by all the communities is the need for open source databases to improve the quality of social science theories and models. Another related theme is that such data is needed to improve the quality of the science in the social sciences to allow increased depth in cultural and cross-disciplinary understanding and applications. There was also discussion about the importance of linking language and culture and how the utility of machine-language translation for defining alerts is gaining acceptance by some in the analyst community because of the improved efficiency and volume of material that can be analyzed.

Also discussed was the importance of overcoming the skepticism of End Users and understanding their specific requirements, doctrine, and workflow in order to understand difficulties they encounter with new tools and models. Tools need to be designed to operate in ways familiar to them. In discussions about transitioning training programs, it was suggested that a preferred pathway may be "grassroots" transition to schoolhouses and training centers since the experimentation required to define requirements often occurs in those venues.

By Richard Pei

The HSCB program has established several formal assessments and integration tests for models and tools developed under this effort. Having well-defined, periodic evaluations will provide the government program officers with an assessment of the individual efforts and will assist in ensuring that the research project meets the requirements of the military user.

One such evaluation is the Integration Demonstration (ID) whose purpose is to assess and test maturing HSCB tools and models in an integrated system-of-systems environment to determine their viability and suitability for transition to field users. Individual models and tools are integrated into military capabilities that warfighters/users can take and evaluate for potential transition and deployment. Military users will be able to witness the utility of HSCB models, tools and applications in a relevant military context. User feedback will be collected and will be used to guide further development. This direct connection will form a driving force in meeting the HSCB development and transition needs.

In order to support the ID, a testbed has been established by the US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Intelligence and Information Warfare Directorate (I2WD) – within the Research, Development and Engineering Command (RDECOM). A typical ID will consist of three discrete steps: a Technical Integration Assessment, a Utility Assessment, and User Demonstration.

The Technical Integration Assessment will involve a sequential series of tests to asssess the models technical implementation as applied to user needed capabilities. Validation of the integrated meta-models will be assessed via external validation of behavior against an approved set of criteria. The integrated models, capabilities and functionalities will be assessed within the HSCB Testbed's HSCB-PMESII Modeling Framework (HPMF).

The Utility Assessment will evaluate the use and transition aspects of the model or tool. This assessment will focus on the knowledge captured in the models and how they help achieve HSCB situation understanding for decision making. Data collection needs, model construction methods, scenario preparation, training, personnel needs, software licensing, equipment installation and maintenance must all be considered. Although some of these considerations are more critical at later stages, the Utility Assessment will start to examine how well the integrated models will support and benefit doctrine, TTP and CONOP to existing operations.

For the User Demonstration, a subset of assessment cases will be selected to best showcase utility for potential program of records (PORs), HSCB community, and Government organizations, including:

- Demonstration of the functional performance of integrated capabilities
- Exercise of major system threads of execution
- Demonstration of validation of the integrated models with SMEs
- Identification of any early utility of the models and improvement

Besides assessment and demonstration, the ID will lay a path toward a transition of mature HSCB products. The ID event(s) will seek to fortify ideas in an integrated solution process and provide coherency in realizing HSCB capabilities and operations. It will continue to seek user and customer feedback as well as help shape requirements generation. In particular, the ID will showcase to warfighters an enhanced understanding of the modern battle space and pertinent social cultural perspectives.

The Integration Demonstration is an "integration" event. It is the synthesis from the recognition that no single model can possibly define and model the multiple regions, cultures, social characteristics, and that a framework approach to bring in appropriate models, tools and applications would serve the HSCB communities with a common user experience, interface, visualization, diagnostics, model construction and threading techniques.

CERDEC / I2WD is currently working on the first Integration Demonstration (known as ID09-1) to be held late October through early November.

For ID 09-1, the objective is to show how HSCB capabilities can support intelligence pillar users and demonstrate how intelligence analysts might use the HSCB tools and models for executing JIPOE (Joint Intelligence Preparation of the Operational Environment). Joint Publication 2-01.3 published on 16 June 2009 explicitly calls for the analysis of "relevant political, military, economic, social, information and infrastructure variables." JIPOE is a process in understanding the operating environment and determining key adversary potential impact. The understanding of these key factors heavily draws on PMESII (Political Military Economic Social Infrastructure and Information) and HSCB domains.

In moving forward, the HSCB program plans to conduct at least two IDs per year. CERDEC / I2WD staff are working closely with the user community to develop requirements and plan for HSCB capabilities transition.

By Tim Clark

Overview

The HSCB Assessment Working Group (AWG) established a framework for project assessment that is appropriate for the breadth and depth of project types, maturity of research, and specific operational environments. The established framework ensures HSCB project deliverables will be suitable for transition and operational use.

One component of this framework, the HSCB Technical Performance Evaluations (TPEs), is a systematic and rigorous test and assessment designed to measure the progress of more mature projects towards achieving programmatic objectives. The US Army Geospatial Center (AGC) hosted the first of these evaluation events from July 20-31, 2009. Seven HSCB performers each had one day to demonstrate their capabilities, allowing the AGC assessors to evaluate the potential military and social science relevance as related to HSCB mission pillars, model type (if applicable), echelon of deployment, maturity of research, and data requirements.

METHODOLOGY

The Assessment Team

The AGC assessment team was comprised of six evaluators who were selected for their expertise in social science, military operations (esp. Counterinsurgency/SSTR, Civil Military Operations (CMO), and Civil Affairs Operations (CAO)), modeling, geoinformatics, computer science, and information technology. Each played a critical role during the development of the assessment criteria and during the TPE event itself.

Criteria Determination

The evaluation criteria were determined through an iterative process which included AGC team workshops and AWG guidance meetings, with the resulting criteria representing a set of desiderata for the program as a whole. This process yielded roughly 120 criteria, which were grouped using the HSCB pillar structure. Each of the criteria was mapped to the Broad Agency Announcements (BAAs) and Congressional R2 programmatic requirements.

A wide range of metrics were proposed and discussed. A set of Core Scope criteria represented those metrics which spanned most of the pillars and could be applied to all the performers. The transparency of computer code and the ease of extensibility were also evaluated. Operations and Planning Analysis pillar criteria were used to assess how well a capability represented the n-order effects of Diplomatic, Information, Military, and Economic (DIME) actions and their resulting Political, Military, Economic, Social, Infrastructure, and Information (PMESII) effects. Intelligence Analysis criteria focused on how well capabilities modeled changes in attitudes and values of individual groups, as well as the ability to provide the foundational underpinnings of data collection, analysis, and information production to support Intelligence Preparation Operational Environment (IPOE). Training and Mission Rehearsal criteria were developed to ensure that multiple echelons would have the technological support to provide a virtual cultural training environment that effectively tracked the progress of trainees. An architecture grouping included criteria such as interoperability, adherence to standard data transfer formats, and access to functionality through well-defined Application Programming Interfaces (APIs).

Self-Nomination of Criteria by HSCB TPE Performers

The HSCB program must assess a disparate set of capabilities to satisfy all the mission pillars and transition paths. The criteria for the first TPE were developed to be a reusable set for future TPEs, with the knowledge that all performers cannot be adequately evaluated using all criteria. To this end, performers were asked to self-select a set of criteria representing their capabilities at the current stage of development. We facilitated this process by hosting a week-long online forum where users could first view and critique our criteria, as well as suggest new ones based on their own expertise or previous knowledge of assessment processes. This proved to be a productive way to engage the performers in the process, and led to the revision of some of the criteria during AGC team meetings. This interaction resulted in a final set of 86 criteria that would be used during the TPE event. All performers then submitted their representative set of criteria to the AGC team using a Web interface.

Mission Thread Development

As a complement to the self-nominated criteria, the performers submitted a Mission Thread document which provided the AGC team with a "roadmap" for assessment. Each performer was asked to tie in to a general military type mission set/scenario and workflow that showed how their capability could be used in a military setting. Performers were also directed to provide references to military doctrine, such as the Army Field Manual (FM) 3-24.2 (Tactics in Counterinsurgency) and FM 3-07 (Stability Operations) to support their assertions of military relevance. These documents were developed during direct interaction between the performers and the AGC team over coordinated conference calls months prior to the event.

The Event

Each performer was invited to spend a day at AGC to present their project concept, progress and to demonstrate their technological development to date.

The daily schedule of the evaluation typically began with performer presentations summarizing the project and work completed up to this point. Next, performers presented technology as part of a previously agreed upon mission thread, in order to demonstrate the technology's efficacy in an operational scenario. In the afternoon, demonstrations were completed and the AGC Evaluation team conducted a hotwash.

The Way Forward

The TPE was intended to provide the HSCB program a robust technical assessment of the state of the performers' capabilities to date. Throughout the process, the assessment team and the performers engaged

in meaningful dialog concerning programmatic objectives and potential transition targets, while at the same time ensuring that a solid understanding of DoD and military culture was necessary for success. Future TPEs will be based on this model, and will continue to provide relevant assessments of HSCB capabilities to support strategic, operational, and tactical decision making that will assist the modern day commanders and warfighters worldwide.

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To begin the transition planning process, we will be working with PM DCGS-A and perhaps other Intel Pillar transition partners by implementing focused HSCB efforts aimed at supporting specific HSCB requirements for the target POR program. The initial step will be to define and develop an approach and top level transition framework for the Technology Transition Agreement (TTA) which lays out the objectives, approach and process to facilitate and focus the various efforts within the HSCB program towards development, integration, testing and demonstration of HSCB capabilities to the POR PM. Upon signing the TTA with the POR PM, detailed implementation and execution of HSCB program activities will begin and will include: Integrated System Concepts Development; Model development efforts; Initial models assessment through the Technical Performance Evaluation (TPE); and Integration and Capabilities demonstration at the HSCB Testbed facility via the Integration Demonstration (ID) events. The HSCB Testbed is the venue and the ID is the event instituted by the HSCB Program for the testing and demonstrating of the various HSCB models and tools as a "Capability" suite for transition considerations. The IDs serve as a major stepping stone in helping transition target partners in determining the degree to which the integrated HSCB "Capability" meets specific requirements of the POR.

The POR transition efforts will continue at the HSCB Testbed. The HSCB Testbed Team will work hand-in-hand with the POR Systems Integration personnel to assure the successful development, and integration of the HSCB Capability package/prototype into the POR system baseline for eventual certification testing and fielding.

HSCB TRANSITION FOR THE INTEL PILLAR

FEATURE ARTICLE

By Barry Costa

In response to the Director, Defense Research and Engineering (DDR&E) imperative "Accelerate Delivery of Technical Capabilities to Win the Current Fight," the HSCB program has stepped out in a new direction. While the primary focus of the program will always remain on conducting great research and transitioning relevant and targeted parts of that research to Department of Defense (DoD) acquisition programs, this new imperative challenges the program, and our HSCB awardees, to see what technologies we might have ready in the near term to support our deployed forces. Some of our goals in that regard are to enhance our technical collaboration with the warfighters to fully understand their current HSCB-related needs and anticipate their future needs. Second, to partner with academia and industry and collaborate within DoD to rapidly prototype and then transition compelling HSCB concepts and technologies to the warfighter. Finally, to identify and solve challenging near and short term warfighter HSCB-related technical problems requiring research and investment not already undertaken by the Services.

In support of that imperative, the HSCB program has aggressively engaged with operational users in group meetings and one-on -one visits that allowed us great insight into operational requirements. HSCB now has, or is in the process of establishing, several projects in direct support to those deployed to Afghanistan and other operational areas. In one case, we took some government owned extraction technology implemented at one of our government partner locations, added some HSCB-related technology, and in less than a couple of months helped the partner answer a pressing operational question and develop an innovative new way of doing business for them. In another case, we are helping one of our partners with assessment, planning and evaluation, and in yet another with advanced analysis and visualization.

These quick wins are a result of the program leveraging that which industry and academia are already working on for HSCB and tailoring it to meet the warfighters' needs. Our HSCB team is comprised of those that deeply understand the research base, those that understand programs of record and how to transition, and those that know the operators and what they need. With this team, we will continue to work that balance between research, transition, and accelerating delivery of technical capabilities.

HSCB SUPPORT TO DEPLOYED OPERATIONS IN AFGHANISTAN

SPOTLIGHT LORA G. WEISS, PH.D.

Quantifying the Qualitative

Dr. Lora G. Weiss is lab Chief Scientist at the Georgia Tech Research Institute (GTRI) in Atlanta, Georgia, where she conducts research in all aspects of behavioral systems, from behavioral analyses of individuals and groups to behavior-based unmanned and autonomous systems. She has conducted research on using computer-based methods to evaluate behavior with researchers from the United Kingdom and has conducted cultural modeling of adversarial actions. She has supported research in intelligent autonomy for unmanned systems and robotics, as well as research on virtual worlds for scientific assessments. Today, Dr. Weiss is involved in all aspects of coupling behavior with technology to develop new methods and novel approaches for quantifying the qualitative.

Dr. Weiss' doctoral dissertation, completed more than 15 years ago, was focused on underwater signal processing for unmanned and autonomous systems. Dr. Weiss quickly realized that even if an unmanned system had the best signal processing available, it still needed to understand how to use that information, how to reason with it, how to respond to what it perceived with a collection of behaviors and actions, and how to do so fully autonomously since unmanned underwater systems have little opportunity to interact with operators. This led to research in developing methods to understand unpredictable behaviors, which often overlapped with quantitative approaches to understanding human behavior.

Before joining GTRI, Dr. Weiss spent 16 years in the Applied Research Laboratory at The Pennsylvania State University, where she led numerous efforts related to these research areas. She not only studied autonomous systems, but she led a portfolio of basic research projects directed at countering improvised explosive devices (IEDs) through all phases of the IED cycle. The portfolio ranged from terahertz imaging to biomimetic sniffer research for trace detection. Her own research within that portfolio was focused on detecting anomalous behaviors of individuals.

Through this research, it became clear to Dr. Weiss that there are multiple facets associated with understanding adversarial behavior that couple the technical aspects of the devices with the behavioral aspects of individuals and groups. It also became clear that more basic and applied research were needed to support cross-domain analysis for forecasting socio-cultural responses in non-conventional warfare missions.

In 2006, Dr. Weiss joined GTRI, where she has expanded her research portfolio to include understanding all aspects of behavior-based systems, manned and unmanned, and at all scale-levels, from micro to meso to macro. David Kilcullen succinctly captured the challenge of analyzing human behavior in asymmetric environments in his book The Accidental Guerrilla stating, "…today's threat environment is complex, ambiguous, dynamic, and multifaceted, making it impossible to describe through a single model." This challenge has driven Dr. Weiss to develop new approaches in computational modeling that support advances in understanding effective courses of action. As such, she and her colleagues have been developing a collection of approaches to support analysis of human social cultural behavior (HSCB).

The approaches that Dr. Weiss and her team use include developing influence models, system dynamics models, and agent-based models for scenario and event analysis. They are also exploring the foundations of modeling and analyzing multi-agency policy interactions by evaluating relationships between Diplomatic, Information, Military, and Economic (DIME) actions that cause non-linear effects across the Political, Military, Economic, Social, Infrastructure and Information (PMESII) variables. Another area of research involves representing cultural descriptions and psychological theories in model constructs, where they seek to develop metadata representations of these theories. These representations are then used in analytic models to support human decision making.

"A FOCUS OF DR WEISS AND HER COLLEAGUES IS THAT A KEY ELEMENT OF QUELLING TERRORISM IS TO UNDERSTAND THE PROCESS SO AS TO DISRUPT IT IN ITS EARLY STAGES."

A focus of Dr Weiss and her colleagues is that a key element of quelling terrorism is to understand the process so as to disrupt it in its early stages. Their research in behavioral and cultural modeling is aimed at helping analysts and decision-makers understand adversarial behavior. By integrating behavioral aspects of adversarial activities with computational methods, Dr. Weiss and her team have been exploring new approaches to support "what-if" experiments related to understanding these activities and to ascertain potentially effective intervention points to disrupt the process of individuals engaging in adversarial behavior.

Dr. Weiss can be reached at Lora.Weiss@gtri.gatech.edu. She invites those interested in computational aspects of behavioral analysis to contact her or visit her at the Georgia Tech Research Institute in Atlanta.

STEVEN C. BANKES, PH.D.

Dr. Steven C. Bankes is Chief Architect with BAE Systems Advanced Information Technologies, which develops software solutions for the defense and intelligence communities. He is also an adjunct associate professor in the department of Computer Science at Carnegie-Mellon University. Dr. Bankes did his undergraduate work at the California Institute of Technology, and received his PhD from the University of Colorado in Computer Science. He has published broadly in literatures spanning computer science, artificial intelligence, artificial societies, operations research, policy analysis, neuroscience, machine learning, and climate studies.

"THE UNIFYING VISION BEHIND DR. BANKES' RESEARCH HAS BEEN THE USE OF MULTIPLE MODELS, INCLUDING BOTH ENSEMBLES OF ALTERNATIVES AND COLLECTIONS OF SYMBIOTIC MODELS THAT CAN BE COMBINED OPPORTUNISTICALLY FOR A GIVEN PURPOSE."

Prior to joining BAE Systems in 2007, Dr. Bankes was with the RAND Corporation for over 20 years. He was a founder of Evolving Logic, a performer on several precursor efforts to the HSCB program that continues to provide consulting services for a range of commercial and governmental clients. While in graduate school he was with the National Center for Atmospheric Research (NCAR), and also worked at the Johnson Space Center in Houston.

The central theme of Dr. Bankes' career has been the pursuit of computational science, both in its foundations and its application. He has worked on multiple simulation efforts, including models of global circulation, solar physics, economic development, climate, international relations, and military combat. He contributed to early development of agent based modeling (ABM) methods, beginning with research at RAND on "object oriented simulation" before the term "agent based modeling" was introduced. In 1991, he and coauthor Carl Builder coined the phrase "artificial societies" for the use of ABMs to better understand social phenomena. Taxonomies of model use were first proposed around that time, with continuing implications for model development and testing. Dr. Bankes introduced the concept of "exploratory modeling" for decision analysis purposes based on the use of iterative computational experiments to develop information about the ensemble of plausible futures. An early paper also described the use of computer models as "prostheses for the imagination." Methods for exploratory modeling he developed were applied to robustness analysis with models, leading to robust decision methods such as Robust Adaptive Planning. That work also contributed to other policy related methods and topics including exploratory analysis, long term policy analysis, and capabilities based planning.

Dr. Bankes was the creator of the Computer Assisted Reasoning system (CARs), a software environment for the exploitation of collections of models of arbitrary type. CARs provided a platform for generating large numbers of computational experiments in support of policy analysis or other decision goals, featured innovative tools for modifying the input/output map presented by a model without altering computer code, and pioneered techniques for model composition. In this, CARs is a clear forerunner to current HSCB efforts to create advanced modeling environments.

The unifying vision behind Dr. Bankes' research has been the use of multiple models, including both ensembles of alternatives and collections of symbiotic models that can be combined opportunistically for a given purpose. The advantages of this approach over the creation of large monolithic models is now matched by the opportunity presented by massively parallel computational resources (multi-core and grid or cloud enabled) that make the use of large numbers of modeling experiments a practical reality. Multi-model, multi-method approaches provide a means to unify across the stovepipes of differing modeling disciples, combining statistical, machine learning, table or rule based, and simulation approaches to modeling. Multi-model methodologies have significant implications for issues of model identification, model estimation, and uncertainty analysis. And combined with the concept of robust inference, these approaches provide a means to support practical decisions without adopting unrealistic assumptions.

Dr. Bankes' current research interests focus on the modeling of systems that span multiple spatial and temporal scales and require representing multiple phenomena. These problems include many HSCB systems where individual cognition, social influence, organizational and institutional behavior, economic activity, and culture all richly interact. Notably, questions of resiliency by definition involve adaptive processes crossing multiple temporal scales, and must be addressed by multi-scale techniques. Dr. Bankes is principle investigator on a new ONR funded project modeling "Belief Formation in Radicalization" that will address the interaction of social influence and cognition in the dynamics of radicalization.

SPOTLIGHT STEVEN R. CORMAN, PH.D.

Bringing Communication Theory and Research to Bear on Problems of Terrorism

By Kathleen Holladay

Dr. Steven R. (Steve) Corman is a Professor in the Hugh Down School of Human Communication at Arizona State University. There he directs the Consortium for Strategic Communication (CSC), an interdisciplinary group of researchers from ASU and collaborating institutions who bring theory and research from the human communication field to bear on problems of terrorism, strategic communication and public diplomacy.

Dr. Corman received his PhD in communication theory from the University of Illinois at Urbana-Champaign in 1988. His dissertation developed a theory describing the role of organizational activity in accounting for differences between perceived networks and observable communication in organizations. Through 2001 his research program continued work on this problem.

Shortly after the 9/11 attacks, Dr. Corman was invited to participate in a workshop sponsored by the Joint Warfare Analysis Center (JWAC). "At first, I thought they had the wrong guy, that there has been some kind of mistake," he said. But after learning that JWAC was interested in counter-network action, Dr. Corman applied his research on organizational activity to offer an innovative idea: Rather than only attacking networks by eliminating individuals, the US should focus on disrupting terrorist *organizations* by strategically stressing their organizational activity networks. "By doing that, you create problems that have to be solved, which requires the Bad Guys to communicate, which improves your intelligence about their personal networks," he said.

"PEOPLE IN MY FIELD KNOW A LOT ABOUT IDEOLOGY, RHETORIC, PERSUASION, SOCIAL MOVEMENTS, AND THE LIKE," HE NOTED. SO HE FORMED THE CSC IN THE SUMMER OF 2005.

Dr. Corman was invited to serve on a Scientists' Panel for the Special Operations Working Group at SOCOM in 2003-2005. There he learned that the concern had shifted from networks to ideology. "People in my field know a lot about ideology, rhetoric, persuasion, social movements, and the like," he noted. So he formed the CSC in the summer of 2005.

The group consists of scholars in the Hugh Downs School, other ASU units, and at outside institutions such as the Combating Terrorism Center at West Point. In its first years the organization focused on a technical report series dealing with outdated ideas and practices in US Strategic Communication. This culminated in a collection co-edited by Dr. Corman and his colleagues Angela Trethewey and Bud Goodall entitled *Weapons of Mass Persuasion: Strategic Communication to Combat Violent Extremism* (2008, Peter Lang).

The CSC joined the HSCB program in May of this year with their project focusing on extremist narratives in contested populations. "Narrative is a key for understanding how extremist groups legitimize themselves, delegitimize the West, and attract recruits and sympathizers. Americans can tell a story about what they were doing on the morning of 9/11, or say 'remember Pearl Harbor,' or call someone 'another Joe McCarthy and have an instant connection to their audience," Dr. Corman said. "The Bad Guys do that too. But they tell about Tora Bora, say 'remember the Battle of Badr,' or call someone another 'Pharaoh.' We need to understand those references and how they work, so we can recognize and work to counter them."

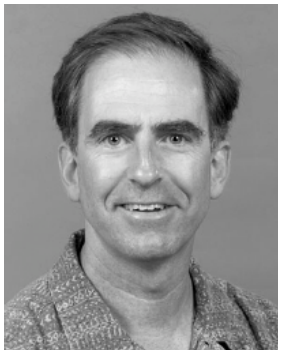
The CSC project will pursue that goal with two initial tasks. The first is to develop a practical model of narrative. "Academic concepts of narrative are too arcane and abstract to be useful to practitioners," Dr. Corman said, "whereas for practitioners narrative is a shallow concept, just another word for 'story'." The CSC project is developing a pragmatic model of narrative, consisting of archetypes, story forms, stories, and narratives. It will lead to a relational database of these elements, stocked from extremist rhetoric using linguistic analysis of explicit stories plus humanistic study of narrative fragments. The database will be useful for both operators and modelers.

The second task in the CSC project involves developing a model of traction. There is a huge body of theory and research on why messages spread. "Research has identified scores of factors, too many to be practically useful. Each study or theory deals with its own hand-full" Dr. Corman said. The CSC team has inventoried these factors and will simulate different combinations in an Agent Based Model.

Their aim is to find the most parsimonious set that reproduces power-law distributions that have been identified in descriptive empirical research. They hope to find a small set of indicators that expeditionary operators can use to assess the spread of stories and other messages, and to create a "heat index" for use in reporting to commanders.

Dr. Corman can be reached at steve.corman@asu.edu, and more information about the CSC is available at http://comops.org. Besides CSC technical reports, the site hosts the blog COMOPS Journal, where Dr. Corman is a regular contributor. It also offers Monitor an aggregation service for blogs on terrorism, strategic communication, and public diplomacy.

EDWARD MACKERROW, PH.D.



Dr. Edward MacKerrow leads the Center for the Analysis of Emerging Threats at Los Alamos National Laboratory (LANL). This cross-disciplinary team of social scientists and computer scientists focuses on anticipating social unrest and political violence using computational social science (CSS). Dr. MacKerrow has worked as a scientist at LANL for 23 years, originally focused on laser physics and remote sensing. In 1999, Dr. MacKerrow took a sabbatical from LANL to develop computer models of human behavior in organizations for better operational risk analyses. He has focused on CSS ever since.

"THE REAL CHALLENGE NOW IS TO HELP FIGURE OUT HOW TO SET UP INCENTIVES AND INSTITUTIONS SO THAT THE TRIBES IN AFGHANISTAN AND PAKISTAN CAN EVOLVE TOWARDS A MORE STABLE FUTURE THAT DOES NOT REQUIRE INTERNATIONAL SECURITY FORCES TO ALWAYS BE PRESENT."

Dr. MacKerrow and his team are currently developing HSCB models of tribal behavior in Afghanistan and Pakistan, and models of consumer behavior to develop better strategies for marketing. The real challenge now is to help figure out how to set up incentives and institutions so that the tribes in Afghanistan and Pakistan can evolve towards a more stable future that does not require international security forces to always be present. To do this correctly requires a holistic model that accounts for adaptation. Moving away from an opium based economy, reducing violence against the Afghanistan government, lower public support for the Taliban, and reducing the threat of terrorism, require accounting for how our own actions drive the incentives and subsequent behavior of many interrelated groups.

Defining a "complex adaptive system" is sometimes a ruminative exercise. In Dr. MacKerrow's view, he sees them as systems that cannot be predicted with absolute certainty from a set of known inputs. Being trained in physics he went into this area looking at how he could represent phenomena mathematically with equations and solve these equations to provide "answers". Now he looks at things completely differently. Models are developed to *represent* complex phenomena so one can better *understand* those phenomena. In traditional physics one strives for equation-based models. Equations are very useful, simple, and easy to communicate and *share* between scientists. One trusts equations. Dr. MacKerrow learned that the goal of obtaining an equation-based representation can blind oneself from other more accurate frameworks for representing the phenomena of study – especially in the HSCB arena.

Computer *algorithms* do not have to be distilled into equations for them to be useful. Today one can utilize computer algorithms to model HSCB constructs like memory, contextual relationships, adaptation and learning, cultural norms, group identity and membership, grievance, honor, and other "softer" phenomena. Object-oriented software design is a natural representation of heterogeneous human social systems. Computational social science (CSS) has really advanced due to the advances in computer modeling and integrating algorithms into our representations versus always forcing things towards equations.

Right now the CSS community is not sharing *algorithms* as well as the physical sciences share equations. This limits the advancement of the HSCB sciences. The HSCB community can establish more scientific transparency and sharing of CSS algorithms by following the practices of an Open Source Community (e.g. The Eclipse Foundation[1] or The Apache Software Foundation[2]). What is needed is for one scientist to be able to use another scientist's algorithm in his or her own social science model or simulation. Sharing and transparency is needed to build and grow this new field. For this to happen the original developer of that algorithm needs the incentives to share. These include (1) giving documented credit to the original developer of the algorithm, (2) providing a meritocratic review process similar to the Public Library of Science (PLOS)[3], (3) establishing an open software community using proven institutions for this like the Eclipse Foundation[1], (4) and requiring USG/DoD funded HSCB performers to contribute their funded works to this open source community. Establishing an Open Source HSCB community well help tremendously. More is needed though. A better sense of community across the myriad of agencies funding the HSCB work is also needed. Today scientists are highly motivated to obtain and maintain research funding – it drives survival. If the USG/DoD funding agencies can work together as an integral part of an Open Source HSCB community this might help. Classified data and the occasional situation of classified algorithms, needed for advancing HSCB research and development can be organized on a similar classified HSCB community.

The DoD HSCB programs are already making huge strides in this direction. Dr. MacKerrow expects that as these open source communities develop the community will see a rapid advancement in computational social science.

Endnotes

1 http://www.eclipse.org/org/

2 http://www.apache.org/

3 http://www.plos.org/

SPOTLIGHT BARRY SILVERMAN, PH.D.

By David Pietrocola

As Professor of Electrical and Systems Engineering at the University of Pennsylvania, and Director of the Ackoff Collaboratory for Advancement of the Systems Approach (ACASA), Dr. Barry Silverman is helping bridge the gap between the traditionally separate realms of social science and systems engineering. His research agenda over the past decade, along with his staff of doctoral students, postdoctoral researchers, and software engineers, has sought to shed light on the topic.

Dr. Silverman earned his Bachelor of Science in Engineering from the University of Pennsylvania in 1975 and his PhD in 1977. Until 1998, he was on the faculty of The George Washington University, where he became Director of the Institute for Artificial Intelligence. Dr. Silverman has authored over 130 articles, 12 books/proceedings and created a board game. He has developed National Institute of Health (NIH)-sponsored expert systems and serious games for health care, and created role-playing diplomatic strategy games that model world leaders for government agencies. He is a fellow of IEEE, AAAS and the Washington Academy of Science, and he currently serves as Associate Editor for *Intelligent Decision Systems.*

Dr. Silverman and his ACASA team have developed an agent-based modeling framework that permits a rich exploration of the cognitive and social processes of human behavior, decision making and societal effects. The core of this effort, PMFserv, packages over 100 best-of-breed models, synthesized from the diverse social science literature, into a unifying mind-body framework. Following the original success of PMFserv, and thanks to Multidisciplinary University Research Initiative (MURI) support from the Air Force Office of Scientific Research, Dr. Silverman and the ACASA team developed a socio-political layer called FactionSim to model factional and institutional interactions in addition to individual agent decision making. Institutions control resource distributions such as health care and education, while factional leaders can make decisions regarding their group assets and resources.

Dr. Silverman's team has used PMFserv-FactionSim extensively in recent years to model conflict scenarios ranging from insurgent behaviors in Baghdad, to Southeast Asia country models, to six-party talks with North Korea. Last year, for example, the team modeled the societies, institutions, and intricacies of several countries for a DARPA Challenge and was able to successfully forecast major government, political and demographic changes. Currently, the lab is expanding its "CountrySim" approach for DARPA and also exploring the project's applicability more generally via an HSCB Integrated Development grant.

The work at ACASA is currently sponsored by all four military services, DARPA, and the HSCB program. For example, NonKin Village is a major research project, conducted with funding from several sponsors, that is fostering a training game as well as a human terrain data framework. Now in its second full year, NonKin has become "a gameworld that brings life to PMFserv agents in an emergent SimCity-like environment," according to Dr. Silverman. Cultural awareness and training are major components of the game, as are implementing current counterinsurgency and SSTR doctrine strategies. Players can attempt tactical DIME actions and observe PMESII effects, often alongside unanticipated side-effects. According to Dr. Silverman, "

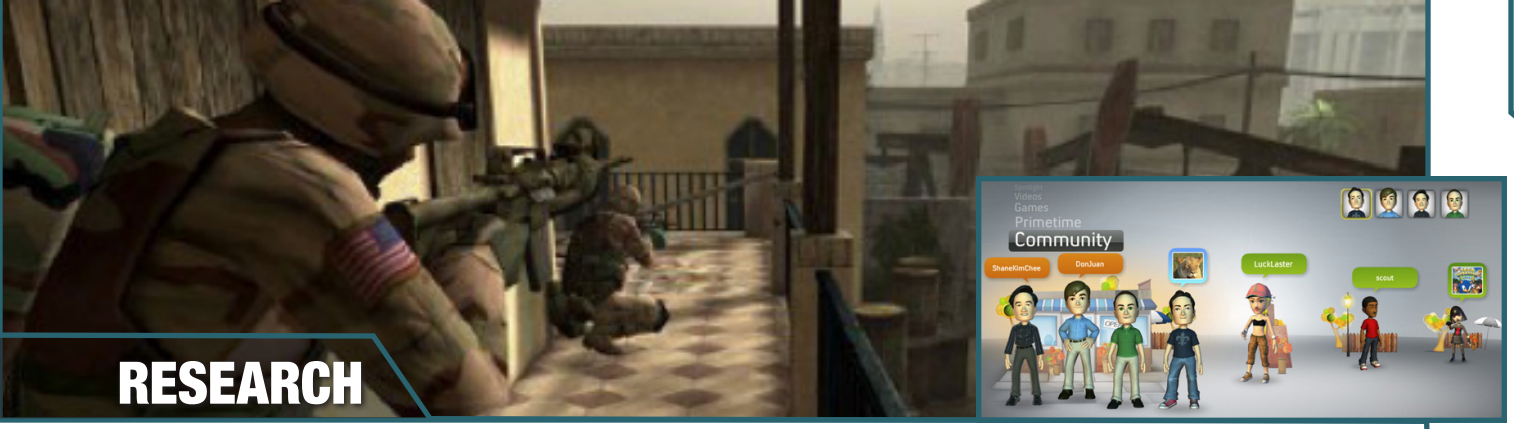
The NonKin project has entered an exciting period in recent months. The team has successfully linked its human terrain village data with the U.S. Marine Corps' MarineLink database, allowing rapid village creation and opening the door to exploration of useful in-theater tools for analysis of dynamic human terrain intelligence. It has also just been given the go-ahead, via another HSCB grant from the Combating Terrorism Technical Support Office (CTTSO) program and jointly with Alelo, to begin plugging into a 3D game engine to help foster HSCB training capabilities. NonKin will bring socio-cognitive awareness, understanding, and decision-making to agents in 3D worlds so they can more realistically express reactions to life and activities in their village.

All this work to collect theories/models from the behavioral literature and to assess and evaluate how they perform alone and in concert with other models has begun to spawn debate about what theories to synthesize – something unimaginable a decade ago.

An overall objective of Dr. Silverman's research program has been to provide a new toolkit for social scientists: one in which this group of theorists and experimenters can actively investigate complex socio-technical systems, a task not possible in the real world. Dr. Silverman envisions a new paradigm in which social scientists work alongside modelers to examine theories, their interactions, and holes that may present themselves in the models. Today, Dr. Silverman and his team continue to develop the systems social science paradigm, winning over colleagues and reaching out to social scientists, one at a time.

Dr. Silverman notes that, "It's an exciting time for the field of social systems science and engineering. Given the vision and framework of Dr. Robert Foster and Dr. Dylan Schmorrow, and the rest of the HSCB leadership, the program is fostering a sense of community and further merging of the traditional reductive science approaches with stages of assessment and synthesis. It seems likely that the field is about to mature in ways not foreseen even a year or two ago in the HSCB modeling and simulation profession."

Dr. Silverman can be reached at basil@seas.upenn.edu. For more information, visit the ACASA website at http://acasa.upenn.edu/. Dr. Silverman also invites interested parties to tour the ACASA lab at the University of Pennsylvania in Philadelphia.



MASSIVELY MULTIPLAYER ONLINE GAMES (MMOG) SOCIAL AND CULTURAL MODEL EMBEDDING TECHNOLOGIES

By Michael Zyda and Marc Spraragen

USC GamePipe Laboratory

Our overall goal is the development of a massively multiplayer online game (MMOG) infrastructure, attractive to various types of players, and utilized as a testbed for models of individual and group (social and cultural) phenomena. This goal includes the following subgoals: the development of an infrastructure for analyzing online gameplay and player / group behavior, the development of a flexible software design for the purposes of externally developed behavioral models, and an architecture for obtaining inputs from real-world news feeds that can lead to emergent behaviors from our game-world population. We plan to work with behavioral models from Carnegie Mellon University's Center for the Computational Analysis of Social and Organizational Systems (CASOS), and from other relevant centers.

General design:
The MMOG, with working title "WarPipe," is set on present-day Earth. Its structure is two-level: outer game and subgames. The outer game is a city- and world-building simulation, including player-level and guild-level conflicts. Inner games, or "subgames," can be housed in any building or area in the world, and can be of any genre: sports, FPS, gambling, etc. Each player can choose to partake of the outer game, the subgames, or both levels. In the outer game, players can choose to compete in a city's subgames, for their own gain and/or on behalf of their guild. The guild whose members win the most subgames in a given city over a given time period "rules" that city; the ruling guild can levy taxes, govern new construction, and attempt to take over neighboring cities.

The outer game + subgames format supports our aim to attract as many players and player types as possible, which translates to more research data. Players can freely interact in peaceful venues, fight it out in guild wars (with an entire city as the prize) or FPS subgames, explore new subgames in various distinctive locales, find and complete task assignments, and/or achieve top subgame ranking, guild rulership, or even world domination.

Sub-goal: Data gathering for behavioral analysis
The first behavioral model that will analyze our game data is Construct, created by CASOS at CMU. Construct is a social networking model that essentially tracks the dissemination of knowledge and the growth of communication networks. Game data extracted for Construct's analysis will include player statistics: guild membership, abilities, battles, tasks, and adjacency / communications records (who talked to or physically approached each other, and when). We will also track knowledge dissemination for Construct via formal, in-game player-to-player training of various skills, such as combo fighting moves or guild-based emotes / gestures. Data logging will also capture various other aspects of the game, including city construction, guild growth, and subgame rankings. All data logs can be presented either in real time or after the fact, either as a graphical "snapshot" or as a trend over time.

A specific set of data to be presented for purposes of CASOS analysis is the record of conflicts from FPS subgames and guild wars, e.g.: team formation, weapons used, communications patterns, casualties, and city takeovers. CASOS will also track the effects of these conflicts, as well as the effects of rare "terrorist attacks" and "natural catastrophes" (as staged by the game administrators) on the behavior of non-combatant populations.

Sub-goal: Flexible research-oriented software design
All data logging parameters (e.g., timeslice granularity, which players / guilds / attributes to track, presentation format) will be adjustable via a web-based research interface.

Furthermore, our game will offer a critical degree of research flexibility beyond the data-logging capability of the standard MMOG. Our overall design composes a federated model architecture; each subgame is a potential lab for a different social and behavioral model, maintaining interoperability with the outer game. Subgames may be added, and gameplay of the outer world can be tweaked, all to meet the analysis needs of any behavioral model whose creators use our game as a research testbed.

Sub-goal: Incorporate real-world RSS feeds
In order to allow behavioral models to track the effect of public information on social groups, we will include real-world RSS feeds on in-game billboards, news screens, etc. The first application of this technique will concern in-game resources. Each region in the game world will have a distinct level of various natural resources to exploit via mining, harvesting, etc. The value of a given resource will rise and fall in accordance with the price of its real-world counterpart. In other words, the daily price quote for gold according to the Wall Street Journal will govern the in-game cost of gold for a commensurate period. These real-world commodity prices will appear in the various news sources of the game. Eventually, disparity in resource value between areas may lead to more people moving from a poorer to a richer region, or to a hostile takeover attempt from a neighboring region.

Conclusion
We are rapidly completing the design for this MMOG. We plan on showing the first demo of the outer world game at the USC GamePipe Laboratory's Demo Day on May the 12th. By August, we will have integrated in the Construct model and have begun to implement subgames and integrate additional behavioral models. The website for the MMOG is **http://gamepipe.usc.edu/warpipe**

CALENDAR OF UPCOMING CONFERENCES AND WORKSHOPS

Date	Event	Location	Sponser	Website
October 14–16, 2009	Fifth Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-09)	Stanford, CA	AAAI	**www.aiide2009.org**
November 30–December 3, 2009	Interservice / Industry Training, Simulation and Education Conference (I/ITSEC)	Orlando, FL		**http://iitsec.org/confinfo.cfm**
December 13–16, 2009	Winter Simulation Conference (WSC)	Austin, TX	INCONTROL Simulation Solutions, Systems Navigator	**www.wintersim.org**
Spring 2010	Behavior Representation in Modeling and Simulation (BRIMS)	Charleston, SC	AFRL, ARI, ARL, ONR, NSC, NASA, MoD	**http://brimsconference.org**
July 17–20, 2010	2010 AHFE International 3rd International Conference on Applied Human Factors and Ergonomics *Jointly with* 1st International Conference on Human Factors and Ergonomics in Healthcare 1st International Conference on Cross-Cultural Decision Making 13th International Conference on Human Aspects of Advanced Manufacturing	Miami, FL		**www.ahfe2010.org**

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