SOCIAL SCIENCE MODELING AND INFORMATION VISUALIZATION WORKSHOP

WORKSHOP REPORT

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SOCIAL SCIENCE MODELING AND INFORMATION VISUALIZATION WORKSHOP

EXECUTIVE SUMMARY

The Social Science Modeling and Information Visualization Workshop provided a unique forum for bringing together leading social scientists, researchers, modelers, and government stakeholders in one room to discuss the state-of-the-art and the future of quantitative/computational social science (Q/CSS) modeling and information visualization. Interdisciplinary quantitative and computational social science methods from mathematics, statistics, economics, political science, cultural anthropology, sociology, neuroscience, and modeling and simulation - coupled with advanced visualization techniques such as visual analytics - provide analysts and commanders with a needed means for understanding the cultures, motivations, intentions, opinions, perceptions, and people in troubled regions of the world.

Military commanders require means for detecting and anticipating long-term strategic instability. They have to get ahead and stay ahead of conflicts, whether those conflicts are within nation states, between nation states, and/or between non-nation states. In establishing or maintaining security in a region, cooperation and planning by the regional combatant commander is vital. It requires analysis of long-term strategic objectives in partnership with the regional nation states. Innovative tools provided by the quantitative and computational social sciences will enable military commanders to both prevent conflict and manage its aftermath when it does occur.

The need for interdisciplinary coordination among the academic, private, and public sectors, as well as interagency coordination among federal organizations, is critical to solving the strategic threat posed by dynamic and socially complex threats. Mitigating these threats requires applying quantitative and computational social sciences that offer a wide range of nonlinear mathematical and nondeterministic computational theories and models for investigating human social phenomena. Moreover, advanced visualization techniques are also critical to help elucidate – visually – complex socio-cultural situations and possible courses of action under consideration by decision-makers.

These social science modeling and visualization techniques apply at multiple levels of analysis, from cognition to strategic decision-making. They allow forecasts about conflict and cooperation to be understood at all levels of data aggregation from the individual to groups, tribes, societies, nation states, and the globe. These analytic techniques use the equations and algorithms of dynamical systems and visual analytics, and are based on models: models of reactions to external influences, models of reactions to deliberate actions, and stochastic models that inject uncertainties. Continued research in the areas of social science modeling and visualization are vital. However, the product of these research efforts can only be as good as the models, theories, and tools that underlie the effort.

The Department of Defense (DoD) and Department of Homeland Security (DHS) have responded to these needs and new developments in the field of quantitative/computational social science modeling and visualization by changing their orientation to social and cultural problems. While these efforts would not have been funded several years ago, they are cautiously being explored and supported today. The DoD and DHS have and continue to embrace this research area - through an

iterative, spiral process where they will build a little, then learn a little - until there is a strong foundation for supporting the social sciences. The DoD and DHS have also broadened their horizons by looking outside the US Government (USG) to understand and mitigate threats by engaging corporations, non-profit organizations, centers of excellence, and academia. The DoD and DHS have recognized the need to respond to a new type of adversarial interaction. Current and future operations demand the capability to understand the social and cultural terrain and the various dimensions of human behavior within this terrain. This evolution will require a re-examination of DoD and DHS actions such as developing non-kinetic capabilities and increasing interagency coordination.

While the DoD and DHS are changing their orientation to quantitative/computational social science modeling, difficulties and challenges remain. First, opportunities and challenges in the theoretical domain include the need for better, scientifically grounded theories to explain socio-cultural phenomena related to national security. Better theories affect modeling on all levels. They yield clarified assumptions, better problem scoping and data collection, a common language to interpret analysis, and inform visualization options. Quantitative/computational social science presents the opportunity to integrate theories, explore their applicability, and test their validity.

A second challenge facing the social science modeling community is the need to clearly frame the core question. This is a step that is often overlooked in the creation of new social science models. The model's intent must be clearly defined from the start. If the model is not framed correctly and if the assumptions, limitations, and anticipated outcomes of the model are not clear, the field of social science modeling can be easily tarnished. Part of the problem is the ambiguous and widespread use of the word "culture," which can be used to mean many things. This term must be better defined and normalized to assist modelers in framing the problem.

The third challenge is the lack of strong datasets for social science researchers. Available datasets may either lack a strong methodology or be unavailable to the open source community. Additionally, because social, cultural, and behavioral issues have only recently come to the attention of policy- and decision-makers, data remains relatively sparse. New efforts and investment in strong datasets are required to fuel the progress of quantitative/computational social science.

Fourth, the USG must adapt to the open-source nature of many social, cultural, and behavioral issues of interest to the defense, homeland security, and intelligence community today. Not only do cleared facilities restrict the access of many researchers and subject matter experts, they also restrict the type of data that can be used and the distribution of the model's output. Ultimately, open source will become the main source of socio-cultural information, and the USG must create environments for these developments to occur.

Finally, visualization should not be considered solely as the final step in the creation of a social science model; it must be considered from the very beginning. It is a form of analytic output that adds depth, value, and utility to an effort. Furthermore, visualization can be used for more than just analysis; it can also be used to evaluate data. Visualization is the means through which analysts and commanders receive and understand data. Its value should not be left as an afterthought.

The degree of interest and understanding in quantitative/computational social science exhibited by government stakeholders are higher than they have ever been before. New efforts at interagency coordination, particularly between the DoD and DHS are signs of the importance of this field.

Likewise, the level of interest and enthusiasm shown by academia in participating in these efforts is unprecedented. The coalescing need for timely, accurate, socio-cultural modeling and visualization tools is growing to such an extent that calls for a concept of operations are emerging. However, further cooperation is needed across the USG to advance, guide, and shape the science and meet the growing need for socio-cultural understanding.

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GLOSSARY OF TERMS

ABM	Agent Based Model
ACE	Automatic Content Extraction
AOR	Area of Responsibility
AFRL	Air Force Research Laboratory
BACH	Bayesian Analysis of Competing Hypotheses
BIWAC	Biological Information and Warning Community
CBRN	Chemical, Biological, Radiological, Nuclear
COA	Course of Action
COE	Center of Excellence
COG	Center of Gravity
CORE	Common Operational Research Environment (Naval Postgraduate School)
CSS	Computational Social Science
CWMD-T	Counter Weapons of Mass Destruction - Terrorist
DARPA	Defense Advanced Research Projects Agency
DDR&E	Director of Defense Research and Engineering
DIME	Diplomatic, Information, Military, Economics
DHS	Department of Homeland Security
DIA	Defense Intelligence Agency
DNI	Director of National Intelligence
DoD	Department of Defense
DOE	Department of Energy
DTRA	Defense Threat Reduction Agency
GDP	Gross Domestic Product
GIS	Geospatial Information System
GPU	Graphic Processing Unit
GVIM	Group Violent Intent Modeling
GWOT	Global War on Terrorism
HSCB	Human, Social, Culture, Behavior
HTS	Human Terrain System
I&W	Indications and Warning
IARPA	Intelligence Advanced Research Projects Agency
IC	Intelligence Community
ICEWS	Integrated Crisis Early Warning System
IED	Improvised Explosive Device
IGO	International Government Organization
IO	Information Operations
IT	Information Technology
JIEDDO	Joint IED Defeat Organization
JIOC	Joint Intelligence Operations Center
JIOWC	Joint Information Operations Warfare Command
JIPOE	Joint Intelligence Preparation of the Operational Environment
MAROB	Minorities at Risk Organization Behavior
NGA	National Geo-Spatial Intelligence Agency
NGO	Non-Government Organization
NRL	Naval Research Laboratory

NSA	Non-State Actors
NSF	National Science Foundation
OASYS	Opinion Analysis System
ODUSD	Office of the Deputy Under Secretary of Defense
OGA	Other Government Agency
OI&A	Office of Intelligence and Analysis
OODA	Observe, Orient, Decide, Act
OSD	Office of the Secretary of Defense
OSINT	Open Source Intelligence
RFI	Request for Information
RRTO	Rapid Reaction Technology Office
S&T	Science and Technology
SIGINT	Signals Intelligence
SMA	Strategic Multilayer Assessment
SME	Subject Matter Expert
START	Study of Terrorism and Responses to Terrorism
Q/CSS	Quantitative/Computational Social Science
USG	United States Government
USAFRICOM	US African Command
USCENTCOM	US Central Command
USPACOM	US Pacific Command
USSOCOM	US Special Operations Command
USSOUTHCOM	US Southern Command
USSTRATCOM	US Strategic Command
WMD	Weapon of Mass Destruction

INTRODUCTION

The Social Science Modeling and Visualization Workshop was convened by the Office of the Secretary of Defense (OSD) / Director of Defense Research and Engineering (DDR&E) / Rapid Reaction Technology Office (RRTO), Department of Homeland Security (DHS), Joint Staff, and US Strategic Command (STRATCOM) from 23-25 January 2008 at the Directed Technologies, Inc. facility in Arlington, VA.

The workshop sought to facilitate the development of Strategic Multilayer Assessment (SMA) efforts. SMA is a multi-disciplinary, multi-agency portfolio of projects that assesses and studies challenging "hard problems" associated with the planning and operation of DoD, military services, and government agencies. SMA projects are typically focused on critical, urgent needs as stated by a Combatant Commander. They are near-term in nature and involve intense, yet finite, study periods of six to nine months where proof of concept and prototype capabilities are developed and applied to overcome challenges. An extensive network of leading researchers and practitioners participate in SMAs, spanning the DoD, intelligence community, non-DoD federal government departments, universities, industry, and national laboratories.

The overarching purpose of this workshop was to better understand and reflect upon the directions in which social science modeling and information visualization techniques are headed over the next 5-10 years. In particular, this workshop was designed to help inform and shape military and civilian government decisions regarding how to take advantage of and influence these directions. This workshop was not a platform to demonstrate the "latest and greatest" technologies and capabilities; it was a forum for understanding "pathways to success."

The social science modeling component of the workshop sought to explore and better understand a wide range of state-of-the-art quantitative and computational social science modeling tools, algorithms, and methodologies of relevance to the SMA. The SMA problems tend to be characterized as inherently complex, highly uncertain, and exceptionally dynamic, where many competing actors, interdependencies, and interests are at play. Social science modeling can aid and inform decision makers in unraveling the complexity, quantifying the uncertainty, identifying biases, assessing risks, and ultimately making sense of the complex socio-cultural environments and the effect USG actions have on those environments. This workshop allowed leading researchers and practitioners in social science modeling to share their insights and views on how their research can provide the analytic rigor that moves decision makers from unaided intuition to socio-culturally informed judgment and action.

The information visualization component of the workshop employed a basic organizing theme that also supports the SMA process, particularly where it applies to a recent initiative dealing with preventing the accumulation and potential use of weapons of mass destruction by both state and non-state actors. Additionally, the workshop examined the role of visualization technologies to new initiatives that would enhance the commander's appreciation of complex fields of endeavor, including both the battlefield and the post-battle operating environments. A key for success is that we establish a worthwhile dialogue between critical players in the visualization world and begin to comprehend the "art of the possible". The workshop addressed the challenge of learning to make investments in order to shape this level of knowledge and decision-making environments.

PRESENTATIONS

OSD/DDR&E/RRTO SOCIO-CULTURAL PROGRAMMING

Ben Riley, Director, Rapid Reaction Technology Office (RRTO)

(This section distributed separately in FOUO Annex)

DHS/S&T SOCIO-CULTURAL PROGRAMS

Sharla Rausch Ph.D., Division Head, Science and Technology Directorate, Human Factors Division

The mission of the Department of Homeland Security Directorate for Science and Technology's (DHS S&T) Human Factors Division is to apply the social and behavioral sciences to improve detection, analysis, and understanding of the threats posed by individuals, groups, and radical movements; to support the preparedness, response, and recovery of communities impacted by catastrophic events; and to advance national security by integrating human factors into homeland security technologies.

DHS S&T is organized so that new ideas are taken from their basic research stage and fostered until ready to be implemented and employed by the end users. The Human Factors division focuses on all things "human," such as finding terrorists and community response and recovery. The Human Factor Division goals are listed below.

- Enhance the analytical capability of the DHS to understand terrorist motivation, intent and behavior.
- Improve screening by providing a science-based capability to identify deceptive and suspicious behavior.
- Enhance the capability to control movement of individuals into and out of the United States and its critical assets through accurate, timely, and easy-to-use biometric identification and credentialing validation tools.
- Enhance safety, effectiveness, and usability of technology by systematically incorporating user and public input.
- Mitigate impacts of catastrophic events by delivering capabilities that incorporate social, psychological and economic aspects of community preparedness, response and recovery.

Most of the Human Factors Division's goals fit within two broad categories. The first is social-behavioral threat analysis which includes precursors, signatures, and deterrence of radicalization; suspicious behavior detection; and community preparedness, response, and recovery. The second is human systems research and engineering, which includes personal identification systems; technology acceptance and integration; and human-systems optimization.

The Human Factor Division supports research initiatives that focus in areas of critical importance to the DHS including radicalization and media studies. However, the role of Human Factors is not simply to do research, but to find indicators and tools that allow analysts to conduct better analysis. Human Factors works closely with the Study of Terrorism and Responses to Terrorism (START) Center of Excellence (COE) because they do a lot of basic, fundamental research that can be applied to issues of great concern to DHS.

The Human Factors Division has a relationship with the START, which is a DHS COE that conducts basic social and behavioral science research aimed at understanding the formation and dynamics of terrorist groups, as well as the social and psychological impacts of terrorism. One product of great use to Human Factors and to the broader security community is START's Global Terrorism Database, which is the largest terrorist event database with more than 80,000 events, and includes worldwide terrorist attacks that have occurred since 1970.

Understanding socio-behavioral phenomena has been underappreciated within DHS especially as compared with the acquisition of new technologies, tools, and equipment. Human Factors is not the softer side of science; it is the critical component in predicting and deterring adversaries' intent on causing harm. None of the work that Human Factors does occurs in isolation. Each project works with a relevant field to develop tools that the target community will use.

Human Factors is currently working on Group Violent Intent Modeling initiative. This socio-behavioral model enables systematic collection and analysis of information related to understanding terrorist group intent to engage in violence. Another project seeks to build a counter Improvised Explosive Device (IED) deter and detect attack tree that may provide actionable indicators to aid the intelligence and law enforcement communities in identifying and deterring those that pose significant threats of IED attacks. The hostile intent initiative identifies deception and hostile intentions in real-time using non-invasive, culturally independent sensors algorithms. This work is being correlated with other unlawful behaviors as well as for suicide bombers.

DHS Human Factors is also concerned with community resilience. It is not enough to protect physical infrastructure; preparation and response plans must also be cognizant of the importance of the social fabric of the nation, as was demonstrated in Katrina. DHS is hoping to expand the 211 project across the nation, which connects people in need with social services like shelter, food, and disaster relief.

STRATEGIC MULTILAYER ASSESSMENT

Hriar Cabayan (OSD/DDR&E)

Strategic Multilayer Assessment (SMA) is a multi-disciplinary, multi-agency portfolio of projects that assesses and studies challenging "hard problems" associated with planning and operation of DoD, military services, and government agencies. SMA projects are typically focused on critical, urgent needs as stated by a Combatant Commander. They are near-term in nature and involve intense, yet finite, study periods of six to nine months where proof of concept and prototype capabilities are developed and applied to overcome challenges. An extensive network of leading researchers and practitioners participate in SMA, spanning the DoD, intelligence community, non-DoD federal government departments, universities, industry and national laboratories. Recently completed SMAs include Sudan Strategic Assessment and Deterrence in the 21st Century. Ongoing efforts include Weapons of Mass Destruction (WMD) Assessment and Global Combating WMD-Terrorism Joint Intelligence Preparation of the Operational Environment (JIPOE).

SMA initiatives are designed to allow researchers to work without consideration of policy constraints. Their objective is to provide the best possible solution and leave the end user to deal with policy implications. There are no fixed relationships between people or organizations to solve problems; a new team may be convened for each SMA.

The social typology task within SMA has been focused on developing a generic model used to understand relationships between parts of a society of concern. The social typology consists of eight variables that could apply to any social group from a small cult, to a terrorist network, to a tribe, to a nation. Creating a social typology was a wakeup call for the DoD, who traditionally measures capabilities in terms of concrete metrics such as airplanes and tanks. The DoD is not used to collecting data about demographics, roles, and other socio-cultural data. However, social and behavioral sciences provide critical insights in support of human terrain assessments. The United States stopped trying to collect this data after Vietnam because it did not believe it would ever get into a similar conflict again. The IED problem made socio-cultural data important again.

Prediction and possible outcomes are critical components of quantitative/computational social science (Q/CSS) modeling. In a Q/CSS model, uncertainty and the time delta are the biggest factors that drive predication accuracy of the model. An accurate prediction exists within an envelope of plausible outcomes. Q/CSS models can compute the envelope and provide the bounds and indicators for future events. With Q/CSS models, the focus should be on generating a range of plausible outcomes rather than point predictions. The benefit of the model is to inform the decision-making process. Efforts at modeling Sudan showed that while the technology and methodology is not yet mature that Q/CSS modeling remains important.

COUNTER WEAPONS OF MASS DESTRUCTION (IN THE HANDS OF) TERRORIST (CWMD-T) JIPOE SMA

Todd Veazie, CAPT(S) Joint Staff/J3

The Counter Weapons of Mass Destruction (in the hands of) Terrorists (CWMD-T) Joint Intelligence Preparation of the Operational Environment (JIPOE) SMA was born out of a need for a common understanding of the WMD-T threat across the USG. The initiative is a methodological process to divine and predict adversaries' courses of actions: the who, what, where, when, why, and how. It will also define the operational environment, describe adversaries' courses of actions (COAs), deliver a common operating picture, develop an intelligence collection matrix, prioritize COAs, and inform policy makers across the government. Once COAs are defined, the government can start collecting information and working to counter adversaries' effort. The solution must enable the USG to view proliferate networks as systems of systems. Shared awareness and network defeat require a networked/federated approach synchronized across the USG. This may require a taxonomy to help understand indicators, create an information web, and build in a real-time shared awareness. This requires a comprehensive, collaborative information technology (IT) environment. The ultimate goal is to complete the OODA (Observe, Orient, Decide, Act) loop faster than the adversary. The result of the JIPOE effort should be a federated IT architecture solution.

The JIPOE is a continuous doctrinal process that provides predictive intelligence, comprehensive analysis of the operational environment, visualization of the full spectrum of adversary capabilities and intent, potential threat courses of action (COAs), and a basis for intelligence direction and synchronization. This requires collaboration with various intelligence organizations, other government agencies (OGAs), and nongovernmental centers of excellence. The JIPOE will also incorporate the social typology created via the SMA process. The DoD is not looking for a purely military instrument. In an ideological fight, US forces have to bring all instruments of national power (Diplomatic, Information, Military, and Economic - DIME efforts) across agencies to bear. There is a need for forces to understand networks as systems of systems. There is also a need to bring in a national level cell to divine adversarial COAs. US forces look to interagency efforts to work together to provide solutions.

The CWMD-T JIPOE effort seeks to provide the USG with a detailed analysis to identify centers of gravity and vulnerabilities, named area of interest synchronization matrix, and prioritized threat course of action. It informs policy, capability development, collection strategies, and operational planning and decisions.

In order to build a WMD-T operations-intelligence fusion enterprise, several efforts are required. First, a global strategic to tactical operational net assessment needs to be completed. Second, the USG needs to develop a "shared understanding" of the WMD-T environment that allows it to get "upstream" of the adversary (predictive intelligence). Third, critical centers of gravity (COGs) and vulnerabilities need to be identified. Fourth, gaps in capability and policy must also be identified. Finally, the goal is to match USG capabilities to adversary vulnerabilities to achieve desired effects.

USSOCOM is charged with countering WMD adversaries. They have the capability to interdict the adversary, yet the intelligence they receive is a static snap shot in time. In order for USSOCOM to effectively counter WMD, they need predictive intelligence. Because special operations forces want to eliminate the adversary, the goal is to anticipate movements and events are far ahead as possible.

They can apply JIPOE methodology to the WMD problem. JIPOE seeks to take a map, identify all centers of gravity in terrorist networks, and identify adversaries' vulnerabilities. However, US forces need to go from the strategic to tactical level of understanding the environment. It is not only about geo-spatial capabilities.

The importance of bringing together the social science community and the modeling community is critical. The challenge is how to visualize a system of systems network that are much richer than a simple map.

SOCIO-CULTURAL MODELING R&D PANEL

Robert Popp, NSI, Inc. (Moderator)
Sean O'Brien, Program Manager, DARPA
Sean Biggerstaff, Assistant Director, Human Systems, ODUSD (Science & Technology)
Laurie Fenstermacher, AFRL, Cognitive Systems Branch, Human Effectiveness Directorate
Kelcy Allwein, Advanced R&D Projects Officer, Department of Defense

The presenters in the panel will speak about the work they are sponsoring in socio-cultural development. They will speak about their visions for the field and the programs they support.

(Portions of this section distributed separately in FOUO Annex)

KELCY ALLWEIN

Advanced R&D Projects Officer, Department of Defense

Applied research into using social science modeling for forecasting and predicting possible outcomes was initiated by the intelligence community through a small interagency group of visionaries in 1999. An exploratory R&D program was funded by IARPA's predecessor ARDA in 2001 to look at human behavior and the spread of infectious disease and leadership decision-making in closed regimes. Valuable lessons were learned on how to articulate the problem which required more basic science in addition to applied R&D. The National Science Foundation (NSF) began a large effort to fund basic human behavior research in 2003. Since then, a number of small models have been incorporated into selected problem sets within the IC, but applied RDT&E continues on how to most effectively integrate technologies to assist in framing the problem, developing new business processes and answer challenging intelligence problems.

One of the key lessons learned was that applying social science models for intelligence problems would require some specialized skill sets to partner with intelligence analysts. Because modeling still requires actually running the models, a series of enablers or coaches often called "methodologists" are needed to transition social science modeling into daily intelligence operations. Methodologists are generally multi-discipline experts trained in facilitation skills, thinking differently and in working complex problems. They work with analysts to develop new solutions and tradecraft. Additional partnerships are needed with subject matter experts both inside and external to the US government as part of this process.

As the DNI stood up in 2005, the use of open source information was formalized with the creation of the National Open Source Enterprise with the goal of open source becoming the "source of first resort". Agencies are working to build the tradecraft to perform open source analysis and integrate results into all source analysis in order to understand the complete picture. While open source is a critical element in forecasting and predicting future events, it is important to understand the value and roles of both classified and unclassified information in a dynamic forecasting process. This is a challenge that requires new tradecraft and increased collaboration at many levels.

Two years ago, Intellipedia was created to share information on some of the most difficult problems facing U.S. intelligence. Intellipedia is based on the MediaWiki software used by Wikipedia (see Wikipedia's article on Intellipedia) and has resulted in the formation of collaborations between

operations, plans, policy, and intelligence at multiple levels. While the Enterprise 2.0 capabilities available with Intellipedia and other Intelink applications provide a good foundation for collaboration at multiple classification levels, there are still issues to be addressed in their potential relevance to modeling and simulation. How would a model use the data collected both in the classified and open source realm and take it to the experts who may not have access at all domains? Another problem is that the accumulation of so much data must be processed in a way to make it useful to the analyst. The data may have to be displayed in a way that is not geospatially oriented. How does the output from models at the open source level move into other domains with sufficient provenance or chain of reasoning attached so that it can be used in models executed at different classification levels. How can models be validated and verified in a collaborative workplace. How can expert judgment and the wisdom of crowds support the process. These are challenges to using social science modeling for intelligence problems.

COMPUTATIONAL SOCIO SCIENCE MODELING: PRESENT AND FUTURE

Claudio Cioffo-Revilla, Director, Center for Social Complexity, Krasnow Institute for Advanced Study, George Mason University

Computational Social Science (CSS) is the investigation of social phenomena at any level of micro-macro complexity enabled by computer models, especially (but not exclusively) through object-oriented, agent-based models (ABMs) and other simulation tools. CSS today differs from earlier statistical models and mathematical models, which are case- and variable-oriented, respectively. CSS acts as the common denominator across various fields including anthropology, economics, and political science. CSS addresses big questions in social science such as:

- Origins of civilization and long-term cultural evolution
- Emergence of economic markets and governance institutions
- Causes of war and peace, both domestic and international
- Anthropogenic causes and consequences of biospheric change
- Future of space exploration and colonization

Social science modeling has evolved from statistic analysis, game, and decision theory to automated information extraction, social network modeling, social geography, complexity theory, systems dynamics modeling, agent based modeling, and many simulation methods.

There are ten future prospects that may change the trajectory of CSS. First, today's fields (SNA, complexity, ABM) will produce new synergies and discoveries, with policy applications. Second, object-oriented methodology will become the *lingua franca* of CSS, just as the calculus in physics, with markup languages, or similar notation, facilitating communication. Third, CSS models will be enhanced by cognitive science and environmental science. Fourth, CSS will become one end of a continuum based on neuroscience: Brain-Mind-Society. Fifth, CSS modeling will mark major strides in Europe and Asia, challenging US advances in basic research, teaching, and policy applications. Sixth, CSS will be taught in college (including the military institutions), as well as high schools. Seventh, CSS will become indispensable for the space program, both civilian and military, including missions related to travel, exploration, and colonization. Eighth, CSS will fail and disappear if it over-promises and is misunderstood as a panacea for solving all social issues. Ninth, visualization, sonification, and other data-communication methodologies will play an increasing role based on demonstrable value and require specialized labs. Tenth, CSS will provide the basis for building the first real-time 24-7 global situational monitoring and advanced simulation facility for supporting US national security policy.

There are several key types of methodologies used in the CSS environment. In social network analysis, the quantification of qualitative variables is producing exciting results. Social geography blends advances in social geography with cartography, in ways which have not been done before. Complexity theory allows modelers and social scientists to use data with dimension and distributions that are not normal. Systems dynamics is an equation based approached solution to social science modeling. Agent based (or object oriented) modeling is the most recent development of CSS. The importance and significance of this is that the great majority of social science theories are thought of in terms of objects, not variables. Many other simulations methods exists such as evolutionary computation, which is valuable for discovering structures in data and patterns of behavior that are

not available using other means. It is very helpful in closing many of the gaps in social science regarding the dynamics of the real world.

Finally, it is important to note that special kinds of physical environments may be needed to test and employ social science models. This may be particularly true in the case of the IC, which is not set up to work exclusively with open source data.

BIG ALLIED AND DANGEROUS: STRATEGIC THREAT ASSESSMENT – THE CASE OF TERRORIST ORGANIZATIONS

Victor Asal, University of Albany

The Big, Allied, and Dangerous project is a threat assessment initiative instantiated on a terrorist organization. This model helps to identify current and future threats. The main variable is state construct with cultural and economic factors. The model is based on data from MIPT database. Because of the paucity of data, the model only looks at the 1998-2005 time frame. Terrorism is defined in this model as attacks on civilian targets. An organization is defined as being either lethal or prolifically lethal. A dangerous group is one that is lethal, has targeting the US, and/or has pursued CBRN weapons.

The key variables for threat assessment (as drawn from social science theory) are ideology, size, age, alliance connections, and state context. Research shows that of the 395 terrorist organizations identified world-wide from 1998 to 2005 that only 68 have killed ten or more people during that period and only 28 have killed more than 100 people. The key question then is what makes a group decide to become lethal?

The following factors make it more likely that an organization will use lethal violence: religious ideology (either alone or compounded with others), large group size, alliance connections, control of territory, and high expenditures on the military. The following factors make it less likely that an organization will use lethal violence: environmental, anarchist or leftist ideology; dilettante, small or young group; and wealth host country.

What matters in determining whether a group will kill prolifically are size, religious ideology, ethnonationalist and religious ideology, organizational connections, and control of territory. What does not matter is ethnonationalist ideology by itself, leftist ideology, democracy of "home-base" state, organizational age, energy consumption per capita of host state, and state sponsorship.

Groups may attack the US because of ideological conflicts or grievances against US actions or policies. Groups might also attack the US because it is a good target and successful attacks establish credibility as well as attract media attention.

Ultimately, what determines if a group will *target* the US is that the group has Islamic ideology, there are over 1000 US troops deployed to the country and the country is not a democracy, and that there are McDonalds (or other prominent signs of US culture). The things that do not matter are democracy, imports from the US, and GDP per capita.

What determines if a group will *attack* the US is the presence of over 1,000 US troops and the country is not democracy, there are McDonalds (or other prominent signs of US culture), the group has alliance connections, and has accomplished three or fewer attacks. What does not matter is Islamic ideology, US troop presence by itself, democracy, imports from US, state sponsorship, and gross domestic product (GDP) per capita. It is important to note the distinction between targeting and attacking. One entails violence while the other does not.

The number of connections with other groups does influence the probability of attacks on the US. The groups with four or more connections constitute 11 percent of the total set of groups but

account for over 70 percent of the fatalities. The top three most connected groups account for 31.4 percent of the total all by themselves

More and better data is needed to support the claims that various factors including organization size, number of networks, ideology, etc. increase a group's lethality. Time series data would help answer many outstanding questions. Network connections also seem to have a big impact as well on CBRN terrorism. A scoring mechanism is being developed.

EVENT DATA FOR POLITICAL ANALYSIS AND FORECASTING

Phil Schrodt, University of Kansas

Machine data coding, originally developed under DARPA funding from 1965-1980, is a well-understood technique for collecting systematic information on political interactions over time. Contemporary automated coding methods allow data to be collected in a transparent and reproducible manner in real time at very low marginal cost. Simple statistical models provide 60-80 percent accuracy in predicting violence in protracted conflicts in out-of-sample tests at policy-relevant forecasts. Contemporary systems deal systematically with sub-state actors and non-state conflict.

It is important to understand the world as it really is for political analysis and forecasting and not as how text books describe it. The realization that there are more players out there than sovereign nations adds a layer of complexity to international models and analysis. There has been a switch from inter-state to intra-state conflict, and a similar shift toward non-state actors. The implications for intelligence are that greater number of regions, actors, and behaviors need to be monitored.

CAMEO was originally designed for coding mediation but subsequently generalized for coding actions of militarized non-state actors. It builds off of the WEIS coding system, but combines ambiguous categories such as "promise/agree." Textual analysis by augmented replacement instructions (TABARI) is another machine coding tool. There are other automated coding tools including PERICLES, VRACoder, and Rice Coder.

The advantages of machine coding are that they are fast and inexpensive. They are transparent because coding rules are explicit in the dictionaries. They are reproducible because a coding system can be consistently maintained over a period of time without the "coding drift" caused by changing teams of coders. Coding dictionaries are also being shared between institutions. And they are unaffected by the biases of individual coders.

However, machine coding has disadvantages. Machine coding makes errors on complex sentences. It requires a properly formatted, machine-readable source of text, therefore older paper and microfilm sources are difficult to code. Development of new coding dictionaries is time-consuming—KEDS/PANDA initial dictionary development required two labor years. However, extensive dictionaries are already available.

The advantage of event data is that new data sets can be generated in near-real-time by a single researcher with limited resources. Customized modification of actor definitions and event categories is very easy. A wide variety of political activity is coded, but with a relatively standard set of categories. Studies are diverse but comparable. In some regions, data are sufficiently dense that techniques requiring a large amount of data can be used over time periods where parameters remain fixed. Systematic methods exist for integrating and differentiating multiple open source textual data streams.

There are many factors that encourage machine coding. First, there has been a conspicuous failure of existing methods. Second there is a technological imperative with increasing processing capability and more information available on the web. Third, there has been a demonstrated utility of existing

methods. Fourth, decision-makers now expect visual displays of analytical information. Fifth, Subject matter experts (SMEs) sources can be problematic or biased.

The old objective for machine coding was that it should attempt to duplicate human coders. Today's objective is that it should attempt to optimize coding systems and models to use information that can be coded most reliably by machine.

NUCLEAR ARMS AND FOREIGN POLICY

Eric Gartzke, University of California San Diego

This project examines the determinants of nuclear proliferation and its effects on international politics. There are two schools of conventional thinking on nuclear weapons. The nuclear pessimists believe that proliferation is dangerous, that it creates conflict spirals/instability, and that it increases conventional and nuclear disputes. The nuclear optimists believe proliferation is benign, that it generates deterrence/stability, and that it reduces conventional disputes. This project supports the "radical middle." It proposes that proliferation generates influence, not war or peace. Nuclear weapons do not affect how nations interact, but it does affect what nations get. This statistical model "postdicts" nuclear proliferation – it helps shed light on the causes and consequences of nuclear proliferation.

This study argues that nuclear weapons neither increase nor decrease disputes because primary national issues are no longer challenged and conflict shifts to secondary/tertiary issues. Nuclear weapons increase diplomatic leverage/influence because proliferators obtain more concessions without fighting. Rather than primarily impacting whether disputes occur, proliferation conditions the quality of settlements. Nuclear status acts primarily on what nations get rather than how they get it.

The study resulted in several conclusions. First, estimating endogeneity matters for estimating nuclear effects. This is because proliferation is caused by the same variables as disputes and because failure to instrument nuclear status introduces bias. Second, nuclear weapons do not increase or decrease conventional conflict because nuclear states are no more or less likely to initiate military attacks. Furthermore, nuclear targets are no more or less likely to be attacked. Third, nuclear weapons increase apparent influence because proliferators get more diplomatic recognition/size of mission and because proliferators give more diplomatic recognition/larger mission.

The main conclusions are that proliferation is caused by the same variables that cause disputes. Additionally, nuclear weapons do not increase or decrease conventional conflict. Finally, countries gain more important role in international system by obtaining nuclear weapons. This research is important because the practice of counter proliferation has been tremendously uneven. If policies are at core at incentives to proliferate, then there is good reason for the United States to allow some to develop while preventing others.

INFORMATION VISUALIZATION R&D PANEL

Carl Hunt, IDA (Moderator)
Frank Connors, Defense Threat Reduction Agency
Bill Preister, United States Strategic Command
Mark Livingston, US Naval Research Laboratory
Brian Norton, Defense Intelligence Agency
Paul Havig, Air Force Research Laboratory

(Portions of this section distributed separately in FOUO Annex)

FRANK CONNORS

Chemical & Biological Defense, Futures Group, Argus Program Manager, DTRA
Project Argus Visualization

Project Argus is currently an open source global biological event detection and tracking capability tool. It assembles indicators and warnings (I&Ws) of biological events. It has an acquiring, collecting, and modeling capability to capture and analyze information from the World Wide Web and from direct reporting. It develops and implements an automated cueing and alerting capability.

No other global biosurveillance capability provides comprehensive near-real time reporting except Argus. It is more powerful than the biosurveillance efforts of the World Health Organization, the Canadian Global Public Health Intelligence Network, and ProMed.

Argus has watchboard where articles and information of interest to analysts may be viewed. It also employs a visualization tool called the Argus Situational Awareness Tool that visualizes disease outbreaks geographically. On the watchboard is another tool called Wildfire that tracks outbreaks that might result in infrastructure compromise or collapse.

Argus visualization was originally developed to use open source information to track avian influenza. It now tracks over 130 diseases. It does not provide diagnoses, but shows analysts where to look. Argus uses a Bayesian network to indicate areas of local disruption. Open source information is a critical component on the Argus initiative. In parts of Africa, the first reports received will likely be unclassified.

Epidemiologic collaboration projects including Wild Fire and BIWAC (biological information and warning community) provide a portal for collaboration. The data must be carefully handled because disease outbreaks can affect the world market. It is important for troops abroad to monitor these developments as well. Argus has engaged USPACOM, USCENTCOM, and USSOCOM.

BILL PREISTER

J8, US Strategic Command

J8's role in USSTRATCOM is combating WMD. Contingency plan 8099 is the strategy for combating WMD. As part of the effort, J8 needed to determine what technology resources would be

needed to accomplish this goal. There is a USSTRATCOM center for combating WMD at DTRA. Their role in the JIPOE is to look for what efforts they need to support to support counter WMD.

The words you use to define a situation matter. Because military personnel were not permitted to call the situation in Iraq an "insurgency," they lost one year of looking into the social dynamics of the conflict. Part of the problem is that studies of insurgencies are sporadic, not systematic. US troops would benefit from more systematic coverage.

BRIAN NORTON

Department of Defense

We are attempting to create scientific solutions to engineering problems for improving intelligence analysis. The problem with most social science theories is that they fall apart when applied to a model. Therefore, the modelers must use the best bits and pieces of theories to solve problems.

One problem encountered by modelers is that if you take the human out of the loop, the analysts would not trust the result. However, what makes an analytic tool useful is that if an analyst does not understand all the data available, the tool will help reveal perspectives that were not obvious or intuitive.

Visualization research is currently exploring different ways to portray data. Visualization is very effective when analytic tools cannot provide the answer alone. Visualization provides analysts with a completely different way to see data. The results have been positive.

PAUL HAVIG

Air Force Research Laboratory

The Air Force Research Laboratory (AFRL) is working in the area of visualization. Two big areas of development are implementation (three dimension visualization) and integration (getting rid of the keyboard and mouse). Visualization helps analysts better understand their data. It also aims to make manipulating the visualization easy enough so that anyone can use it. Multidimensional analysis is also being researched since often times there are many variables that need to be represented.

CBRN TERRORISM – SOCIAL SCIENCE AND MODELING MOTIVATION

Gary Ackerman, Research Director, National Consortium for the Study of Terrorism and Responses to Terrorism (START)

Understanding CBRN terrorism is difficult because the problem space is unclear. It is difficult to predict the behavior of any human, but even more so for terrorists because terrorism is an extreme form of human behavior. Terrorists can be hyperdynamic, resilient, and have obscure motivations. This creates difficulties for defining the problem space, especially since opportunities for open dialogue with terrorists are limited.

Because the sample size of large scale use of WMDs is zero, it means that researchers must rely on proxy data, which creates inherent problems. Even using small scale WMD data presents difficulties in terms of fidelity of information.

Various elements must be considered when studying CBRN terrorism. First, researchers must distinguish between small-medium scale CBRN attacks and catastrophic attacks ("WMD"). Second, there are significant differences in ease of acquisition/use between C, B, R, and N. Third, the CBRN capabilities of terrorists might be improving, both as a result of technological advances and the diffusion of knowledge. Fourth, a variety of terrorist groups and individuals espousing different backgrounds and ideologies have considered using CBRN weapons. Fifth, there are a wide variety of motivational incentives, including an apocalyptic worldview; technological fetishism; potential for mass casualties, or the singularly tremendous psychological impact exerted by CBRN agents. Sixth, there is at least a minimal possibility that a technologically and organizationally adept terrorist organization will succeed in acquiring a CBRN weapon capable of causing mass casualties.

The likely suspects for using WMDs are Jihadists (Sunni or Shi'i), apocalyptic cults, right-wing extremists, brutalized ethno-nationalists, and radical environmentalists (mainly biological threats).

University of Maryland's START center is building a tool to model WMD terrorism. The tool will examine statements and training materials "published" by terrorists (manifestos, CBRN manuals, etc.). It will use proxy data (small-scale CBRN terrorism, CBRN plots, conventional attacks), especially historical cases. It will take into account changes in terrorist environment (CBRN technology, geopolitics, etc.).

The vast majority of scholarly contributions to the CBRN terrorism problem have relied upon hypotheses derived from the general secondary literature on terrorism and anecdotal evidence. Nonetheless, gathering data is possible and in many (but not all) cases formal social science methods can be useful. Researchers need to use all methodologies at our disposal including:

- Quantitative: e.g. regression analysis; trajectory analysis; social network analysis; M&S
- Qualitative: e.g. content analysis; historical-theological analysis; behavioral profiling

START research shows that factors that are not significantly related to the use or pursuit of CBRN terrorism include state sponsorship, organizational size (but close to significance), organizational age, and religious ideology. Furthermore, if costs associated with adapting new technology are lowered, it may create a tipping point. If costs lowered enough, the technology could rapidly take over. When

you hit a tipping point, instead of seeing a gradual increase, it will be a sudden increase. However, conventional attacks will always likely be more effective.

MODELING POLITICAL CONTENT: TERROR AND REPRESSION

Stephen Shellman, Director, VIPCAT Research Laboratory

VIPCAT is a hard science laboratory for the social sciences.

Project Civil Strife is a response to closed, non-publishable data sets and a lack of quality domestic terror data. It does not explain why conflict breaks out at a certain time, but looks at particular actors and leaders. There is a concern that terrorism is studied in isolation of other forms of conflict. So far, Project Civil Strife has complete five-to-six cases and is collecting data for 29 counties in South East Asia.

PERICLES is a new machine coding program that has been updated to increase the signal to noise ratio. PERICLES has show some advantages over TABARI especially in coding complex sentences.

The Violent Competition project is a systematic empirical study of multiple group dissident dynamics in Cambodia from 1980-2004. The project hypothesizes that one group's violent activities should positively correlate with other competing group's violent activities.

The Road to Violence project looks at the effects of state repression on the activities of nonviolent and violent groups in Bangladesh from 1980-2005. It hypothesizes that when nonviolent dissident groups are repressed to the same extent as violent dissidents, the government imposed costs associated with nonviolent tactics become equal to the costs associated with violent tactics. When this happens, nonviolent groups increase their violent activities.

The "How Have You Killed Lately?" project is a substitution model of terrorist tactics in India from 1980-2005. The project found that certain government policies may actual increase terrorist while other government policies may cause a rise in covert attack. A group maximizes its shared goal by generating media coverage, political instability, and fear, subject to a resource constraint; this is done through terrorist attacks.

The Pausing Democracy project measures the effects of President's Rule on regional terrorism in India from 1980-2005. This project attempts to understand how government counter-measures affect the frequency and lethality of terrorist activities. The project found that President's Rule does quell terrorism over time.

The Forecasting Escalation in Civil War project presents a quantitative case study of the Aceh conflict in Indonesia.

The Forecasting Terrorism project examines the interrelationship between terrorism tactics and government countermeasure efforts.

PUBLIC OPINION IN IDENTITY AND ATTITUDES: HOME-GROWN RADICALIZATION AND "RAPID RESPONSE" SURVEYS

Paul Harwood, Asst. Prof. & Director of the Public Opinion Research Laboratory, University of North Florida

The Public Opinion Research Laboratory studies terrorist group dynamics, specifically looking at the radicalization of different domestic demographic groups. The research showed various factors affecting the identity of demographic groups including:

- Individual Attitudes (and values). [Long and short term]
- Individual Identity and Identity within/ and of the "ingroup."
    - For example, different: ideological groups; religious groups; and interest groups.

The lab also studies societal responses to the terrorism threat. The research showed various factors affecting societal response including:

- Public Perceptions
- Identity/ Attitude toward demographic groups
- Risk, emergency preparedness, psychological factors
    - Particularly applicable for "rapid response" – gauge change.

This research asks two questions. What variables lead domestic demographic groups to be radicalized? What is the role of social networks? They used the telephone, Internet panel surveys, and one-to-one elite interviews with identified high risk cohorts. The goal of the research is to understand beliefs and behaviors of different groups on issues related to violent radicalization and to learn effectiveness of government efforts to combat radicalization. To truly understand these phenomena, data need to be collected after an attack or raised threat level.

Gauging public opinion requires multiple methods, especially triangulation to ensure conclusions are correct. The lab also uses multi-modal methods including response rate, demographic reach, and visual modes. The ultimate goal of this research is to have a better informed citizenry that will increase public resilience against threats.

SOCIAL SCIENCE MODELING AND R&D PANEL

Robert Popp, NSI, Inc. (Moderator)
Jennifer O'Connor, Human Factors Division, DHS
Kathleen Smarick, Executive Director, START
Ann Speed, Cognitive and Exploratory Systems, Sandia National Laboratories
Ed MacKerrow, Center for the Analysis of Merging Threats, Los Alamos National Laboratory
Paul Whitney, Pacific Northwest National Laboratory

JENNIFER O'CONNOR

Group Violent Intent Modeling (GVIM)
Human Factors Division, DHS

The objective of the Group Violent Intent Modeling (GVIM) initiative is to support the Office of Intelligence and Analysis (OI&A) analysts in their strategic analyses of the likelihood that a group, either a domestic US group or transnational or foreign group, will adopt violence as a strategy, and what factors influence the group's decision. The system shall also provide potential indicators and warnings of when a group is likely to adopt violence as a strategy to achieve its goals.

There is much to learn from the social and behavioral sciences. Using these theories to understand group behavior is important for intelligence analysis. Theories provide different lenses through which to view group behavior. However, they do not provide answers for questions about group violent intent.

Using social and behavioral theories should not have to be an art. Every analyst brings a different set of knowledge, skills and abilities to the table. Every intelligence problem requires different information, data, and research to answer. There is a need for a systematic application of what we do know or theorize to strategic questions.

The analytic framework for GVIM is a five step process.

1. Analyst receives a problem
2. Relevant social/ behavioral science and models suggested
3. Content analysis and data extraction to identify evidence based data and collect in repository
4. Current knowledge reviewed for gaps – request for model/ simulation runs
5. Generates reportable information – provides foundation behind the findings and conclusions

KATHLEEN SMARICK

Social Science Data on Terrorism and Preparedness
Executive Director, START

START conducts basic research on the human causes and consequences of terrorism, using theories, methods, and concepts of the social and behavioral sciences. The Human Factors will apply the social and behavioral sciences to improve detection, analysis, and the understanding of threats posed by individuals, groups, and radical movements. When discussing social science models, there are

three essential components: theory, data, and methods. There are lots of theories out there, but the shortage of data is creating a bottleneck. Therefore, START focuses on remedying the shortage of data.

Open source information is critically important to studying terrorism. The fact that terrorists are specifically seeking to attract attention through the media means that open source media coverage can tell us far more about terrorism than other types of crime.

There is great value in using social science modeling for understanding the human causes and consequences of terrorism. Social science modeling is useful in:

- Establishing empirically grounded expectations (and busting myths) about the use of terrorism and the actions of terrorists
- Identifying long-term trends, including identification of when trends have changed and under what conditions
- Specification of indicators historically associated with radicalization and with terrorist activity

START supports several research initiatives including the Global Terrorism Database, Extremist Crime in the United States, Minorities at Risk/Organizational Behavior, Use and Non-Use of Violence, International Surveys: Attitudes toward the United States, and National Household Survey on Preparedness.

ANN SPEED

Cognitive and Exploratory Systems
Sandia National Laboratories

There are several factors influencing future progress in social/behavioral modeling. First, there needs to be recognition that problems are human-oriented, not widget-oriented. There should be an emphasis on multidisciplinary teams. Modeling should solve real-world problems. There are evolving national problems and progress in computation sciences that may make these efforts more effective.

Social science modeling is an extremely challenging area of research. Application to national problems will require a national effort. However, the benefits yielded by this area of research are manifold. Social science modeling can capture dynamical, nonlinear processes. They produce higher-fidelity behavior representations (culture, personality) at multiple levels (individual, group, society) in the same model. Modeling results in clearer links between hypothesized behavioral mechanisms and assumptions instantiated in computational architectures. New computational architectures, and possibly new hardware, support and enable the advancement of the art.

Results of this influence may be that data becomes available to models (real world data, direct links to data via sensors) and significantly larger datasets linking social/behavioral models to economic, physics, other types of models. As model complexity increases, the need for advanced visualization and analysis capabilities will also increase

Organizations are being stood up to marry multidisciplinary sciences. This workshop is a great example of joining people who know about real world problems and people who know about theory/modeling.

As social scientists interact with modelers, it will have impact on quality and complexity of models they generate.

EDWARD MACKERROW

Center for the Analysis of Merging Threats
Los Alamos National Laboratory

Social modeling attempts to address the weaknesses of mental models, which humans use to process information. Mental models are flexible, readily available, and extremely useful, but they make assumptions difficult to examine and they are difficult for others to understand. Computation models, in theory, provide some advantages over mental models for various reasons. One, the assumptions are explicit. Two, one can calculate the logical consequences of the modelers' assumptions. Three, they are able to account for many factors. And lastly, they are similar to experiments in that they are repeatable, safe and controllable.

However, in reality, computation models have many weaknesses. They are often poorly documented. They may be overly complex. Their assumptions cannot be examined. They are unable to deal with soft relationships and factors. Finally, they are often over over-sold and over-promised.

To overcome these weaknesses, computational models must be verified, valid, and credible. Credibility can be defined as when the end users accept the results of the model as correct. A credible model is not necessarily valid and a valid model is not necessarily credible.

End users have a responsibility to clearly define the problem of interest that the model will investigate. They must define and document the objectives of the modeling exercise, specific questions the model should address, metrics, scope of the model, system configuration to be modeled, time frame, and required resources available for the modeling effort.

Because funders are a major factors in advancing the science of modeling, they should fund long-term efforts, acknowledge the difference between model types, work closer with real world problems, and make sure the work they fund is not repeating previous efforts. Other countries have smaller modeling departments, but they have steady funding, over long periods of time, and have dedicated effort. The DoD needs something like a JIOC to develop these models.

There are different modeling needs for different types of intelligence analysis and problems. Stove piping reduces multidisciplinary capability. There is a great need for social science theory to be advanced in concert with new modeling and simulation methods. Developing this research and development is timely since many of today's, and tomorrow's challenges deal with social problems.

PAUL WHITNEY

Bach-Bayesian Analysis of Competing Hypotheses
Pacific Northwest National Laboratory

The original intent of Bayesian Analysis of Competing Hypotheses (BACH) was to model the propensity towards group violence based on social science mechanisms from the social and behavioral sciences' open, refereed, technical literature. This effort produced a functioning software tool and an associated collection of models based on the open social science literature. The models are 'context free' and the domain of applicability for each model is an ongoing research question. Additionally, the lab has represented in the software a formal mechanism for attaching evidence to the social science-motivated models. Attaching evidence results in underlying calculations (directed by the model and by the evidence characteristics) of the relative likelihoods of various outcomes and characteristics.

In BACH, social science mechanisms related are represented and referenced in Bayes Net Models. Evidence Assessment is done in conjunction with the Bayes Net Models. Models and evidence are structured to support intelligence analysis. Bayes Net Models provide a visual summary of social science mechanisms.

BACH relies on a series of social science theories and mechanisms.

- Group Schism Theory – propensity of a group to split off from a larger group
- Political Radicalization and Violence mechanisms
- Personality Profiling Theories (Psychology and Political Sciences)
- Framing
- Social Movement Theory
- Some published works integrate across theories. E.g. theories cited in McCauley's work:
    - Group polarization/group extremity shift, risk shift
    - Dissonance theory
    - Relevant arguments theory
    - Social comparison theory
    - Group dynamics theory

BACH software is designed to support intelligence analysis. The evidence types are text reports (news, chat transcripts) and sensor output (imagery, SIGINT). The model relies on a human-in-the-loop to link and assess evidence. However, there are problem solving strategies and hurdles for prediction. Successful strategies include decomposition (going from the problem to the sub-problem), amalgamation (combining distinct/eclectic predictors), and retaining past experience. Some of the hurdles include bias, anchoring, and uncertainty assessments.

ORGANIZATIONAL TRAJECTORIES OF TERRORISM ACTIVITY

Laura Dugan, START

Trajectories of terrorism activity were first developed by Daniel Nagin to examine the aggressive patterns of individuals over the life course. START is applying this theory to organizations instead of individuals. Groups can be analyzed by calendar year or by birth year - the year the group first commits an attack. All analysis was completed using the Global Terrorism Database. There are seven birth groups:

1. High Frequency Persistent (4.2%)
2. High Frequency Late Bloomers (6.3%)
3. Medium Frequency Uni-Modal (4.0%)
4. Medium Frequency Early Desistors (3.1%)
5. Medium Frequency Early Rise Early Fall (6.2%)
6. Low Frequency Persistent (18.2%)
7. Low Frequency Early Desistors (57.9%)

There are seven calendar groups:

1. High Frequency 1980s-Modal (3.3%)
2. High Frequency 1990s-Modal (3.6%)
3. Medium Frequency 1990s-Modal (5.0%)
4. Medium Frequency 1980s-Modal (8.8%)
5. Medium Frequency Bi-Modal (4.7%)
6. Low Frequency Persistent (23.7%)
7. Low Frequency Increasing (50.9%)

The study found that many groups are not very violent, but some groups make the transition at some point to become very violent. Some groups become highly violent and then stop, which is an interesting area of study.

Victor Asal noted that his research closely aligns with this study. He expects that the number of connections and the size of terrorists group will correlate with these finding. This illustrates what is wrong with the way data is analyzed; it misses all the variables that help explain terrorism.

CARA: A CULTURAL REASONING ARCHITECTURE

V.S. Subrahmanian, Laboratory for Computational Cultural Dynamics, University of Maryland

The objective of this study is to rapidly build (within 48 hours of an event) accurate models of the behavior of groups (political organizations, terror groups, corporations, etc.). An event might be a terrorist attack or a change in the threat to the United States. The goal is to use such a model to accurately forecast the most probable responses of a given group in a situation and identify what actions can be taken in order to maximize the probability of eliciting a desired response from a group. Preliminary models for 45-50 groups have already been built.

The model is a three step process. First, it extracts timely, relevant data from open source information. Data is extracted using T-REX: the RDF extractor. T-REX collects data in English and some data in Spanish and Chinese. Then it builds behavioral models that assess how strongly a group feels about various issues. To do this it uses OASYS Opinion Analysis System. Third, repercussion and COAs are explored. To do this it uses SOMA Analyst Forecast Engine (SAFE), which evaluates potential COAs.

The laboratory is also working on a virtual experience environment. It is a 3D environment that helps US decision makers decide what repercussions potential US policies might have and to decide how best to play out the actions of multiple groups involved in a region.

STATE OF VISUAL ANALYTICS – NATIONAL AND INTERNATIONAL

Jim Thomas, PNNL

Visual analytics is a relatively new science, which took off in 2004/2005. It was the NSF study on visualization in 1987 that really kick started interest in this area. Drivers for visualization include the burgeoning availability of data from the open source arena. Visualization became popular because it allows analysts to interact with the data. One effort, the assessment wall, is built like a command wall, which allows analysts to view multiple kinds of data with a drill down capability to allow the user to read the original source material.

Mobile analytics may also become an important tool for military or criminologists out in the field. Visual analysis may also enable complex graph structures. They are difficult for humans to create due to time and complexity. However, a computer generated version that runs on a personal computer has been developed for applications in the cyber area as part of transaction analytics. Work on making this application real time is underway.

INFORMATION VISUALIZATION R&D PANEL

Sue Numrich, IDA (Moderator)
Lisa Egan and Kate Walters, DoD
Antonio Sanfilippo, Pacific Northwest National Laboratory
Al DiLeonardo, SKOPE, NGA

(Portions of this section distributed separately in FOUO Annex)

ANTONIO SANFILIPPO

Next Generation Visual Analytics Anticipate and Counter Strategic Surprise
Pacific Northwest National Laboratory

The success of visual analytics will be significantly determined by the ability to address strategic surprise. Predictive analysis is the future focus of visual analytics. Pacific Northwest National Laboratory (PNNL) Initiative on Technosocial Predictive Analytics is a four year R&D program that started in FY08. Strategic surprise is when a force affects an unexpected target in an unexpected way at an unexpected time so that vulnerabilities cannot be corrected.

Advances in visual analytics and mathematical, computational, and statistical modeling foster the move from forensic to anticipatory analytics. However, there are gaps and weaknesses in current predictive modeling approaches such as:

- Ability to integrate human and physical factors into predictive models systematically remain a challenge
- Model setup is knowledge intensive
- Expert user is needed for modeling and interpretation
- Weak integration of evidence
- Difficulty in tracking inference processes
- Inadequate evaluation

There are three main areas of visual analytics: techno-social modeling, knowledge inputs, and cognitive enhancement. Ontologies are important in developing metadata schemes, which can function as a lingua franca for knowledge inputs.

The group that has achieved the most success at looking across disciplines and combining models is the Global Change Group, which just won the Nobel Prize.

TERRIFYING LANDSCAPES

Nancy Hayden, currently at DTRA/ASCO, work done at Sandia National Laboratories

The purpose of this study was to survey recent academic research, analyze the knowledge domain, and relate to WMD proliferation modeling and analysis paradigms. The study seeks to understand the scope of the enduring knowledge domain for motivations of non-state actors to cause mass destruction. Models help explore the problem, but they do not provide the answer. Models are a helpful tool for dealing with complex problems involving cyclical decision making on WMD.

A literature review revealed that the number of peer reviewed journal articles on WMD is low. However, the number of peer reviewed articles with indirect relevance is high but underutilized. Furthermore, there is a distinctly different perspective in the European community than in the U.S.

There were several major premises discovered during the course of the study, some of which are controversial. First, motivations of non-state actors are different than state actors. Second, non-state actors most likely to use WMD have apocalyptic/millennial beliefs with sense of global mission. Third, "new" vs. "old" terrorism has increased threat. Fourth, there is an ease of WMD acquisition and use. Fifth, there has been a rise in apocalyptic goals. Sixth, terrorists have become transnational and networked. Seventh, high stakes decision-making is always deliberate and rational. Eighth, decision-making on basis of sacred values trumps rationality.

There are other motives for terrorism that have not changed much over time. Terrorists seek to attract more attention to cause. They may also want to create economic havoc, hasten the apocalypse, promote a worldwide race (culture) war to establish homogenous state, create an aura of divine retribution, impress target audience with high technology, or pursue copy-cat tactics.

What is new in understanding terrorist motivations undermines the Westphalian notion of nation-state supremacy in international order and power brokering. Terrorists are motivated to entice strong enemy to advance cause through Ju-Jitsu politics. Terrorists fuel global ideological movements from below by showing strength of weak against strong. Terrorists seek more empowerment at lower levels in the pyramid. On the other side of the coin, analysts have sought new data based analysis techniques to understand terrorist motivations.

However, modeling terrorist motivations is difficult due to various factors including the lack of consensus on the concept of WMD, the role of Islam as experienced by different communities, and lack of validity of new and old assumptions. Therefore, models may be used to clarify complex situations, test assumptions, aid decision making, explore co-evolutionary motivations, and bound the expected and outlier behaviors.

Analytic framing is the first and most import step in the modeling process. The question the model is supposed to answer must be clearly stated. It must accurately reflect end user needs. The question must also be one than can be answered based on available theory and data. If you do not start this process out correctly, the final product will not meet user needs.

DHS UNIVERSITY PROGRAMS OFFICE

Tiffany Lightbourn, DHS University Programs Office

The basic research portfolio enables discovery and invention to enable future capabilities. It brings the capabilities, talent, and resources of the Homeland Security Centers of Excellence, DOE National Laboratories, and DHS Labs to bear to address the long-term R&D needs for DHS in sciences of enduring relevance. This type of focused, protracted research investment has potential to lead to paradigm shifts in the nation's homeland security capabilities.

The office keeps an eye on the basic behavior questions DHS is trying to model and as well as where the modeling is not mature enough yet. Where science is underdeveloped, more controversy is needed to get it tested and agreed upon. Competing data sets are also ideal to ensure the best data becomes available to researchers.

Models need to be updated regularly and automatically based on new theories and new data. There needs to be a system of checks and balances to make sure this is happening. DHS, by virtue of having a consortium of universities, is able to tap into a wealth of knowledge beyond what is available from a small cadre of trusted researchers and contractors. A new generation of researchers must also be brought into the field. Finally, decision makers must be educated to make and understand science-based decisions.

All centers of excellence must review performer work every two years. Many have annual reviews to which they may or may not allow outsider attendance. Every year there is a center of excellence summit. Not all performers will have time to present, but the directors of the centers and select performers will be there. The annual conference is in June.

Corporations are another area of interest for the government. General James Cartwright at USSTRATCOM has put together a group of private sector CEOS from various non-defense-related industries. He found that in certain areas, the private sector provides unique insights unavailable from the academia and the public sector. The private sector is less willing to provide the USG with data about their own companies or data they have collected. JIEDDO also has a standing committee with the National Academies. The committee convenes quarterly and acts as a sounding board for JIEDDO.

SYSTEMATIC TEXT ANALYSIS: SIMPLICITY TO IMPACT

Robalyn Stone, Social Science Automation

The goal of Social Science Automation is to communicate the abilities of Profiler Plus as a multi-purpose and multi-lingual platform. In addition, it should underscore the need for transparent and solid construction of automated text analysis applications. Once a coding scheme has been well-constructed, its impact is unknown because it has not been tried in different formats, contexts, and experiments. A well constructed tool should have the capability to be applied to many situations.

Profiler Plus is a rule-based system. It was developed in 1997 in response to the limitations of TABARI. It has been used and continually improved since creation. It is a multi-pass, general purpose coding engine for which rule sets can be developed in any language. Ten years worth of coding scheme development methodology and tools have been developed for the Profiler Plus platform.

The concept for the coding scheme has been solidified in such a way that it is teachable and transparent. The coding scheme developer and hand coder have been trained on the concept and work independently of each other. A third person drives development and understands the fundamental concept and the bigger picture. The scheme has been validated on to over 80 percent twice in a row. It is as simple and concrete as possible – computers should do what they are good at, not what humans are good at.

Media analysis applications include Perception Metrics, which conducts positive and negative coding on pre-existing components. This is a preliminary tool that uses BBC local, national, and international news as its primary source. In order to determine good and bad words, experts must agree 80 percent or more on the word's intent. Conducting an analysis on words that are defined as good or bad can lead to a polarized discourse. The team constructed a Venn diagram to show words that have both good and bad connotation and denotation.

VISUALIZATION OF GTD AND MULTIMEDIA

Remco Chang, Charlotte Visualization Center, UNC Charlotte

The Charlotte Visualization Center is working with Bank of America on a financial visual analysis tool. The tool is designed to visually detect fraudulent wire transactions. The tools allow analysts to use their visual cortex to detect suspicious patterns. The effort was initiated following the failure of a Wachovia's black box approach, which did not work because the bad guys changed their tactics too often.

Visualization is different than visual analysis. Google Maps is a visualization tool. However, visual analytics provides the user with layers and multiple ways to look at the data to draw conclusions, relations and observation. Another visual analytic tool, Geospatial Urban Analysis, combines analytics with GIS displays to provide the user with answers to specific questions. Agent based modeling is another visual analytic tool. In an Afghanistan model, the tool will allow the user to drill down to an area of interest to see what might be happening in the region. It allows you to substitute one factor with another.

Visualization cannot be an afterthought. It needs to be considered from the beginning of a project. Analysis and reason should be directly embedded in the analysis tool.

Parallel sets display relationships among categorical dimensions and show intersections and distributions of categories. There is dynamic filtering on continuous dimensions that can show more information.

SOCIO-CULTURAL MODELING R&D PANEL

Robert Popp, NSI, Inc. (Moderator)
Jim Chen, Director of Graphics Lab, George Mason University
Roberto Sandoval, JIOWC
David Sallach, Argonne National Laboratory
Julio Diaz, Julio Diaz, Lawrence Livermore National Laboratory

JIM CHEN

Director of Graphics Lab, George Mason University

The technological advances that have allowed for visualization development are graphics engine growth and GPU parallel processing. These advancements have allowed for progress in visualization including new algorithms in rendering, simulation of volume phenomena, and detailed surface and volume effects. The future of visualization includes interactive display, massive data processing capability, multiple levels of detail traversal, detailed volume and surface effect realization.

ROBERTO SANDOVAL

Joint Information Operations Warfare Command

Information operations takes advantage of many of the techniques discussed at this workshop. It is the J3's responsibility to look for new techniques and capabilities that may be used by the information operations (IO) engineers and intelligence analyst.

The Common Operational Research Environment (CORE) Lab at the Naval Postgraduate School is chartered to train IO tool analysts/students and to develop course material related to this training and mapping the human terrain. There is a need to layer human terrain data over maps. There are touch tables used for kinetic battles that may be useful for non-kinetic option. These non-kinetic efforts must be a precise as precision-guided weapons. Each area must be targeted with the right message. DARPA has a current effort called the digital information operations picture, which is a spinoff of the Command Post of the Future, to address these issues.

IO may use real data from Iraq to build an understanding of distinct neighborhoods to determine the right message to counter IEDs.

DAVID SALLACH

Socio-Cultural Modeling: The R&D Horizon
Argonne National Laboratory

There are limits when working with empirically based tools. Past patterns cannot predict the future. There is a vital need for social theory to identify generative patterns and structures within social complexities.

Propensity theory concerns the foundation of the probably. It helps explain why things happen when they do. It is an alternative to frequentist and Bayesian interpretations. It also incorporates the

factors that keep statistics stable. Propensity also generalizes and further extends the concept of forces. Social propensities can be integrated with natural forces.

Fluid cultural dynamics suggest that modern cultures are contradictory, loosely integrated, contested, weakly bounded, and thinly coherent. All such 'weaknesses' must necessarily be overcome, in interaction and in practice.

Culture, Identity, Discourse is a model with three permeable layers.

1. Cultural resources which are created and repurposed
2. Situated identities that shift, evolve and are shared
3. Public and private discourses that draw cultures and identities into dynamic transformations

Institution structures have changed over time, typically reducing the role of religion and increasing the role of the market. Over next five years, socio-cultural modeling will be theory driven to a greater degree and will develop more effective computations models. At the same time, the definition of culture need to be better defined and normalized. When talking about culture, there are competing influences that are weakly bounded. There is only enough coherence to allow a cultural to remain together without pulling apart. So it may be useful to pull out aspects of culture to be tested. This is complicated by the fact that cultures are always evolving.

JULIO DIAZ

Other Visualization Issues
Lawrence Livermore National Laboratory

Much has been said about visualization in support of information extraction and visual analytics, but much less attention has been paid to visualization in support of knowledge management. Wikipedia, for example, has good knowledge capture allowing the user to drill down or explore related topics.

Knowledge maps for systems of systems let one see how one part fits within a large system. Links can take you to detailed descriptions. Knowledge maps, such as kartoo.com, presents results as individual items with relationships that exist between these. It is useful if you do not really know what you are looking for.

Scientograms display knowledge held by an organization as a network. In a pathway chart, a block can represent a simple decision or a complex production step. A critical node diagram shows relationships between nodes. A visual thesaurus is another visualization tool that can help an analyst with word associations.

For modeling and visualization to be successful, there needs to be greater common ground between the communities and with the end users. As the social science goes through its own life cycle, there will be a decreased need for social scientists and modelers to site next to the end user.

Visualization is not the last step of the process; it is part of the analysis. This must be considered for the JIPOE process as well.

DoD acquisition structure makes it difficult to upgrade hardware to support new applications. A converse problem is that new hardware often makes old, but good, software obsolete.

CULTURAL ANTHROPOLOGY TYPOLOGY AND MODELING

Larry Kuznar, National Security Innovations (NSI), Inc.

Efforts towards understanding the enemy are nothing new in security studies. However, there is a need today to take advantage of social science to learn more about the adversary.

Researchers use social typology to help understand adversaries. Most DoD and social science typologies represent relationships between parts of a society. The uses of social typology are numerous. They help users orient to a society or culture. They insure all relevant information is captured. They expose key relationships that may not be apparent. They are essential for knowing how to collect the right kind of information and they create ontologies necessary for construction of computational models.

SMA social typology is generic. Its ten variables apply to any social group from a small cult, to a terrorist network, to a tribe, to a nation. The variables' content and the connections between variables vary depending on social group. Variable content can change through time. The stability of variable types provides guidance for collections. Flexibility of variable content provides dynamism in the typology. The challenge of the SMA social typology task is not to come up with one universal typology; it does not exist. What is needed is a typology that was sufficiently flexible to deal with a wide variety of what the DoD will face. Typologies can help go down the check list to make sure all bases are covered.

Cultures need to be understood as a set of resources, stories, and archetypes. It does not exist as a monolithic thing. Culture is a tight nexus of interaction of elements. The people considered terrorist one day are the same people the government is doing business with the next. That is because groups change.

All models need to be validated and tested empirically. If this step is skipped, the models will be of little use to the end user.

MINERVA

Bob Chamberlain, Jet Propulsion Lab

Minerva is a bounded geographical play box with neighborhood. It has towns with civilian populations. The tools trains force groups (military, police, etc.) and organizations (NGOs, IGOs, etc.) to train in a realistic environment. It contains at least five different models that allow events to change with time. Minerva is not an intelligence tool. It neither predicts nor forecasts. It is designed for training or analysis.

There is a ground simulation model which generates physical events, situations and activities. There is a joint non-kinetic effects model that helps determine civilian states of mind. There is a demographic model that provides civilian numbers, locations, and characteristics. There is a macroeconomic model that formats labor, industry, products, unemployment, inflation, taxes, investment, and growth. There is a political model that provides actors, their clout, and how they use it to seek their goals. There are plans for a media/information model.

In conclusion, while validation of models and data may take years it is important to proceed cautiously. SMEs remain a vital part of the model validation process. True experts really do have "good instincts." If SMEs do not agree on data values, the model is probably wrong. Real-world decisions are seldom based on enough data to be sure. Expert opinion and feedback from users whose lives have depended on results may be the best validation we will get in our generation.

Because Minerva is a training tool, validation is not as important. Its goal is to provide experiences to training group so that they are rewarded for doing good things and punished for doing bad.

VISUALIZATION OF CHANGE IN SOCIAL NETWORKS

John O'Hara, Pennsylvania State University, Applied Research Laboratory

There is a large amount of social network (event) data that is time series based. These complex datasets are often indicative of shifting relationships. The challenge is discovering how to best display this data. The solution was to create force directed layout in three dimensions.

To do this, researchers must treat every person in the network as a point mass. The treat every relationship you know about as force that attracts or repels the two people at a rate proportional to the magnitude of the relationship. Then, the researchers solve the resulting system of equations for the positions of the nodes in three dimensional spaces. After equilibrium is reached, researchers can alter the edge weights and re-solve for a new stable positioning.

In the long term, the model will have a degree of interactivity. The model will enable the exploration and alteration of the parts of a social network. It will perform "what-if" analysis of the network data and well as conduct information coupling. Eventually, the model will couple the visualization to feeds for up-to-date visualizations. There is a desktop version of the model, but the lab may develop portable and immersive versions.

The goal of visualization is to support decision makers. There is much to be gained by visually inspecting data that you might not see by simply looking a set of numbers or reading text. Visualization can be used for more than just analysis; it can also be used to evaluate data.

VIRTUAL WORLDS: A REVOLUTION IN SOCIAL SCIENCE

Travis Ross, Indiana University

Virtual worlds can act as petri dishes. Many gaming worlds have economies and societies the size of small countries. There are parallel constructions or shards to house them all. The dragons are fantasy, but the markets, groups, networks, powers, norms, messages, symbols, and cognitive processes are real.

Researchers have studies a phenomena unintentionally introduced into the World of Warcraft game. The Corrupted Blood Plague has been cited as an example of how the virtual world can be used to study the real world. Corrupted blood was a virtual plague that infected characters in World of Warcraft, spreading rapidly from character to character. Its resemblance to real-life disease epidemics drew international attention in the news and resulted in several studies in peer reviewed publications. This occurrence showed researchers how virtual worlds might be used to study natural occurrences such as disease outbreaks.

To create virtual worlds as test beds, researchers must create parallel worlds, control for independent variables, measure dependant variables, and researchers must understand design. Game design is as complex as modeling. It must be created in a way that is fun and achieves objective of world. The social aspects of policy and warfare must be understood before you can make progress.

One participant noted that the IC is creating a virtual world, not intended for open use, called ICWorld for immersive cultural training.

Another participant noted the positive aspect of existing virtual gaming worlds. It gives players another identity through which they can interact with other players from other cultures and environments.

VISUALIZATION OF COMPLEX PATTERNS IN SPATIAL INTERACTIONS

Diansheng Guo, University of South Carolina

There are three types of spatial analysis: point pattern analysis and visualization, area (aggregated) data and visualization, and spatial interactions and visualization. Point pattern analysis and visualization is the represents to geographic distribution of events (terror attacks, instances of pandemic disease), which may carry important information that can lead to new hypotheses and theory. Area data and visualization represents compositional information regarding groups of events (terrorism events aggregated by country and/or year) that can be analyzed. Analysis and visualization of spatial interactions would include urban population mobility and air travel.

Spatial interactions are important because both the physical environment and the human society are highly dynamic systems and because such location-to-location interactions are among the essential forces that drive many physical and socioeconomic processes, and thus, are often critical components in a wide range of research fields and decision-making applications.

The purpose of this research is to develop a general visual analytic approach to synthesize and visualize very large spatial interaction data. These kinds of efforts can reveal the cluster structure of an event (such as pandemic outbreak), critical locations (connect points between large regions), and early detection and efficient targeting.

SYNTHESIZING SYSTEM ENGINEERING & SOCIAL SCIENCE FORECASTING: THE CHOICE OF VIOLENCE

Victor Asal (SUNY/Albany) and Kihoon Choi (University of Connecticut)

The challenge of this study is to determine the best way to achieve useful actionable intelligence at different levels of analysis that predicts behavior of other actors, gives useful information about impact of US policies, can be validated and repeated, and that is as free of bias as possible.

There is a critical disconnect between the social science and system engineering. The social sciences have theoretical grounding and empirical knowledge, but focus on explaining rather than predicting. System engineering has useful tools (e.g., pattern recognition, graphical models, neural networks, forecasting) that are rarely applied to social science problems. There is a need for theoretical and analytical synthesis of two disciplines.

The *Forecasting the Choice of Violence: Application to Minorities at Risk Organizational Behavior in the Middle East* project is an effort at synthesizing the two disciplines by combining theoretical approaches and data from social sciences on violence with computational approaches from systems engineering. The result should produce useful predictions on likely behavior of non-state actors (NSA's) and the impact of government policies. This project uses the Minorities at Risk Organization Behavior (MAROB) database.

The study found that choosing to use violence is influences by state policies of discrimination and repression, ideology, and the impact of bringing organizations into "regular" politics. There is some indication that government policies can have an impact on organizational behavior.

AGENDA

23 January 2008

0830 – 0900: Logistics and Introductions	Bob Popp (NSI); Carl Hunt (IDA)
0900 – 0930: OSD/DDR&E/RRTO Socio-Cultural Programs	Ben Riley (OSD/DDR&E)
0930 – 1000: DHS/S&T Socio-Cultural Programs	Sharla Rausch (DHS S&T)
1000 – 1030: Strategic Multilayer Analysis (SMA)	Hriar Cabayan (OSD/DDR&E)
1030 – 1100: Joint Intel Preparation of Operational Environment (JIPOE)	Todd Veazie (Joint Staff/J3); Sue Numrich (IDA)
1100 – 1230: Socio-Cultural Modeling R&D Panel	Bob Popp (NSI – Moderator) Sean O'Brien (DARPA) Sean Biggerstaff (DDR&E) Laurie Fenstermacher (AFRL) Kelcy Allwein (DoD)
1230 – 1330: Lunch	
1330 – 1400: Computational Social Science Modeling	Claudio Cioffi-Revilla (GMU)
1400 – 1430: Terrorist Choice of Behavior	Victor Asal (SUNY/Albany)
1430 – 1500: Event Data and Conflict Behavior	Phil Shrodt (Kansas Univ.)
1500 – 1530: Bargaining, Nuclear Proliferation & Interstate Disputes	Erik Gartzke (UC San Diego)
1530 – 1600: Break	
1600 – 1730: Information Visualization R&D Panel	Carl Hunt (IDA – Moderator) Frank Connors (DTRA) Bill Preister (STRATCOM) Mark Livingston (NRL) Jamie Guy/Brian Norton (DoD) Paul Havig (AFRL)

24 January 2008

0830 – 0900: CBRN Terrorism - Modeling Motivation	Gary Ackerman (START/UMD)
0900 – 0930: Terrorism and Repression	Stephen Shellman (U. of Georgia)

0930 – 1000: Public Opinion in Identity and Attitudes	Paul Harwood (U. of N. Florida)
1000 – 1030: Break	
1030 – 1200: Social Science and Modeling R&D Panel	Bob Popp (NSI – Moderator) Jennifer O'Connor (DHS S&T) Kathie Smarick (START/UMD) Ann Speed (Sandia) Ed MacKerrow (LANL) Paul Whitney (PNNL)
1200 – 1330: Lunch	
1330 – 1400: Socio-Cultural Criminology	Laura Dugan (U. of MD)
Constructing Behavior Models of Terrorist Groups	V.S. Subrahmanian (UMD)
1400 – 1430: Break	
1430 – 1500: State of Visual Analytics - National and Int'l	Jim Thomas (PNNL)
1500 – 1630: Information Visualization R&D Panel	Sue Numrich (IDA – Moderator) Lisa Egan/Kate Walters (DoD) Antonio Sanfilippo (PNNL) Al DiLeonardi (NGA/SKOPE)

25 January 2008

0830 – 0900: Terrifying Landscapes	Nancy Hayden (DTRA)
0900 – 0930: DHS University Programs	Tiffany Lightbourn (DHS)
0930 – 1000: Systematic Text Analysis: Simplicity to Impact	Robalyn Stone (SSA)
1000 – 1030: Terrorism Visualization and Multimedia Analysis	Remco Chang (UNC)
1030 – 1100: Break	
1100 – 1230: Socio-Cultural Modeling R&D Panel	Bob Popp (NSI – Moderator) Roberto Sandoval (JIOWC) David Sallach (ANL) Jim Chen (GMU) Julio Diaz (LLNL)
1230 – 1330: Lunch	
1330 – 1400: Cultural Anthropology Typology and Modeling	Larry Kuznar (NSI)

1400 – 1430: Minerva	Bob Chamberlain (JPL)
1430 – 1500: Visualization of Change in Social Networks	John O'Hara (Penn State)
1500 – 1530: Virtual Worlds of Macro Social Phenomenon	Travis Ross (Indiana University)
1530 – 1600: Visualizing Spatial Interactions and Networks	Diansheng Guo (U. South Carolina)
1600 - 1630: Choices of Violence	Kihoon Choi (UConn)