HUMAN, SOCIAL, CULTURAL BEHAVIOR (HSCB) MODELING WORKSHOP I: CHARACTERIZING THE CAPABILITY NEEDS FOR HSCB MODELING FINAL REPORT

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EXECUTIVE SUMMARY

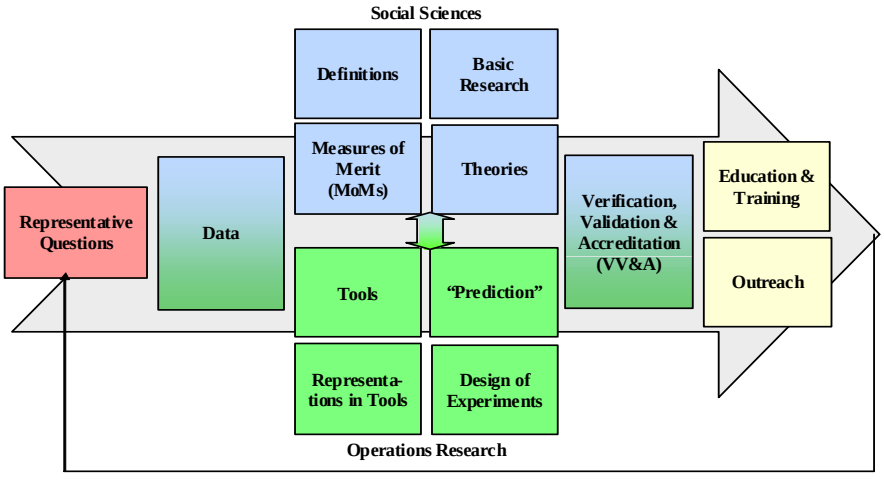
On 28 – 30 July 2008, a workshop was conducted on the campus of the National Defense University (NDU) to characterize the capabilities needed to perform effective Human, Social, Culture Behavioral (HSCB) modeling in support of operational users and senior decision makers. The workshop was sponsored by Dr. Robert Foster, Director, BioSystems, in the Office of the Director, Defense Research & Development (DDR&E). The workshop was organized and conducted by the Center for Technology and National Security Policy (CTNSP), NDU. To achieve the primary goal of the workshop, approximately 120 participants were assembled from the social sciences and operations analyses communities. Participants were drawn from government, academia, industry, Federally Funded Research & Development Centers (FFRDCs) and University Affiliated Research Centers.

The workshop was divided into three parts. The first part consisted of plenary briefings, which characterized the nature of the problem, depicted the state-of-the-practice, and identified the steps needed to achieve desired capabilities. The second and third parts were organized as working groups. On the first day of the workshop, the participants were assigned to discipline panels (i.e., Social Sciences (Micro); Social Sciences (Macro); Operations Research (methodologies and tools); Operations Research (data and verification, validation, and accreditation (VV&A)). On the second day of the workshop, the participants were assigned to problem-domain panels to address issues posed by operational users and senior decision makers (e.g., deterrence; counterterrorism; counter insurgency; stability, security, transition, reconstruction (SSTR) operations). In each case, the groups were asked to characterize the capabilities needed to satisfy the interests of operational users and senior decision makers.

This Executive Summary synthesizes the insights from these three perspectives to develop a holistic picture of needed capabilities.

Key Needs

Ultimately, HSCB modeling needs were classified into twelve interrelated categories. As noted in the figure below, the driver for the needs arises from the representative questions from operational users and senior decision makers. There are four key categories where the needs transcend disciplinary needs: data, VV&A, education and training, and outreach. Four categories are of particular concern to the social sciences: definitions, basic research, Measures of Merit (MoMs), and theories. Four categories are of particular concern to operations researchers: tools, representation in tools, "predictions" or forecasts, and design of experiments. Each category is summarized below.



Capabilities Needed for HSCB Modeling

Questions. Many of the questions from operational users and senior decision makers can be assigned to five areas. First, there is interest in **predicting** a future state. For example, there may be interest in predicting refugee flows, contagion of disease, or authenticity of cultural change. Second, there is interest in **supporting an activity**. As an example, analysts are frequently asked to support the generation of Theater Security Cooperation Plans (TSCPs). Third, there is often the need to **balance competing activities**. For example, a request may be made to balance flow through the SSTR process (e.g., characterize which activity should be done, when). Fourth, there is interest in **prioritizing** among competing options. This can range between investing resources (e.g., among S&T options) to support to operations (e.g., which SSTR operations to undertake). Finally, there is pervasive interest to **understand** the context or root causes. For example, there is interest in understanding, inter alia, failed states, legitimacy, why people become insurgents, deterrence/influence /containment, unintended consequences, and governance. Consistent with these questions, the participants at the workshop identified the following HSCB modeling needs.

Data Needs. The workshop participants identified six key themes for data needs. First, there is a need to develop appropriate HSCB taxonomies and ontologies. Second, it was observed that there is a need to implement efforts to tailor HSCB data to satisfy the intended purposes. Third, it is important to perform and record data V&V efforts (e.g., integrity, consistency, reliability, source) as metadata. Fourth, it is vital to avoid "stale" data. Thus, there is a need to update local and national data, with appropriate periodicity. Fifth, the complexity of the questions requires that we capture data capabilities in many dimensions. As a partial listing, we need data in the areas of the environment, medical, attitudes, affiliations, and legal systems. Finally, given the dispersion of the data, it was recommended that we perform an assessment of the desirability of a Central HSCB Data Repository. That study should address a variety of issues including classification, access, open source data, legal, granularity, qualitative data, maintenance, and dissemination.

Definition Needs. At the workshop, it was noted that for HSCB modeling the social scientists needed to develop more specific definitions and define commonalities across disciplines to drive action. Specifically, there is a need to develop a variety of products including, inter alia, a library of ontologies, semantic descriptions, a thesaurus, a dictionary, data lexicons with metadata, and standards. Many of these needs overlap with the data needs, cited above.

Measures of Merit (MoMs) Needs. Historically, the operations research community has been comfortable with the concept of formulating MoMs subsuming Measures of Performance (MoPs) and Measures of Effectiveness (MoEs). However, practitioners of the social sciences are less familiar with this approach. Thus, we need to tailor the MoMs to HSCB problems of interest and develop relationships that link key MoPs and MoEs. Furthermore, we need to display HSCB MoMs to operational users and senior decision makers in a fashion that conveys appropriate levels of uncertainty and risk.

Theory Needs. As demonstrated at the workshop, the social sciences have formulated competing theories for many subjects of interest (e.g., root causes of terrorism). When multiple theories exist, we need codes of best practice/guidelines on which theory to use, when. In addition, there are many areas where the social sciences have not yet developed theories in forms useful for HSCB modeling. We need to develop appropriate social sciences theories to address these key gaps or mismatches.

Basic Research Needs. There are many areas of interest to national security where basic research in the social sciences must be performed to support HSCB modeling. For example, we need studies of influencers on attitude/behavior of civilians based on ethnic, tribal, cultural, religious, and political considerations. It is important to develop a comprehensive list of these areas where basic social science research is needed and to prioritize this list from a national security perspective.

Tools Needs. There was broad agreement at the workshop that we require an expanded set of HSCB tools. However, the proper architecture/framework for these HSCB tools is an open question. The workshop did, however, elicit the following needs with respect to tools: the suite of tools should include a balanced mix of techniques that take advantage of the strengths of the tools while ameliorating their weaknesses (e.g., system

dynamic models; agent based models; wargames); consideration should be given to creating a "collaborative environment" in which selected models can be linked/federated and evaluated (particularly with respect to "precision"); consider the use of a "service bus" or Global Information Grid for data repositories; ensure that models are tailorable; employ hierarchical modeling with meta-model/meta-data aggregation/disaggregation; and assemble a resource repository of models and data.

Representations in Tools Needs. The question in this area is what real-world factors should the tools represent? The participants at the workshop warned against "mirror-imaging". Thus, it is important that we use creativity in modeling ourselves as well as "others". In addition, the workshop subdivided the social scientists into the categories of "micro" and "macro" representations. This is an artificial distinction and we need to provide feedback between "micro" and "macro" representations. Overall, there is a need to capture phenomena from multiple perspectives. These include organizational performance, cultures and institutions, all types of operations, and situational awareness of all parties.

Prediction Needs. Above, we cited representative questions that might be posed by the operational users and senior decision makers. It is important to clarify the extent to which we can perform HSCB modeling to "predict" outcomes. As an example, at least four possible levels of prediction are envisioned. These include: "hard" predictions of events (with "error bars" to characterize uncertainty); "soft" predictions of likelihoods (e.g., for multiple possible results); explorations of possibilities (e.g., "what if…?"); or situational awareness and understanding. For this reason, "forecasting" is a better term to use than "predicting."

Design of Experiments Needs. It was clear from the workshop presentations that many of the users of HSCB models were not familiar with efficient, effective designs of experiments. We should draw on the insights developed in academia (e.g., at NPS for M&S characterized by large numbers of variables) to characterize the interesting parts of response surfaces using innovative experimental designs (e.g., focused fractional factorial designs).

Verification, Validation & Accreditation (VV&A) Needs. One of the key themes of the workshop was the need to perform VV&A for HSCB models. To achieve that objective, there is a need to generate guidelines that enable us to perform V&V credibly, with acceptable levels of resources. Historically, the operations research community has focused on V&V of models and data. However, the workshop emphasized that the social sciences pose additional challenges in order to V&V relevant theories and Subject Matter Experts (SMEs). Note that the V&V process must be documented, transparently, to facilitate implementation of the accreditation function. In addition, the working group on VV&A recommended that we use V&V to create "tags" for theories, methods, models, and data to allow retrieval of desired item when needed. Furthermore, there is a need to create open data on the detailed VV&A status of models and data.

Education and Training (E&T) Needs. Three E&T needs emerged from the workshop. First, there is a need to augment the curriculum for social scientists and operations analysts to give them adequate education to enhance cross-discipline communication. Second, it is vital to create and sustain a HSCB Community of Interest (COI) to foster high performance, multidisciplinary teams. This COI should provide continuity of action using a variety of approaches (e.g., electronic interaction; face-to-face meetings). This continuity might be achieved by drawing on MORS' proposed Social Science COI. Lastly, there is a need to develop the tools and data needed to "train as we fight" to support both the E&T and operational communities.

Outreach Needs. The workshop highlighted three areas where enhanced HSCB modeling outreach is needed. First, it is vital to expand the HSCB COI to include balanced interagency participants (e.g., National Security Council, US Institute of Peace, Department of State, Department of Justice) Second, there is a need to participate actively in international forums that address HSCB modeling issues. These would include NATO SAS initiatives on HSCB and Irregular Warfare. Finally, there is great sensitivity to the attitudes of many members of the social sciences community who believe that it would be unethical to work with the DoD. To address that issue, it is important to develop a compelling narrative to explain the value of a collaborative relationship between the social sciences community and DoD.

Where Do We Go From Here?

This workshop was extremely successful in generating baseline needs for the HSCB modeling community. It will be followed by two subsequent workshops that will build on its achievements. In Workshop 2, the participants will be asked to characterize the state-of-the-art in HSCB modeling with respect to the twelve categories cited above. They will also be asked to compare the state-of-the-art to these needs to identify major gaps. Although the precise criteria have yet to be finalized, there is interest in assessing the risks associated with these gaps (e.g., their severity and frequency).

In Workshop 3, the participants will be asked to assess the resources that are needed to mitigate those gaps. Based on the risk assessments and resource needs, it should be feasible to identify "low hanging fruit" (e.g., significant gaps for which limited resources are needed) as well as vital gaps (e.g., gaps that are catastrophic or critical and occur frequently). The results of those deliberations will be used to generate an initial version of a Science & Technology Roadmap for HSCB modeling. It is anticipated that this roadmap will be a "living document" that evolves as we gain a deeper understanding of the problem.

Subsequently, the results of the workshops will be used to justify the allocation of resources for HSCB modeling to OSD and Congress. As necessary, follow-on workshops will be conducted to characterize progress and to re-evaluate priorities.

-- Dr. Stuart Starr, Synthesis Group Chair

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FIGURES

ACRONYMS

ACASA	Ackoff Collaboratory for Advancement of the Systems Approach
ACT	Allied Command Transformation
ADD	Assurance/Dissuasion/Deterrence
AFIT	Air Force Institute of Technology
AFRL	Air Force Research Laboratory
AO	Area of Operations
ASD(NII)	Assistant Secretary of Defense (Networks & Information Integration)
AWC	Army War College
BAH	Booz Allen Hamilton
BDE	Brigade
CDR	Commander
Cdr	Commander
CERP	Commander's Emergency Response Program
CIFP	Country Indicators for Foreign Policy
CMO	Civil Military Operations
CNSTI	CNS Technologies, Inc.
COA	Course of Action
COBP	Code of Best Practice
COCOM	Combatant Command
COI	Community of Interest
COIN	Counter Insurgency
COMPOEX	Conflict Modeling, Planning and Outcome Experimentation
COTS	Commercial Off the Shelf
CT	Counterterrorism
CTNSP	Center for Technology and National Defense Policy
DDI	Data Documentation Initiative
DDR&E	Director of Defense Research and Engineering
DHS	Department of Homeland Security
DIAS	Dynamic Information Architecture System
DIME	Diplomatic, Information, Military, Economic
DIS	Distributed Interactive Simulation
DNA	Dynamic Natural Attribute
DO JOC	Deterrence Operations Joint Operating Concept
DoD	Department of Defense
DOJ	Department of Justice
DOS	Department of State
DUSD	Deputy Undersecretary of Defense
EBR	Evidence Based Research
FAST	Flexible Asymmetric Simulation Techonologies
FFRDC	Federally Funded Research and Development Centers
FISA	Foreign Intelligence Surveillance Act
FLVN	Fort Leavenworth
FOIA	Freedom of Information Act
GIG	Global Information Grid
GMU	George Mason University
GWOT	Global War on Terror
GWU	George Washington University

HBR	Human Behavior Representation
HIV	Human Immunovirus
HLA	High Level Architecture
HSCB	Human, Social, Cultural Behavior
HUMINT	Human Intelligence
IDA	Institute for Defense Analyses
INFORMS	The Institute for Operations Research and the Management Sciences
IPA	Intergovernmental Personnel Act
ISSM	Interim Semi-static Stability Model
ITEA	International Test and Evaluation Association
IW	Irregular Warfare
JDS	Joint Data Support
JEM	Justice and Equality Movement
JFCOM	Joint Forces Command
JHU/APL	Johns Hopkins University Applied Physics Laboratory
JMEM	Joint Munitions Effectiveness Model
Lt Col	Lieutenant Colonel
LTG	Lieutenant General
M&S	Modeling and Simulation
M&S CO	Modeling and Simulation Coordination Office
MCCDC	Marine Corps Combat Development Command
MIT	Massachusetts Institute of Technology
MOE	Measure of Effectiveness
MOM	Measure of Merit
MOP	Measure of Performance
MORS	Military Operations Research Society
MOTS	Military Off the Shelf
MPICE	Measuring Progress in Conflict Environments
NATO	North Atlantic Treaty Organization
NDIA	National Defense Industrial Association
NDU	National Defense University
NGO	Non-Governmental Organization
NPS	Naval Postgraduate School
NRL	Naval Research Laboratory
NSF	National Science Foundation
OASD(PA&E)	Office of the Assistant Secretary of Defense (Program Analysis and Evaluation)
ODU	Old Dominion University
OR	Operations Research
OSD	Office of the Secretary of Defense
OUSD	Office of the Undersecretary of Defense
PITF	Political Instability Task Force
PMESII	Political, Military, Economic, Social, Information, Infrastructure
PMF	Performance Moderator Function
PSYOPS	Psychological Operations
PTSD	Post-Traumatic Stress Disorder
R&D	Research and Development
RFP	Request For Proposal
S&T	Science and Technology
SAC	Simulation and Analysis Center
SAS	System Analysis and Studies
SEAS	Synthetic Environments for Analysis and Simulation

SLA	Sudan Liberation Army
SME	Subject Matter Expert
SSTR	Stability, Security, Reconstruction, And Transition
SSTRO	Stability, Security, Transition, and Reconstruction Operations
STRATCOM	Strategic Command
T&E	Test and Evaluation
TAF	terrorism attenuating force
TBD	To Be Decided
TENA	Test and Training Enabling Architecture
TIF	terrorism increasing force
TRAC	TRADOC Analysis Center
TRADOC	Training and Doctrine Command
TSCP	Theater Security Cooperation Plan
UARC	University Affiliated Research Center
UCLA	University of California, Los Angeles
UK	United Kingdom
UK MoD	UK Ministry of Defence
UMLS	Unified Medical Language System
US	United States
USA	U. S. Army
USAF	U. S. Air Force
USAID	U. S. Agency for International Development
USG	U. S. Government
USIP	U. S. Institute of Peace
USMA	U. S. Military Academy
USMC	U. S. Marine Corps
V&V	Verification & Validation
VMASC	Virginia Modeling, Analysis, and Simulation Center
VV&A	Verification, Validation & Accreditation
WAD	Warfighting Analysis Division
WG	Working Group

1. BACKGROUND

The Director, BioSystems, DDR&E, is sponsoring work on Human, Social, and Cultural Behavior (HSCB). As part of this work, the Center for Technology and National Defense Policy (CTNSP) of the National Defense University (NDU) is organizing and conducting three workshops. These workshops investigate the needs for HSCB modeling, the current state of the art in HSCB modeling and the gaps between the needs and current modeling, and formulate a Science and Technology (S&T) roadmap to address the highest priority gaps. The results of the workshops will be used to justify the allocation of resources for HSCB modeling to the Office of the Secretary of Defense (OSD) and the Congress. This report describes the results of the first workshop, "Needs."

The needs workshop was held on June 28 – 30, 2008 at NDU. Approximately 120 people attended the by-invitation-only workshop. The participants were selected from the government, academia, industry, and the Federally Funded Research and Development Centers (FFRDCs). The stated purpose of the workshop was the following:

> **Characterize the capabilities needed to perform effective HSCB modeling in support of operational users and senior decision makers.**

A secondary purpose was the opportunistic capture of additional insights of the participants that would be helpful in supporting HSCB modeling.

1.1 WORKSHOP ORGANIZATION

Michael Baranick, Senior Research Fellow at NDU, organized and chaired the workshop. He organized it in three phases: pre-workshop, workshop, and post-workshop.

The pre-workshop phase included the production of papers and presentations by plenary speakers and working group chairs and co-chairs to be distributed prior to the workshop to attendees. These papers were designed to set the stage for the workshop and create a common understanding among the participants, increasing the amount of time available for productive work in the workshop phase.

The workshop was organized with plenary sessions, working group breakout sessions, and a wrap-up session. The first two days consisted of plenary sessions in the morning and working group sessions in the afternoon and involved all of the participants. The final half-day session was attended only by the working group chairs and co-chairs and the Synthesis Group.

The plenary sessions consisted of presentations by leaders in various fields. The purposes of the presentations were to characterize the nature of the HSCB modeling problem, depict the state-of-the-practice of HSCB modeling, and describe the steps needed to achieve the desired capabilities.

The working groups were constructed with two divisions. The first day's working groups were divided by discipline: micro-social sciences, macro-social sciences, operations research (OR), and Verification, Validation and Accreditation (VV&A) of models, data, methods, and theories. The second day's working groups were divided by problem set: deterrence, counterterrorism (CT), counter insurgency (COIN), and Stability, Security, Transition, and Reconstruction Operations (SSTRO). The working groups were not segregated by individual specialties, but were composed of mixes of specialties to ensure full communication and surfacing of ideas from all points of view. In addition, each working group had participation by members of the Synthesis Group to ensure that valuable connections could be made among the separate sets of results. The wrap-up session was designed to permit the chairs and co-chairs of the working groups to gather and digest the results from their individual sessions and present them to each other.

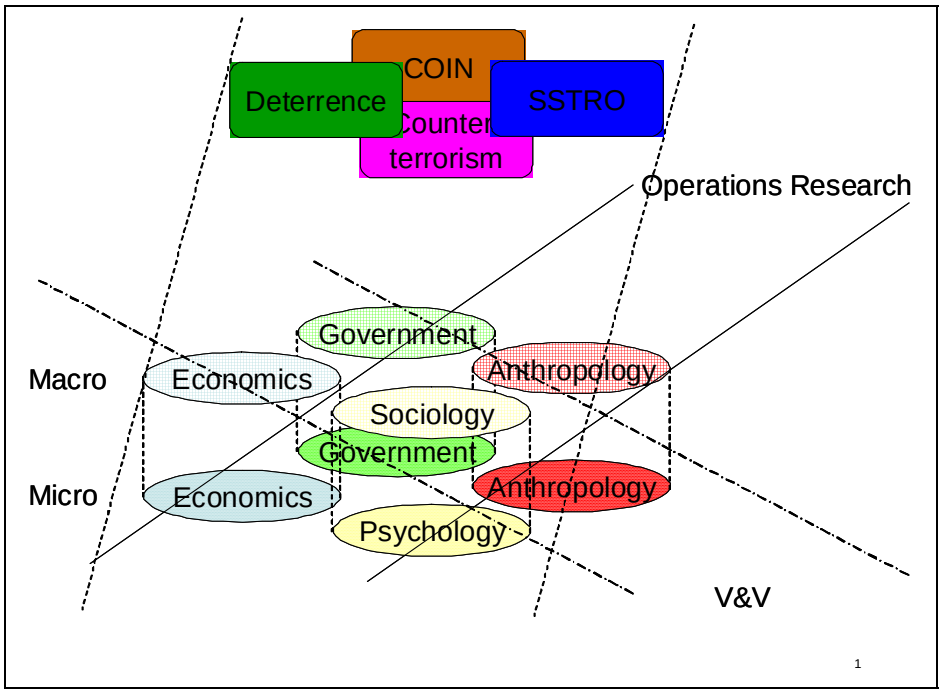

Figure 1. Dividing the HSCB Modeling Problem

The post-workshop phase included two parts. The first part was the polishing of the individual papers and working group reports, including the Synthesis Group report, with its overall view of the results of the workshop. This first part also included the production of the Final Report Briefing, this Final Report document, and the creation of a book detailing the results of the workshop. The second part of the post-workshop phase consisted of the production of ideas for HSCB modeling tasks, both from the social sciences and the modeling points of view.

1.2 DETAILS OF THE WORKSHOP

The attendees were a diverse group, as shown in the list below. The original expectation was that about 80 of those invited would be able to attend. The 50% larger than expected attendance indicated that they were also motivated.

- Government
  - OSD/Joint Staff (e.g., DDR&E, OASD(PA&E), OUSD(Policy))
  - COCOMs/Services (e.g., JFCOM, NRL, AFRL)
  - Academia (e.g., NDU, USMA, AFIT, NPS, AWC)
  - Interagency (e.g., USIP, DOS, DHS)
- FFRDCs/UARCs (e.g., IDA, MITRE, RAND, JHU/APL)
- Industry (e.g., Sentia, IBM, BAH, Phase One Communications, Group-W, SAIC, EBR, Hartley Consulting)
- Academia (e.g., University of Maryland, University of Pennsylvania, GMU, Florida State University, Purdue, University of California (San Diego), GWU, ODU, Virginia Tech)
- Non-profit (e.g., Potomac Institute, Alaska Native Heritage Center)
- International (e.g., Canada)

The plenary presentations were meant to ensure that the working groups had relevant, fresh material to stir their thinking processes. Clearly they succeeded, as the large number of questions from the audience showed. The plenary speakers and presentation titles are shown below.

- Context presentations
  - Bob Foster, DDR&E
  - Andre van Tilborg, DUSD, S&T
- Patricia Partnow, Dean Hartley, "Using Cultural Information to Model DIME/PMESII Effects"
- David Carment, "Approaches to Country Risk Analysis and Early Warning"
- Eli Berman, "Sects and Violence for Economists"
- Will Moore, "Cross-National Correlates of Terror: An Economical Inquiry of the Late 20th Century"
- David Siegel, "Social Network Structures and Counterinsurgency / Counterterrorism…"
- Barry Silverman, "Systems Engineering is the New Social Science"
- Thomas Ferleman, "Modeling Global Futures…"

The leaders of the working groups were chosen from among the experts of the respective fields. Figure 2 shows the disciplinary working groups and their leadership. Figure 3 shows the problem domain working groups and their leadership.

Disciplines	Chair	Co-Chair
Social Science -- Micro	Jerry Post	Larry Kuznar
Social Science -- Macro	Richard Lobban	Lauren Cobb
OR (Theories)	Mike McGinnis	Bob Sheldon
OR (VV&A)	Dean Hartley	Marina Arbetman-Rabinowitz

Figure 2. Disciplinary Working Groups and Leaders

Problem	Chair	Co-Chair
Deterrence	Pat McKenna	Yuna Wong
COIN	Paul Goldstone	CDR Brett Pierson
CT	LTC Lailari	Dr. Gupta
SSTRO	Paul West	Dick Deckro

Figure 3. Problem Domain Working Groups and Leaders

The Synthesis Group was recruited from those knowledgeable in HSCB theory and modeling and from those with experience in the Military Operations Research Society's (MORS) synthesis group procedures. Several of its members met both criteria. The members are shown below.

- Stuart Starr, NDU (Chair)
- Dean Hartley, Hartley Consulting (Co-Chair)
- Myriam Abramson, NRL
- Chuck Barry, NDU
- Doug Clark, NRL
- Skip Cole, USIP
- Dave Davis, GMU
- Margaret Hayes, EBR
- Richard Hayes, EBR
- Roger Hillson, NRL
- Pat McKenna, STRATCOM
- Al Sciarretta, CNSTI
- Ted Woodcock, GMU

2. DETAILED RESULTS

The results of the workshop are divided into three sections, Plenary Presentations, Disciplinary Working Group results and Problem Domain Working Group results.

2.1 PLENARY PRESENTATIONS

There were nine plenary presentations. Each presentation is briefly described in this section.

2.1.1 Foster

Dr. Bob Foster, the sponsor of these workshops and Director, BioSystems, DDR&E opened the workshop with the statement, "The social sciences are the HARDER sciences." His principal point was that in order to deal with the issue of HSCB modeling, it will be necessary to develop a multi-disciplinary approach that involves multiple partnerships, both domestically among academia, government, and industry and internationally between the US and its allies, such as NATO Allied Command Transformation (ACT).

2.1.2 Van Tilborg

Dr. Andre van Tilborg, the Deputy Under Secretary of Defense (Science and Technology) (DUSD(S&T)), serves as the principal advisor and assistant to the Director of Defense Research and Engineering (DDR&E) for all scientific and technical matters. Dr. van Tilborg gave the keynote address.

He stated that the key challenges in performing HSCB modeling include acquiring evidence-based, convincing data (vice opinions) and developing a suite of tools that can be transitioned to the warfighter. With respect to the data, the main problems are in knowing where to look for the data and getting access to it. However, there is another relevant challenge, that is to convince OSD and Congress that this endeavor is worth doing. Van Tilborg suggested that the principal argument was stated by Sun Tzu, "know your enemy!"

2.1.3 Partnow and Hartley

Dr. Patricia Partnow is an anthropologist and is the Vice President of Cultural and Educational Programs at the Alaska Native Heritage Center in Anchorage, Alaska. Dr. Dean S. Hartley III is the Principal of Hartley Consulting and has done work in HSCB modeling for a dozen years. Partnow and Hartley presented the paper, "Using Cultural Information to Model DIME/PMESII Effects."

Creating models that are based on cultural information is difficult, but not impossible. Partnow and Hartley proposed a methodology that melds the strengths of anthropology and operations research to provide a holistic approach to DIME/PMESII (diplomatic, information, military, economic/political, military, economic, social, information, infrastructure) modeling. The anthropologist starts with the people and looks for those areas that form culturally important categories for the people being studied, such as cosmology, leadership, land use, social control, and affiliation. Deep ethnographies are used to create an anthropological model. A top-down model of the DIME/PMESII system is then connected to the relevant anthropological models for an area.

2.1.4 Carment

Dr. David Carment is Professor of International Affairs at the Norman Paterson School of International Affairs, Carleton University, and principal investigator for the Country Indicators for Foreign Policy project (CIFP). Carment's primary research interests fall into the categories of conflict prevention, conflict resolution, ethnic

conflict, peacekeeping, internet technology, and Canadian foreign affairs. He presented "Approaches to Country Risk Analysis and Early Warning."

His paper laid out a framework for country risk analysis and early warning drawing on the methodologies developed by CIFP. Special attention was given to the identification of failed and fragile states. The paper was in four parts. In the first section, he provided some concepts and definitions as they relate to early warning, state failure and country risk. He analytically distinguished between fragility (e.g., development, conflict, stability) and failure. Carment noted that conflict is a symptom, not a cause, of fragility and made the observation that autocratic states are not the most fragile. The second section assessed the strengths and weakness of specific approaches to country risk analysis. In the third section he examined structural risk indicators and events based monitoring. The main issue is what criteria should be used to rank-order nations with respect to key factors, e.g., legitimacy, authority, and capacity. The fourth and final section concluded by discussing the integrated product. Carment emphasized the need to get policy makers involved; in order to be relevant, you must speak their language!

2.1.5 Berman

Dr. Eli Berman of the Department of Economics, University of California, San Diego and the National Bureau of Economic Research. Berman's research interests are Labor Economics, Labor Demand and Technological Change, Religion, Middle East, Terrorism and Insurgency, Fertility, Immigration, and Language. He presented the results from two studies.

The first, "Religion, Terrorism and Public Goods: Testing the Club Model," addressed the question, "Can rational models, once theological explanations are discredited, explain why certain radical religious rebels are so successful in perpetrating suicide attacks?" The fundamental barrier to success turns out not to be recruiting suicide attackers; there is a rational basis for volunteering. Rather, the barrier is the danger of other operatives defecting. A club model, portraying voluntary religious organizations as efficient providers of local public goods explains how they weed out potential defectors by requiring sacrifices as signals of commitment. They are thereby able to succeed in risky terrorist attacks. The model has testable implications for tactic choice and damage achieved by clubs and other rebel organizations. Data spanning a half-century on both terrorists and civil war insurgents, much from Middle East sources and Israel/Palestine, reveal that: a) missions organized by radical religious clubs that provide benign local public goods in the absence of competing provision by government are both more lethal and are more likely to be suicide attacks than missions organized by other terrorist groups with similar aims and theologies; and b) suicide attacks are chosen when targets are "hard," i.e., difficult to destroy. The results suggest benign tactics to counter radical religious terrorism and insurgency.

The "Hearts and Minds" model helped define the effects on victims of terrorist violence and the relationship between Commander's Emergency Response Program (CERP) spending and reduction in violence.

2.1.6 Moore

Dr. Will H. Moore is Professor of Political Science, Florida State University. Moore's area of expertise is the scientific study of violent political conflict. He presented the paper, "Cross-National Correlates of Terror: Empirical Analysis of the Late 20th Century."

Moore stated that data limitations have prevented scholars from developing a strong sense of the cross-national covariates of terror. A handful of such studies exist using the ITERATE data set, but those data exclude all domestic terror events, which is to say most such events. Further, those studies suffer from a common weakness in cross-national studies of violence: they focus on the characteristics of polities, economies and societies while ignoring the behavior of governments and dissidents. Moore's study addressed both weaknesses by [1] utilizing a new dataset (the Global Terror Database) and [2] including the behavior of governments and dissidents within the context of the national characteristics that influence their behavior. The empirical domain is all countries in the

world from the mid-1970s through the 1990s. Moore identified the variables that influence the amount of dissident terror. He also emphasized that "terror is a tactic." He concluded that his work provided support for Paul Wilkinson's arguments (e.g., value of liberal democracy).

2.1.7 Siegel

Dr. David A. Siegel is an Assistant Professor of Political Science, Florida State University. His work uses formal and computational models to explore the organizational dynamics of terrorist organizations, and the effect of repression and the media on participation in collective actions such as insurgency and terrorism. Siegel presented the paper, "Social Network Structure and Counterinsurgency/Counterterrorism: Using Theory to Limit Causal Links and Aid in Strategic Planning."

According to Siegel, both qualitative and quantitative methods have utility in political forecasting, yet they are often treated independently. Siegel argued for an approach that formalizes the insights inherent to qualitative models, and so provides for their quantitative measurement and their broader generalization. The modeling approach he offered treats individuals as heterogeneous in intent, and influenced by their interactions with others in their social networks. One's location within these networks affects one's individual behavior; the large-scale structure of the networks influences aggregate behavior. Siegel offered a typology of qualitative network types to classify how different networks affect aggregate outcomes, and incorporate the actions of an external repressor to explore the way in which participation in collective actions may be limited by outside pressure. After analyzing the role of both violent and non-violent repression, he illustrated which types of data on social networks are most useful to forecasting within each network type. Siegel also showed that the form of repression is often less important in understanding particulars than details of social connections or prior motivations. This fact allows for application to substantive cases with little available data. The presentation concluded with an application, using information known prior to the event to forecast the differential effect of repression on turnout in the 2005 Iraqi Legislative elections.

2.1.8 Silverman

Dr. Barry G. Silverman is Professor of Electrical and Systems Engineering at the University of Pennsylvania where he is also Director of the Ackoff Collaboratory for Advancement of the Systems Approach (ACASA). The focus of his research has largely been on aesthetic and cognitive engineering of embedded game-theoretic agents that can help humans improve their learning, performance, and systems thinking in task-environments.

According to Silverman, a holy grail for military, diplomatic, and intelligence analysis is a valid set of software agent models that act as the desired ethno-political factions so that one can test the effects that may arise from alternative courses of action in different lands. This presentation enumerated the challenges of such a testbed and described best-of-breed leader and follower profiling models implemented to improve the realism and validity of the agent. Realistic, 'descriptive' agents were contrasted to rational actor theory in terms of the different equilibria one would expect to emerge in conflict games. These predictions were examined in two real world cases (Iraq and Southeast Asia) where the agent models were subjected to validity tests and a policy experiment was then run. Silverman concluded by arguing that substantial effort on game realism, best-of-breed social science models, and agent validation efforts is essential if analytic experiments are to effectively explore conflicts and alternative ways to influence outcomes. Such efforts are likely to improve behavioral game theory as well.

Thus there is a need for a toolbox (vice a single tool). Silverman argued the need to cross-fertilize across the "silos" of social science: the key involves "interactions." He said the major hole in our knowledge lies at the bottom: social science theories. As a technique, Silverman proposed the use of Performance Moderator Functions (PMF), drawing on "best of breed" PMFs for the toolbox.

2.1.9 Ferleman

Dr. Thomas Ferleman is an Associate with Booz Allen Hamilton and is the Global Futures Modeling & Simulation (GFM&S) practice lead. He presented "Modeling Global Futures: Forecasting Patterns, Determining Alternatives, and Mitigating Risk."

Ferleman described his model and its architecture. The architecture draws on mix of domains (e.g., economics, socio-political, international political, population, agriculture, energy, technology, and environment). Ferleman exercised the model for a variety of scenarios; e.g., self-sustainment, export, human development, in forecasting trends over several decades. In his presentation, Ferleman cited the work of Barry Hughes, University of Denver, as a major source. In the discussion of the presentation, several issues were raised about the experimental design used for these scenarios.

2.2 DISCIPLINARY WORKING GROUPS

The workshop included four disciplinary working groups: micro-social sciences, macro-social sciences, operations research, and VV&A. The description of each working group and its results is divided into membership, presentations, discussion topics, and expressed needs sections. The "expressed needs" are those statements from the working group that most directly addressed the Workshop purpose.

2.2.1 Micro-Social Sciences

Membership:

- Jerrold Post (chair)
- Lawrence A. Kuznar (co-chair)
- Myriam Abramson
- Eli Berman
- Deborah Duong
- Lee Ellen Freedland
- Rebecca Goolsby
- Jeff Hansberger
- Lauren Lee
- Will Moore
- Jennifer O'Connor
- Peter Pham

Presentations:

Dr. Lawrence A. Kuznar is Chief Cultural Sciences Officer for National Security Innovations (NSI). Prior to joining NSI, Dr. Kuznar was a professor of anthropology at Indiana University—Purdue University, Fort Wayne in Fort Wayne, IN. His research focused on decision theory, theories of conflict and terrorism, and computational modeling. He presented "Bridging the Micro-Macro Gulf in Social Science Research: Military and Intelligence Applications." The key points of this presentation were the following:

- Micro units of society are individuals
- Methodological individualism and reductionism do not obviate appreciating social wholes
- Appreciation of emergent social phenomena is grounded in understanding the complex interactions of their units
- Units should not be static; people are not static, their states and behaviors change
- Aim of social modeling should be the emergence of macro-phenomena; these are the sorts of phenomena of most national security concern (riots, revolutionary movements, insurgencies, terrorist networks, state collapses, genocides)

- Ultimate models will have emergent social phenomena that will take on their own rules of interaction; modelers are far from this
- Models must be evaluated and validated; they must predict, although precise predictions are not reasonable
- Over-calibration can lead to accuracy and precision but not validity, especially for near-term phenomena
- General long-term trends can, ceteris paribus, be predicted, but there is a many-to-one mapping of models to such phenomena
- Ensemble computing, in which model behavior is explored over its complex parameter space is a more practical and responsible means of judging the validity of a model

Dr. Jerrold M. Post (M.D.) is professor of psychiatry, political psychology, and international affairs and director of the political psychology program at The George Washington University. Dr. Post presented "When Hatred Is Bred in the Bone: Psycho-cultural Foundations of Contemporary Terrorism."

Post stated that the lay public often considers terrorists to be crazed fanatics; however, in fact terrorist groups regularly exclude emotionally disturbed individuals from their ranks—after all, they represent a security risk. His comparative research on the psychology of terrorists does not reveal major psychopathology, rather that the common characteristic of terrorists is their normality. Post said that social psychology provides the most powerful lens through which to examine and explain terrorist behavior, emphasizing group psychology and collective identity, not individual psychopathology. The importance of collective identity and the processes of forming and transforming collective identities cannot be overemphasized. This in turn emphasizes the socio-cultural context, which determines the balance between collective identity and individual identity. Post then described the importance of distinguishing the particular type of terrorism that one might encounter, as shown in Figure 4.

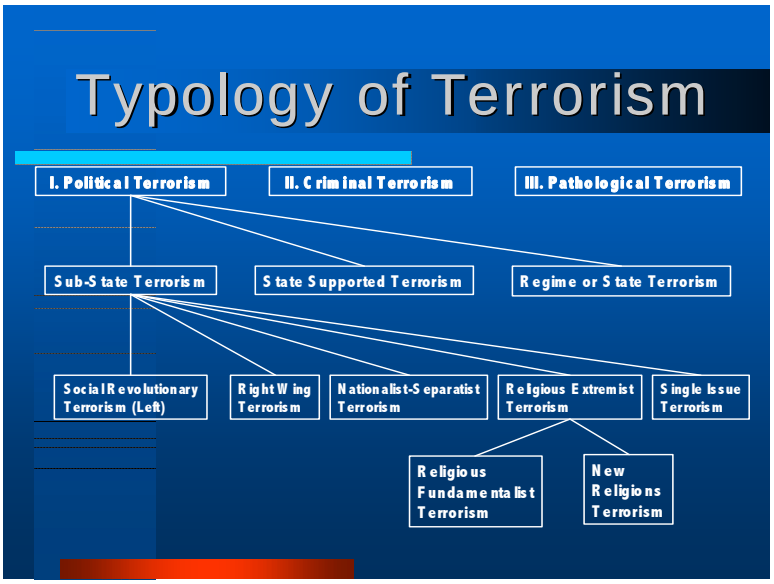

Figure 4. Post's Typology of Terrorism

Discussion Topics:

1. Defining Micro

   The first and perhaps most important issue was the definition of "micro" for social phenomena. Everyone agreed that the distinction between micro and macro was arbitrary. After discussing different small social units (individuals, families, terrorist cells), Dr. Will Moore made the following suggestion:

Definition: Micro social units are defined as the lowest reducible decision making units of a society; micro units are capable of making their own decisions.

After some discussion, the group came to consensus on this issue.

2. Prediction

Another key issue concerned the use of models for prediction. Everyone agreed that the use of models for precise and accurate point prediction (prediction with a capital "P") was misguided. Instead, the group argued that models should be used for forecasting, increasing understanding, and creating plausible futures. Dr. Kuznar noted that these terms were not well defined and that people still use increases in understanding to predict. Dr. Post noted that increases in understanding, the creation of plausible futures, etc. were more like prediction with a small "p," and everyone in the group agreed that traditional notions of prediction (point prediction, capital "P") were not useful for modeling social phenomena.

3. Other Issues

Participants were concerned with general modeling issues and concerns with responding to government RFPs/executing contract work. In particular, participants wanted better guidance form the government regarding what kinds of models were desired and what sources of data were available.

Related to the issue of more transparent requirements was the argument that models need to address commander's intent, field operator's concerns, as well as academic and theoretical constructs.

Models should also model U.S. actions in order to provide a more complete picture of the situations modeled.

One issue that was discussed was the need to adhere to doctrine in framing models and their variables and parameters. While some military folk advocated such an approach, other military personnel and the rest of the participants argued that this was overly restrictive for R&D modeling.

Eventually, the group settled upon binning their concerns and recommendations into several categories. These categories include: scale/units to be modeled, data issues, modeling approaches, and variables/constructs to be modeled. Those points that the group deemed of paramount importance are in bold.

Scale/Units

- Individuals are obvious atomistic units of societies.
- Groups: **Micro unit can make its own decisions; lowest reducible decision making unit**
- This definition can apply to families, tribal units, even military juntas and the elite leadership of a country.
- Also consider scale across time.
- The increase in rogue leaders implies that individual profiling is important.

Data Issues

- **Models should address what data exist, and also what does not exist? Identify gaps.**
- **Models should be actually empirically based; no synthetic data**
- Need to address validation of data
- How are data tied to questions asked?
- **There is a great need for a Common Ontology/ Thesaurus (cross disciplinary/cross military/civilian/International Community).** A common social ontology is probably a bridge too far, given the differences among social science disciplines, but modelers should provide a thesaurus of their ontology to show how that ontology relates to others.
- Modelers should use expertise of personnel previously deployed

- Models should provide both Hindsight (retrodiction) AND foresight (prediction)

Approaches

- There is a need for transparency on how to decide on models
- **Modelers should specify assumptions and limitations of models (for all micro models, best with short term phenomena)**
- Identify missing components/theories
- Include Qualitative and Quantitative models and bridge them
- Hypothesis testing/gaming/COA analysis is important for DoD modeling efforts
- **Dashboard** – to apply a variety of models to specific problems, models do not necessarily need to be combined, but could be used in a dashboard on a problem or data set to see which models are most appropriate and work best on a specific problem.
- A micro model must operate in an operational framework of macro and other models
- Sources of empirical data: content analysis, polling, ethnographies, case studies, SMEs need to be varied and well-specified
- Models should provide feedback across emergent levels of the phenomena they model
- Evolution of preferences (habituation) of micro units is important
- Evolution of norms in models is also important
- Impact of macro-variables on micro phenomena should be included in a model (e.g. effect of interest rates on individual decisions to buy a home)
- Need to address commander's intent vs. field operators vs. what social scientists can provide
- Need to include models of ourselves in our models of red and green populations
- Models should be validated in part by peer review
- **Include strong representation of social scientists/interdisciplinary.** The days of engineers including only token social scientists should be over.
- Multiple futures exploration vs. prediction
- Service oriented architecture
- How do other countries use social scientists?

Variables/Constructs to Consider (very incomplete list)

- Legitimacy
- Shared motive/intent
- Differentiate between what people say and what people do
- Genetic and biological variables relevant to human behavior
- Psychological variables
- Need leadership psychological profiles, especially since many post-cold war conflicts are precipitated by rogue leaders; can be focused on leader predominant societies
- Family structure/dynamics
- Peer influences
- Economic variables
- Education
- Demography
- Social networks
- Goals (explicit vs. implicit, private vs. public)
- Leading indicators/intervening variables that lead up to ultimate dependent variables
- Every model is context-dependent
- No model is knowledge-free
- The independent variables are themselves context-dependent.
- Requirements for models can't be driven by the consumer.

Expressed needs:

- Particular questions
  - If the military does a task (for example, give water in an SSTR task), what are the implications from a societal point of view?
  - What to look for in a village you are going through?
  - Understanding should include
    - Legitimacy
    - Motive/intent, Goals (explicit, implicit, public, private)
    - Leadership profiles
    - Family structure/dynamics
    - Peer influences
- Supporting research needs
  - Data, what exists? What doesn't exist?
  - Data needs to be validated
  - Common terminology – common ontology is too restrictive
  - Permanent repository of rules/relationships like Cyc for the social sciences
- Model architecture needs
  - How to connect the people on the ground with the social scientists?
  - Should include model of ourselves
  - "Prediction" should be replaced with "forecasting," with emphasis on possible, multiple futures
  - Should include feedback between micro and macro
  - Model assumptions should be evident
  - Need quantitative and qualitative models
  - Validation is required, in part by peer review
  - Service oriented architecture

2.2.2 Macro-Social Sciences

Membership:

- Richard Lobban, Anthropology, Rhode Island College (chair)
- Loren Cobb, Mathematics, University of Colorado at Denver (co-chair)
- Tim Bacon
- Cherie Beck
- Nathan Bos
- Doug Clark
- Jennifer Edwards
- David Garment
- Margaret Hayes
- Jonathan Jackson
- Pauline Kusiak
- John Lawson
- Michael Manno
- Pat McKenna
- Danielle Miller
- Charlene Milliken
- Brice Nicholson
- Maureen O'Mara
- Patricia Partnow
- David Siegel

- Barry Silverman
- John Sokolowski
- Peter Tikuisis
- Mike Vlahos
- Yuna Wong
- Paul Works
- Bill Young

Presentations:

Dr. Loren Cobb, of the Mathematics Department of the University of Colorado at Denver, presented "The Impact of Social Theory on Model Development." This paper focused on the use of social theory in quantitative simulations:

- A social theory is any well-developed and coherent set of ideas that de-scribes the structure and functioning of society, and its ills. These may come from any of the social sciences (psychology, anthropology, sociology, economics, political science, jurisprudence, linguistics), or from history or philosophy. Social theories may deal with raw human behavior, or with social ideas, or with systems of symbolic meaning employed by a society. They may be structural or dynamic; they may be deterministic or fuzzy or stochastic; and they may be expressed in the medium of mathematics, diagrams, or ordinary language.

- Social theory comes to bear upon social modeling in the smallest spatial and temporal units of analysis. In macro-scale modeling the behavior of society as a whole is built up out of how variables and conditions change in these smallest units. When these are small geographic cells, then the function of social theory is to provide or motivate equations that specify the rates of change of state variables within each cell, as influenced by their current values in the cell and in all nearest neighbors.

- In models of refugee flow during political crises, as in the Rwandan terror campaign of 1994, for example, existing social theory proved to be almost useless in predicting when people would leave their homes, in which direction they would decide to go, and where they would decide to stop. In the actual event about one million Rwandan refugees ended up in a treeless, foodless, waterless volcanic plain near Gomah, in the Congo.

- In social epidemiology, in contrast, the mathematical theory developed in the 20th century does a reasonably good job of predicting the flow of most contagions through the population-density map of contemporary societies of all types. To the extent that innovations and ideas can be modeled as social contagion, this theory may also apply to the flow of new ideas through society.

- On the other hand, the inter-generational social epidemiology of post-traumatic stress disorder (PTSD) reveals a serious gap in social theory. What happens to the institutions of society when its individual members have been affected for generations with epidemic levels of PTSD? Social theory should be able to tell us whether the individual psychological characteristics of PTSD (e.g. hypervigilance, simplified good vs. evil cognitive categories, hair-trigger violence, and apocalyptic thought patterns) are capable of seeping into institutional worldviews, religions, and behaviors. Unfortunately, existing social theory is completely silent on this topic.

Dr. Richard Lobban, of the Anthropology Department of Rhode Island College, presented "Reality Check: Marrying Modeling with Empiricism: the case and context of Sudan." The major variables and conclusions of the paper were the following:

- Among all so-called "failed states", Sudan presents a case that is more than interesting: it may be the iconic case, the signature case that contains almost every dynamic of importance.

- Most serious Sudanists probably agree that the causes of the Darfur conflict are multi-factorial, interactive and changeable. Likewise the solutions are equally complex. Some of the variables are stronger than others, some clusters of variables can be more important than single variable.

- Historical: Probably the strongest single means to understand Darfur are the patterns that are derived from its very long history. At times it has been sovereign and independent; it has been strong and weak. It has central and peripheral. It has made and broken power in the central Sudan.

- Economic: There are the broad economic factors whereby material bur-dens of Sudan fall heavily against the people of Darfur and the redistribution of wealth from manufacture, agricultural and expanding petroleum production only very slowly reaches this province. Disruption of the agricultural and commercial life of Darfur partially set the stage for the pre-sent complex conflicts.

- Political: The overarching domestic / national / internal dimensions of the conflict in Darfur are political and failures of governance that could not fairly and adequate address the underlying sources of conflicts. There are very many overlapping and intersecting political variables.

- Ecological & Demographic: It is clear that this conflict has emerged at the present in the context of persistent ecological crisis of increased desertification and lack of production and limited grazing lands among the pas-toral and agricultural peoples. There is a clear correlation with rainfall shortages, population concentrations and the areas of the highest level of clashes and differentiated violence.

- Natural Resources: Mostly at subsistence production and small scale trade the natural resources of Darfur are limited in terms of cash exports. Other resources such as water in the far north, oil in the south and uranium in the west are possible future factors.

- Military: There are many purely military factors in this situation which pits the irregular and now split, Sudan Liberation Army (SLA) led by Abd al-Wahid Mohamed Nur and the other faction led by Minni Arku Min-nawi, and the Justice and Equality Movement (JEM) led by Khalil Ibrahim which also recently splintered. All are more or less fighting against formal elements of the Sudan military led by General Omar Beshir and the ir-regular militia called locally the janjaweed camel and horse riding raiders led by Musa Hilal among several others. The extensive regional presence of small arms makes it easy to take up arms. Smuggling and trafficking has long been part of the local economy.

- Cultural & Linguistic: Central Sudanese are broadly Arabic speakers, and in Darfur Arabic is more likely a second language than the primary language at home. The skilled use of Arabic is emblematic of higher social position; the awkward use of the language can be twisted to imply people of a lesser degree of social status.

- Racio-Ethnic Dimensions: The painful question of racio-ethnic prejudice. is sometimes rendered simplistically as “Arabs vs. Africans.”

- Religion: The majority of combatants on all sides of this conflict are Sunni Muslims, but this commonality has not curbed the bloodshed.

- Gender and the Social Order: So far, most victims are refugee women and girls who are intimidated and systematically terrorized by rape re-ported by many independent accounts. As long as sexism and gender prejudice are deeply rooted, the ease to overlook gender abuse assist in worsening the conflicts on the planet. As hard as it is to discuss race in Sudan it is equally difficult to frame a debate or undertake negotiations about gender.

- Conclusions:

- The crisis in Darfur is multi-faceted and needs serious reflection on cultural, historical, ecological, religious, political and racio-ethnic variables
- Foreign intervention has both positive and negative features, but the best, but not simple hope lies for constructive intervention (if not too little and too late) might lie with the AU force.
- Presently this crisis situation is serious and likely getting worse. At this rate the human dimension is likely worsening and the chance for anyone to control the levers of power in Darfur is declining.
- The rebel movements, the janjawed and Sudanese political players all have substantial complexity relative to their own orientations and objectives.
- There is broad domestic and regional linkage of this conflict to other issues and political players in and especially, out of Sudan in the utilization and degree of concern for the Darfur crisis.

Discussion Topics:

1. What are the special needs of macro-scale simulation models? In what form should a social theory be written to have the greatest utility for the modeling and simulation community?

   Several participants made the strong point that we as a community need to step back from the general head-long rush to quantification and mathematical model-building, in order to examine and better understand the interior cognitive models and categories at work, both in the subjects under consideration and — of equal or greater importance — within those who are constructing the quantitative models.

   The point was made that the individual disciplines of social science do not share a common terminology, and that we therefore need to establish a correspondence between the concepts (or semantic categories) of each discipline with all others.

   In addition, there are special needs of macro-scale social theory. The primary users are policy-makers, politicians, and the general public, each of whom are more likely to use homilies as their preferred or indeed only interior model, rather than any form of quantitative or mathematical model. Those who construct or use quantitative models may find themselves talking to an empty audience.

   In regard to the connection between micro and macro-scale social theory, there are micro motives for macro behavior and vice versa – e.g., the majority concurs, a vocal minority disagrees.

   The subject turned to cultural change, and it was observed that there is little agreement on the fundamental nature of cultural change. We need a better lexicon for change, and also an appreciation of its ontology. In particular, we tend not to pay attention to the authenticity of culture change, yet when change is imposed from outside by foreign influence it is often perceived as inauthentic, and either rejected or transformed into something more acceptable to the ambient culture.

   Throughout the preceding discussion a gulf was easily visible between two radically different cognitive and analytical styles: that of the quantitative and mathematical modelers on one hand, and that of post-modern social scientists on the other. At times it seemed as though each nurtured an internal cartoon-like caricature of the other's concepts, models, and worldviews.

2. Are failed/failing states just a normal part of the rise and fall of states? If so, should we mostly be discussing how to manage failing, collapsing, transforming states, with or without a power vacuum?

   In the discussion of failed states, the point was made that we need to include "the search for identity" in any model of state or nation formation. Efforts to increase the social and political integration of a nascent state-like unit depend upon an awareness of common identity among the people involved, and also upon the level of consciousness, in the sense in which that term is used in Spiral Dynamics (Beck, 2005).

There is an emerging point of contact between the two worlds of social modeling (quantitative vs. post-modern), in the relatively new area of agent-based models that seek to learn what specific characteristics of individual agents produce the coalescence of geographic political units.

The contemporary process of globalization was cited as bringing forth an ironic weakening of traditional nation-states at the same time as it encourages non-state and proto-state entities to greater political integration.

More generally, it was noted that in many contexts it may be more important to create a model of the primary actors (people, organizations, institutions) than of the dynamics of the variables that characterize the context. Within actors, it is of primary importance to model the different cognitive/semantic maps that they employ to understand any given political situation.

Furthermore, we asked which should be primary goal of a modeling effort: the elegance or the complexity of the resulting model and their supporting theories? While this may ultimately come down to individual preference, it may also be one of the defining distinctions between the mathematical and the post-modern approaches to model construction.

There was contention regarding the failure of states – that it is the normal course for states to divide or be absorbed from time to time. By artificially freezing the status quo (of territorial boundaries) states which would ordinarily be absorbed fester in failure and stasis.

3. For predictive models of conflict, how can we get the attention of the right people for early attention before expensive intervention becomes necessary?

   Discussion turned to the question of what institutional changes may be needed if the modeling community, broadly construed, is to have any palpable impact on policies, plans, and programs.

   It was observed that the Theater Security Cooperation Plans (TSCPs) maintained by each Geographic Combatant Commander present an immediate opportunity. At present these plans are seldom tested or developed with the aid of models contributed by the community. Perhaps we could foster the creation of teams or task forces which advise and assist those who must develop or test operational plans and policies, using models that have passed a rigorous validation review and are written to standards developed by the community for social science input, documentation, and use of best practices.

   Given the multiplicity of approaches to modeling, not to mention of the social theories that support these models, it might be better to present a federation of modelers for any given policy or plan-testing context. The multi-model approach avoids the dangerous trap of identifying any one model or approach as the one single right answer, and instead relies on a family of models to provide a rich base of insights with which to improve policy and plan development.

   This collaborative effort among heterogeneous modeling teams, grouped together into a loose federation of modelers, has many appropriate uses:
   - development of a multi-modal vision of any situation,
   - generation of insightful multi-factor commentary and evaluation, and
   - provision of content-rich recommendations for plans and policies.

   Given the variety of serious challenges and threats that the entire planet will be facing in the near future, including climate change, decreasing supplies of fossil fuels, a brittle world financial and economic system, and the near certainty of global pandemics of contagious disease, it will behoove the modeling community to move forward with some urgency towards improved standards for model construction, greater self-discipline, consistent use of the entire range of available modeling approaches, and better integration of social scientists in the model construction.

Other discussion points:

Social science models should not be viewed as definitive, but as decision aids not unlike weather forecasts. They will always be probabilistic (not deterministic) and should be screened by subject matter experts. A meta-analysis of various model predictions would likely yield a "safe" but not necessarily accurate prediction. Subject matter experts would be helpful in the latter. Despite the plethora of available models it is unlikely that all significant variables have been suitably quantified, such as leadership statements, radicalization, low level lawlessness or civil disobedience, etc.

A desire was expressed on several occasions for a “SimCountry” application; Cobb shared an early prototype of same. Criticisms: obvious over-extension of technology not yet capable of simulating reality effectively. – admission by Cobb that any solid results are about twenty years off…

Expressed needs:

- Particular questions
    - Predict refugee flow during political crises: inadequate
    - Predict the flow of contagions through the population-density map of a society: good
    - Predict effects on societies institutions of long-term epidemic PTSD: inadequate
    - Predict when cultural change will be regarded as authentic
    - Understand failed states
        - History
        - Economy
        - Political contents
        - Ecological and demographic factors
        - Natural resources, both for internal use and as exports
        - Military and paramilitary forces
        - Culture and linguistic situation
        - Racio-ethnic dimensions
        - Religious factors
        - Gender and social order
        - External influences on all of the above, e.g., globalization
    - Support Theater Security Cooperation Plans (TSCPs)
- Supporting research needs
    - Establish common terminology among the social sciences
    - Understand interior cognitive models
    - Either
        - construct converters of mathematical models to homilies or
        - Educate policy-makers, politicians, general public in mathematical models
- Model architecture needs
    - Support multi-modal vision of situations
    - Generate insightful multi-factor commentaty and evaluation
    - Provide content-rich recommendations for plans and policies
    - Provide probabilistic statements, screened by subject matter experts
    - Don’t use internal political boundaries, but use cells with flows among cells

2.2.3 Operations Research

Membership:

- Mike McGinnis, VMASC Executive Director (chair)
- Bob Sheldon, Senior Analyst, Group W Inc, (co-chair)
- Gary Citrenbaum
- Skip Cole
- Dave Davis

- Krista Elefante
- Dipak Gupta
- John Hummel
- James Morris
- Matt Nickens
- Jay Persons
- Brett Pierson
- Kevin Roney
- Vince Roske
- Al Sciarretta
- Al Sweetser
- Victor Wiley
- Ben Wise
- Charles Worrell

Presentations:

Dr. John Sokolowski (VMASC) – "Population & Social Dynamics Modeling"

CDR Brett Pierson (J8) – "Systems Dynamics Modeling"

Lt. Col. Larlai Guermantes (USAF Staff) – "Terrorism & CT M&S"

Mr. Mike Ottenberg (OSD PA&E SAC) – "Wargaming / Gaming"

Mr. Jack Jackson (TRAC-Monterey) – "Counter-Insurgency Modeling"

MAJ Jay Persons (TRAC-FLVN) – "Discussion of HSCB and OR/M&S/Analysis (USA/USMC background study)" This study identified 160 key issues/questions, derived 14 decision issues and 56 required analytical capabilities, and identified 35 gaps. Of these, 20 were associated with soft science (behavioral) and 34 gaps were associated with data.

Discussion Topics:

- Types and Levels of Models
    - Systems dynamics not an adaptive modeling environment but very appropriate for high level aggregated cause and effect modeling
    - Agent based models better suited for modeling complex adaptive behaviors
- Semantics, Lexicon, Taxonomy, Standards, and Repository
    - HSCB modeling requires standards and definitions of common terms for both OR and social science communities
    - Need a resource repository for HSCB models and data
    - Establish / identify references & organizations to oversee (provide) validated models and data similar to those for warfare models (e.g., Joint Munitions Effectiveness Model)
- Improve understanding and manage expectations. Key groups: HSCB model users / consumers. For what purposes: prediction, forecasts, exploration (branches/sequels), and discovery & exploration of black swans
- Alternate / Complementary Approaches: holistic architecture (level to-be-decided) versus vignette/scenario driven. Which is most appropriate for deriving needs for these models?
- Standards for data lexicon, semantics, and ontology
    - Must include metadata & HSCB protocols
    - Must be developed within the real-world context of the model
- Decomposition of the problem domains

    - See for example various 'candidate decomposition' of the IW environment presented during the session.
    - HSCB Model Architecture requires flexibility to integrate / aggregate domains; e.g., integrate social-religion-political domains when dealing with the Muslim world
- HSCB Model Review
    - HSCB modeling would benefit from inclusion of Bayesian analysis with SMEs to take into account a combined scale/score
    - Need a consistent approach to dealing with SME evaluations
    - Need to identify / include multi-disciplinary & cross-disciplinary experts when conducting model review
- Identify output metrics relevant to make decisions

The working group also decided it would have been helpful if we had developed ahead of time ….

- HSCB modeling frame of reference to provide a context to development of our (OR-working group) set of requirements
- Reference problem/case study/scenario/vignette to bound the scope of the problem-space which would have in-turn helped focus discussions
- Included interagency involvement and attendance at this workshop

Workshop II Considerations: Reset the working groups versus keep same groups; form new groups based on Workshop II agenda; Invite interagency personnel; Sequence sessions and presentations to maximize information flow and knowledge generation & sharing.

Expressed needs:

- Particular questions
    - prediction, forecasts, exploration (branches/sequels), and discovery & exploration of black swans
    - What are the key questions HSCB models will answer?
        - Identify enduring, reoccurring questions that arise in military operations
        - Partially addressed by Army/USMC IW Study
- Supporting research needs
    - What are the HSCB theories that drive how the models function?
    - HSCB modeling requires standards and definitions of common terms for both OR and social science communities
    - Standards for data lexicon, semantics, and ontology
        - Must include metadata & HSCB protocols
        - Must be developed within the real-world context of the model
    - Knowledge, data, and algorithms that account for the effects of influencers (operational activities) on the attitude/behavior of the civilian population based on ethnic, tribal, cultural, religious, and political considerations
    - Data and algorithms that translate civilian attitudes into levels of cooperation with friendly forces and result in corresponding levels of HUMINT provided by the civilian population
    - Knowledge, data, and algorithms to account for discrimination between civilian and adversary actors based on presented physical and behavioral signature (e.g., insurgent in civilian clothing)
    - Knowledge, data, algorithms that account for how affiliations and support for other actors change based on the application of influencers (e.g., friendly operations, government activities, adversary operations)
    - Data and algorithms that account for changes in target audience attitudes caused by the application of PSYOPS
    - Knowledge, data, and algorithms that reflect adversary HUMINT networks (e.g., attributes of the HUMINT network, how the network is formed, how the network adjusts if a node or element is

removed, what adversary activities tend to facilitate or discourage the population's provision of HUMINT)
    - Knowledge, data, and algorithms to account for unique adversary PSYOPS techniques and the effect of those techniques on the target audience
    - Data and algorithms to represent the effects of CMO on the attitudes of the civilian population (or other target audience)
    - Data to implement the effects of essential services (or lack thereof) on civilian population's attitudes/behaviors
    - Knowledge, data and algorithms accounting for the effect of governmental corruption on governmental institutions and on the civilian population's attitudes/behaviors
    - Knowledge, data and algorithms reflecting the attitudes/behavior of actors (e.g. civilian population) based on the state of physical infrastructure used by the actors
    - Knowledge, data and algorithms accounting for non-homogeneous groups of actors. This is particularly problematic when group members have overlapping affiliations (e.g. a single actor or group belongs to multiple groups - religious groups, ethnic groups, political groups, tribal groups, etc.)
    - Data and algorithms accounting for levels of civilian support for and the provision of physical or monetary resources to adversaries
    - Knowledge, data and algorithms accounting for the performance/effectiveness of actor organizations based on the level of cooperation between those organizations (e.g. USAID and local government)
    - Knowledge, data and algorithms accounting for the behavior of actors (e.g. civilian population, religious leaders) based on their level of support for the existing government
    - Knowledge, data and algorithms accounting for the legitimacy of the existing government as viewed from outside the nation by external groups and the effect of international legitimacy on government effectiveness
    - Knowledge, data and algorithms accounting for the of the state of the existing legal system and its impact on the attitudes/behaviors of the civilian population
    - Data to define civilian attitudes/behaviors based on existing economic conditions and how the attitudes/behaviors change as the economic conditions change
    - Knowledge and data about the effects of media activity on the attitudes/behaviors of actors
    - Knowledge and data about the effects of friendly operations on media themes and activity
- Model architecture needs
    - How to handle proprietary information?
    - How to handle "personal" information (privacy and use of information)?
    - Need a resource repository for HSCB models and data
    - Establish / identify references & organizations to oversee (provide) validated models and data similar to those for warfare models (e.g., Joint Munitions Effectiveness Model)
    - Concerns related to VV&A
        - How do modelers reduce uncertainty in "squishy" HSCB models?
        - How much uncertainty reduction is feasible/sufficient?
        - Subjective nature of models suggests data will be required for both V&V and to train the model?
    - holistic architecture (level TBD) versus vignette/scenario driven. Which is most appropriate for deriving needs for these models?
    - HSCB Model Architecture requires flexibility to integrate / aggregate domains; e.g., integrate social-religion-political domains when dealing with the Muslim world
    - HSCB Model Review
        - HSCB modeling would benefit from inclusion of Bayesian analysis with SMEs to take into account a combined scale/score
        - Need a consistent approach to dealing with SME evaluations

        - Need to identify / include multi-disciplinary & cross-disciplinary experts when conducting model review
    - Identify output metrics relevant to make decisions
    - Tailorable and adaptable HSCB models
        - Focus on identification of common factors as a baseline for HSCB models (e.g., ODU/VMASC Insurgency Studies of Columbia and Nigeria found 60 of 125 insurgency factors to be common)
        - Easily change/add non-common factors
    - Define / design a family (framework) of HSCB models that can be integrated and federated to model specific scenarios and casual effects
    - Adopt a model framework that can accommodate meta-model and meta-data aggregation and disaggregation
    - To make models efficient & cost effective. Minimize model development costs, runtime and overhead (admin, user, and developer).
    - To replicate real world activities and instantiate HSBC theory/protocols/methods
    - To represent 'external' influences (e.g., ever-changing views/norms, local/societal demographics, and processes of individuals and societies) that in turn influence both physical and cognitive environments.

2.2.4 VV&A

Membership:

- Dean S. Hartley III, Principal, Hartley Consulting (chair)
- Marina Arbetman-Rabinowitz, Sentia Group and the Claremont Graduate University, (co-chair)
- Michael Bailey
- Pauline Baker
- Chuck Barry
- Todd Brethauer
- Alok Chaturvedi
- Claudio Cioffi-Revilla
- Rick Cunningham
- Jack Goldstone
- Ari Greenberg
- J.C. Herz
- Charles Macal
- Brett Marvin
- Mary McDonald
- Jimmie McEver
- Anne McGee
- Lisa Moya
- Jennifer O'Connor
- Maureen O'Mara
- Michael Ottenberg
- Brett Pierson
- Eunice Santos
- Gary W. Schaeff
- Stephen Shellman
- V.S. Subrahmanian
- Ben Wise

- Jordan Willcox
- Ted Woodcock

Presentations:

Dr. Dean S. Hartley III is the Principal of Hartley Consulting and has done work in VV&A for 35 years. Hartley presented the paper, "VV&A for DIME/PMESII Models."

Verification and validation (V&V) are difficult processes and the complexity of the DIME/PMESII (diplomatic, information, military, economic/political, military, economic, social, information, infrastructure) domain adds to the difficulty. However, V&V, under the proper approach is not impossible and supports the need for accreditation (the "A" in VV&A). This paper describes a risk-based, entrenched methodology that meets the needs of DIME/PMESII modeling. The paper also covers the special cases of agent-based models and compressed and hyper-compressed VV&A.

Dr. Marina Arbetman-Rabinowitz, of the Sentia Group and the Claremont Graduate University, presented the paper, "Time to Measure Up: Dirty Little Secrets in Data Collection Or on how Econometrics is Easier without data."

According to Arbetman-Rabinowitz, in political economy there are an abundance of theoretical postulates and models, yet very few indicators and measures are developed to test the validity and reliability of the arguments beyond contrasting the results to reality. She said this is particularly evident in the lack of value placed on data collections, with little to no emphasis attached to maintaining time series data bases that relate to variables beyond the economic realm. Modern data-collection techniques allow us to **systematically** collect information about our objects of study (people, objects, phenomena) and about the settings in which they occur. The constraints in availability of data are one reason why data is collected haphazardly; and as a consequence makes it difficult to answer our research questions in a conclusive manner. The presentation charted the steps to successful data collections through specification before estimation, operationalization, data collection techniques, data collection and measurement repeatability, reproducibility, accuracy, and stability.

Often the Failure of Predictive Models is due to inaccurate specification and poor data collection:

- Fundamentals of applied work require a problem oriented approach rather than technique oriented approach
- Hierarchical Modeling: The organizing question should navigate across theories, models and levels of analysis
- Specifications of variables: require Concepts and Operationalization (semantics and ontology)
- Inventory of concepts, variables and specifications is needed
- Data Integrity, Consistency, Maintenance, and Dissemination are required
- Reliability and Validity Tests of operational qualitative and quantitative variables must be performed

Discussion Topics:

The following were the formal discussion topics:

- Given the scope and breadth and varying depths of the methodologies (theories and computational modeling techniques), tools (models and systems of models), data related issues and econometric techniques (time series, static, real-time)
    - How should we organize these dimensions to make them comprehensible in a useful way?
    - Assuming VV&A can help us with this organization by structuring what we know about them, how do we make that happen?
    - What do we want from HSCB models, annotated by "wishful thinking," "possible in the future," "possible in the near future," and "possible now"?
- Data Requirements – Has this been a limiting factor?
- How much time is allocated in your projects to data related items?

- How can data help improve your efforts? What are the gaps? Ideal world?

The group performed two brainstorming efforts. The first addressed the question of organizing the methodologies, tools, data, and techniques. The consensus was that V&V should be used to create tags that define the items to a much greater depth than is usually found in model catalogs and that a visualization tool should be created to allow a user to search and identify items that meet the user's criteria. The group created an initial list of tags, as follows:

- General characteristics
    - Systemic Organization – Inputs, Processes, Outputs
    - Academic Discipline
    - Function – Outcomes produced
    - Assumptions Used
    - Level (strategic, operational, tactical)
    - Domains: land, sea, air, space, cyberspace
    - Time – Forecasting, Assessment, Historical
    - Granularity: Sub-individual, Individual, Group,
    - Coverage of DIME/PMESII
    - Methodological Approach
    - Representation: Descriptive, Observation, Intervention
- Secondary characteristics
    - Update rates on Data
    - Update to the Model (granularity in time)
    - Military Functions, maneuver, fires, C2, intel, sustainment
    - Surfboards: training, analysis, T&E, planning, operations
    - # of sides – where can model be used ..
    - Deterministic vs. stochastic, closed form vs. human in the loop.
    - Pedigree- metadata data – characteristics of data
- User Needs characteristics
    - Owner / How do I acquire it (COTS, MOTS, web services)
    - Ease of use
    - What is time / effort / cost of usage
    - Maintenance (software & training) requirements
    - Interoperability with other systems (DoD, agencies, allies)
    - Tactically mobile, reliable, networked

The second brainstorming effort created a set of possible end-user questions that HSCB models would need to address. The group was not able to define how easily these questions could be answered. Following the workshop, a number of participants emailed their responses. These were collated and are shown in Figure 5.

Why people become insurgents?	2
Why are people X becoming Insurgent Y in location Z?	3
Which of these people are becoming insurgents?	3
How do I "reverse this"? How long? What will it take?	6
How are the red team going to respond to our actions? Who is the red team?	5
Given limited $$, what part of DIME should we invested in?	4
Given desire for success, which COA should be done?	3
Tools that provide situational awareness and short-term forecasting. (Desired)	1
What are the consequences including unintended of our actions?	4
How robust are results against uncertainty? Model incompleteness – other possible answers.	5
What are the system drivers / interaction mechanisms of the results.	3
Scalable organizational performance model of social institutions [city/town]. (MPICE).	2
Model that accommodates all theories, or knows why not.	6
Bridge training/education/operations – all tailored to be the same, see book "Ender's Game".	7
Do we want a GIG (global information grid) service of DIME/PMESII. We want something that plugs in a question and spits out an answer relative to the population.	7
Technical –	
models should measure outcomes and not inputs. Not by what you do, but by what happens when you do it.	3
Standardized, interoperable data. Needs to be available on point to the end user and automatically enforced. Knowledge of what model does not do.	5

Figure 5. Estimates of Number of Years to Solve Needs

There was not enough time to fully discuss the questions on data gathering during the workshop. The questions were emailed to the participants and the responses are shown in Figure 6.

Have data requirements been a limiting factor? (1= very, 10=none)	
1-2	
3-4	
5-6	
7-8	
9-10	
How much time is allocated to your projects for data related items?	
0-10%	
11-20%	our problem is not as much with the lack of time devoted to trying to find data/information … more with the difficulty of finding what can support the modeling need
21-30%	Problem of incomplete time series and lack of correspondence between concepts and available data
31-40%	
41-50%	
How can data help improve your efforts? What are the gaps? Ideal world?	
Real world data can help us better select the relationships, functional forms, and parameters we use in our modeling efforts. The gap is that information is hard to find, or when found, must go through a non-trivial 'conversion or translation process' to be usable by certain models. Ideal world is that all of the different USG projects collecting HSCB-type information have a link on some common 'portal' that USG (or their contractors) can access -- may be classified.	
Especially need baseline socio-cultural data in areas of operations before US intervention/occupation so that ? /t can be measured.	
Economic data is the most accessible, therefore social concepts get translated into economic variables with too many degrees of separation. Need a clear ontology of concepts across social scientists.	
We need an overall community data creation effort. There is a methodology for building a library of these taxonomies to create standards for building datasets, but it would be helpful to better understand the scale, range, metrics of needed data.	

Figure 6. Impact of Data Gathering

During the general discussion, a number of points were made that have been collected and organized:

- VV&A issues
  - Definitions
    - Verification is the process of determining that a model or simulation implementation accurately represents the developer's conceptual description and specification
    - Validation is the process of determining the degree to which a model or simulation is an accurate representation of the real-world from the perspective of the intended uses of the model or simulation.
    - Accreditation is an official determination that a model is acceptable for a specific purpose
  - Actually doing VV&A
  - Standards of accomplishment
  - Agent-based models
  - Theology: are precise definitions, levels of accomplishment, descriptions of pitfalls more important than getting started with performing VV&A?
- Data VV&A issues
  - DIME/PMESII data V&V has similarities to combat model data V&V; however, significantly larger complexity of the data sets means the V&V is done at the variable level by [time span & country (or unit of analysis), conceptual definition]
  - [Standard/original source] Data sets are never really ready for use – require clean up to fit current need
  - Need Central Library with concepts, variables, metadata (Data dictionaries, semantic descriptions, ontologies), granularity & validation, needs to include qualitative data as well as quantitative data

    - A concepts to measurements workshop would be useful
        - Outcomes vs. outputs [counting # of flyers distributed is not same as measuring the impact of the information operation]
- Theories & methods need V&V equivalent, just as have need for VV&A of data & tools
    - In the sense of detailed "examination" of same to produce "tags"
    - Need standards for the tags
- Lack of data
    - Wealth of models
        - No data or insufficiently "good" data to test them
    - How to look at what is available, what is not available –
        - create synthetic data? Anonymous data?
        - Who can get best data – not necessarily the classified data
    - Database maintenance & poor dissemination of data & metadata
    - Models that use "similar" data to the data that are really needed for the model may have dissimilar outcomes from what they ought to have – because there is an additional implicit model of the real data by the "similar" data
        - This is a thing that VV&A needs to look for
- Legal issues
    - Data Ownereship
        - Who owns data/intellectual property
        - If the government owns it, it may be subject to FOIA release
        - It may be illegal for the government to own or even store some data
        - Government sponsored projects and attendant data restrictions and requirements
    - Consequences
        - What happens when data collected for one purpose (passive) is made available to support US military operations? Are original (non-military) researchers potentially liable?
        - What happens when incorrect data is used to formulate policy that harms innocent individuals?
        - Lawyers to keep you from being sued when someone you interviewed is killed
        - FISA and the Telecom companies
    - Distribution restrictions
        - Classification
        - Academic retention until publication
        - Privacy issues
- The want is for data vs. model co-evolution
- Deciding how close we are to being able to do X (answering a particular question) is hard
    - We can almost always build a model that purports to do X
    - How do we know if it really does X?
    - How do we know when we will be able to do it in future?
    - What data are needed to do testing of whether X is done? Time & money are involved in getting the data.
- Added Value of Workshop: Opening of Communications
    - People come up afterwards and say – yes (or no)
    - Working Group is sending out to group for post-workshop feedback: Group could not agree on whether these some **could** be answered.

The group also created a set of recommendations to NDU:

- Define Data
    - Start with PITF data gathering project and extant data list
    - Consider whether HSCB modeling requires a larger data set
    - Define metadata requirements

    - Parcel out conceptual islands for validation of concepts-measurements
    - Gather and analyze data
        - Commission searches through social sciences professional societies
        - Hold a conference to refine metadata and data V&V
        - Commission a multi-disciplinary group to perform rough V&V for metadata tagging purposes
- Define Theories
    - Start with extant theory list
    - Define metadata requirements
    - Gather and analyze theories to models
        - Commission searches through social sciences professional societies
        - Hold a conference to refine metadata and theory V&V
        - Commission a multi-disciplinary group to perform rough V&V for metadata tagging purposes
- Define Methods
    - Start with the Encyclopedia of Operations Research and Management Science
    - Define metadata requirements
    - Gather and analyze methods
        - Commission searches through INFORMS and MORS
        - Hold a conference to refine metadata and method V&V
        - Commission a multi-disciplinary group to perform rough V&V for metadata tagging purposes
- Define Models
    - Start with the extant list of DIME/PMESII models (Hartley, NRL, JFCOM, OSD PA&E)
    - Define metadata requirements (start with DIME/PMESII Model VV&A Tool and above sources)
    - Commission a multi-disciplinary group to perform rough V&V for metadata tagging purposes
- Hold a Data Library Concept Workshop (after above work)
    - Consider the potential problems of a Data Library
    - Consider the options: central library, virtual library (distributed), government vs academic vs joint
    - Consider the legal issues
    - Consider the data maintenance, creation, VV&A, tagging, and funding issues
- Hold a Measures of Merit (MOMs) Workshop (after first four items)
    - Outcomes vs outputs vs inputs measures [counting # of flyers distributed is not same as measuring the impact of the information operation]
    - Desired MOMs vs availability of data vs model conversion of data to MOMs

Expressed needs:

- Particular questions
    - Why people become insurgents?
        - Why are people X becoming Insurgent Y in location Z?
        - Which of these people are becoming insurgents?
        - How do I "reverse this"? How long? What will it take?
        - How are the red team going to respond to our actions? Who is the red team?
    - Given limited $$, what part of DIME should we invest in?
    - Given desire for success, which COA should be done?
    - Tools that provide situational awareness and short-term forecasting. (Desired)
    - What are the consequences including unintended of our actions?
    - How robust are results against uncertainty? Model incompleteness – other possible answers.
    - What are the system drivers / interaction mechanisms of the results.
    - Scalable organizational performance model of social institutions [city/town]. (MPICE).

    - Model that accommodates all theories, or knows why not.
- Supporting research needs
    - Central Library with concepts, variables, metadata (Data dictionaries, semantic descriptions, ontologies), granularity & validation, needs to include qualitative data as well as quantitative data
    - Data Integrity, Consistency, Maintenance, and Dissemination are required
    - Reliability and Validity Tests of operational qualitative and quantitative variables must be performed
    - Legal issues regarding data collection and storage need to be identified
    - Concepts to outcomes (measures of merit) connections
- Model architecture needs
    - Bridge training/education/operations – all tailored to be the same, see book "Ender's Game".
    - Do we want a GIG (global information grid) service of DIME/PMESII. We want something that plugs in a question and spits out an answer relative to the population.
    - models should measure outcomes and not inputs. Not by what you do, but by what happens when you do it.
    - Standardized, interoperable data. Needs to be available on point to the end user and automatically enforced. Knowledge of what model does not do.
    - Models, data, methods, & theories all need to be characterized with tags (done with a type of V&V), with visualization tool to find desired entries
    - Hierarchical modeling to navigate across theories, models and levels of analysis
    - Data and models should co-evolve
    - Best practices guide for VV&A of models and data

2.3 PROBLEM DOMAIN WORKING GROUPS

The workshop included four problem domain working groups: deterrence, counterinsurgency, counter-terrorism, and SSTRO. The description of each working group and its results is divided into membership, presentations, discussion topics, and expressed needs sections. The "expressed needs" are those statements from the working group that most directly addressed the Workshop purpose.

2.3.1 Deterrence

Membership:

- Pat McKenna, STRATCOM (chair)
- Yuna Wong, OSD (co-chair)
- Myriam Abramson
- Katherine Banko
- Loren Cobb
- Skip Cole
- Max Crownover
- Ivy Estabrooke
- Richard Hayes
- Krista Hendry
- Jonathan Jackson
- Richard Lobban
- Charles Macal
- Robin Marling
- James Morris
- Jennifer O'Connor

- Eunice Santos
- David Siegel
- John Sokolowski
- V.S. Subrahmanian
- Peter Tikuisis
- Jordan Wilcox
- Bill Young

Presentations:

Mr. Pat McKenna is the Senior Advisor – Analysis, STRATCOM, Plans and Policy Directorate. His current focus is developing and implementing approaches to enhance the analytic foundations of the command's plans. Specific activities include deterrence and PMESII assessment capabilities. McKenna presented "The Deterrence Analytic Challenge."

According to McKenna, the analytic processes used for Assurance/Dissuasion/Deterrence (ADD) have changed little since the Cold War, when defense analysts focused on mutual deterrence between two nuclear-armed adversaries. Since deterrence proved successful, and bi-polar competition remained relatively stable for decades, each government began to believe that it understood the other's values and motives. Today, we are faced with different types of ADD and policy analysis. Our actions and policies target, or indirectly affect, entities that may or may not be legitimate governments, may or may not be conventional military powers, and may or may not share our cultural norms. The world is now a multi-polar environment, where our objectives against one player may be achieved or thwarted by our actions against another. Our deterrent actions include not only threats of cost imposition, but also the promise of benefit denial and incentives for restraint. The effects of actions propagate through other players whose strategic interests are differently aligned, making the net effects difficult to understand beforehand or measure afterwards.

McKenna continued with an analysis of the elements of deterrence and the nature of the problem, which was labeled a "wicked problem." (The definition was included, but basically came down to a "really bad" problem.) McKenna listed Operations Research, game theoretic, and social sciences techniques that are applicable to the problem.

Deterrence Central Idea (from DO JOC exec summary)

The central idea of the DO JOC is to decisively influence the adversary's decision-making calculus in order to prevent hostile actions against US vital interests. This is the "end" or objective of joint operations designed to achieve deterrence.

An adversary's deterrence decision calculus focuses on their perception of three primary elements:

- The benefits of a course of action.
- The costs of a course of action.
- The consequences of restraint (i.e., costs and benefits of not taking the course of action we seek to deter).

Joint military operations and activities contribute to the "end" of deterrence by affecting the adversary's decision calculus elements in three "ways":

- Deny Benefits.
- Impose Costs.
- Encourage Adversary Restraint.

The "ways" are a framework for implementing effective deterrence operations.

Problem Overview

- Deter adversary X from doing Y under Z conditions

- Three broad areas of assessment
    - Foundational elements (or building the baseline understanding of the adversary)
    - Pre-action assessment (or deterrence planning)
    - Post action assessment (or examining the effect of an executed action)
- Complicated by
    - Uncertainty
    - Conflicting theories and approaches
    - Unknown (really not knowable) deterrence threshold
    - Nth order effects
- Applicable methodologies and tool will vary by X, Y, and Z as well as area of analysis

Dr. Yuna Huh Wong is a Senior Studies analyst for SAIC supporting OSD PA&E Joint Data Support (JDS). She is the lead JDS analyst for irregular warfare (IW) and human behavior representation (HBR). Wong presented the paper "A Methodology for Valid, Fast, Cheap, and Practical Analysis of Irregular Warfare Using War Games with Computational Adjudication and Analysis Tools."

Her paper described the extended war game, or X-game, which is the OSD/PA&E political military game with extended (week long) turns to allow for extensive adjudication. It was applied to the Global War on Terror (GWOT) but has the design characteristics needed for irregular warfare in general. In her paper, Wong discussed statistical analysis and robustness issues with respect to the game. She also discussed data mining and ontologies as analysis tools.

Discussion Topics:

General discussion produced the following points:

- Phrasing is wrong, it is influence
    - Deterrence is one subset
    - Others
        - Theater security cooperation
        - Dissuasion
        - Containment
        - ……
- Deterrence Operations JOC definition of deterrence assumes rational choice economic models
    - Behavioral aspect needs to be brought in
- Don't necessarily know who attacked us
    - But can target terrorist financiers, logisticians
    - Need to broaden the problem space
- Success only measured by lack of behavior?
    - Doesn't make sense: trying to prove a null
    - Indications of "success" exist but can you link a deterrent action to an indication?
    - Can we model deterrence failure instead?
- Decision makers comfortable with partial solutions
    - Small and focused models (not mega models)
    - "Magic" models that incorporate everything may give poor answers
- Needs / approaches discussion
    - Focus groups suggested as an approach to examine deterrence issues
    - Need cognitive models (of who you are trying to deter)
    - Does work in social sciences on deterring criminal activity apply to other actors?
    - Historical case studies (e.g., studies of pre-WWI telegrams)
- Other issues:
    - Including influence gives other metrics
    - Deterrence is just one part of influence

    - Cyber deterrence
    - Challenge of linking US actions to outcomes
- Who is the adversary? (Need to focus problem)
    - To advance the discussion, you have to get concrete: specific examples
    - Decompose goals to create a process, then have something more actionable to watch

The working group then split into five subgroups to discuss how different actors might require different approaches to deterrence (the "Isolated small groups" possibility was not discussed).

X (Actor)	Y (Deterring Entity)	Z (action being deterred)
Individuals (hackers)	U.S. government	Hacking
Small groups (Symbionese Liberation Army)	U.S. government (law enforcement)	Violent acts
Isolated small groups (British med students)		
Organized crime (Colombian drug cartels)	U.S. and Colombian government	Drug trafficking
State (Saudi Arabia)	U.S. government	Building schools that teach extremist ideology
Non-state actors (al Qaeda)	U.S. government	Attacks against U.S. targets (9/11 and now)

Figure 7. Subgroups of Deterrence WG

Individuals:

- Example: hacker
- Motives
    - Build reputation
    - Personal financial gain
    - Direct damage
    - Retaliation
- Issues:
    - Small barrier to entry, one person can cause significant damage
    - Identification of the individual
    - Attribution, location
    - Understanding intent and motivation
    - What they value
- Carrots:
    - Options for promoting desired behavior?
    - Reward for hacking (challenge – build reputation but in a positive way)
- Sticks:
    - Hack back? But potential escalation
- Tools:
    - Systematically explore motivations for individuals to get to root causes
    - Profile, understand demographics and bound solution space
    - Is it worth it to build expensive tools to deter an individual? Maybe it is, because of the potential damage
- Other issues:

- Cyber mechanism – used for trafficking and other destabilizing issues
- Damage from propaganda
- Application of contagion framework
- Cyber bribery?
- Nigerian fraud rings

Small groups:

- Symbionese Liberation Army
  - Violent actions: kidnapping, bank robbery, agitation, context of 1960s radicalism
  - Motivations: anti-war, anti-authority
- Do we deter?
  - Deter next generation from organizing
- Law enforcement authority
  - How well financed, observed is the authority?
  - How aggressive in operations and in infiltrating?
- Issues:
  - Group repurposing – deterrence fails
    - Why do groups repurpose? What are the mechanisms?
  - How to raise flags about isolationist behavior
    - Can we detect it?
    - Can we model it?
  - Surveillance – does it deter? (let's watch UK experience)
- Generalizations:
  - Law enforcement approach generalizes
  - Model functions (e.g, police arrest, surveillance, patrol, etc)
- Hypothesis
  - Law enforcement's effective presence must have been factor in decline of these groups in the US
  - Decline of relative gains; prosperity, social cohesiveness, inter-ethnic relations in US
  - Good state suppresses
  - Small group violence has declined with the rise of the state
- Foreign groups
  - Deter, neutralized, kill
  - Classifying: part of larger group? Tools will likely vary depending on answer.

Organized crime:

- Example:
  - Colombian drug traffickers – loose coalition of opportunistic groups
  - Who is deterring: US and Colombian government
- Who is doing the smuggling?
  - People with long history, experience, education in violence who weren't offered an effective way to repatriate into society
  - How do you send an appetizing message to these types of people?
- Analytic difficulties:
  - Unintended consequences (rerouting drug flow)
    - Nth order effects
  - Adaptive organizations
  - Governments try only part of the solution set
    - Need to include "host" country elements in tools
  - How to create a niche in a fully formed society for disaffected members
    - Modeling equivalent positions (stature/pay/authority)

- Issues:
    - Groups may be multi-functional?
        - Drug gangs also street gangs who control territory
        - Smuggling drugs may just be providing $ for other activities
    - Model process from security → criminal organization?
        - Modeling transition of group purpose
    - Corruption
        - Do we apply U.S. view or their view? Is their an "acceptable"/ "expected" level of corruption?
        - Everyone is corrupt except our group – helping own group is not corruption (may even be killed otherwise)
    - Modeling or data collection problem
    - What are the situations when arrests don't become convictions?

State:

- Example: Saudi Arabia
    - Deter Saudi government from building schools with radical ideology
    - Context: Wahabbism, want to maintain relations with the Saudi government
- Analytic issues:
    - Don't want to look like you're against Islam
    - How fragile is the Saudi government?
    - Variables: perceptions of domestic audience
- Generalizeable issues:
    - Overt vs covert deterrence actions
        - Can't look like the US made a government do something
    - Lack of intelligence (lack of data)
    - US biases
    - Nth order implications
    - Influence, not deterrence
    - Model is of context, not just target, including outside perceptions
    - Small models versus capturing the context (tendency to scale up model to try to capture context)
    - Scale about the seriousness of the threat when deterring states (Saudi textbooks vs. North Korean nuclear weapons, Venezuelan oil output)
        - How should models incorporate implications of deterrence failure? (think allocation of resources to n deterrence challenges – which ones get resources?)
    - Model the entire state
        - Oil: U.S. moving sources to African oil
        - Osama bin Laden is a Wahabbi
        - Saudis also building mosques like crazy – need some kind of antidote to rival or be an alternative (Saudis really opposed to other kinds of groups)
    - Likely need to include more than one state in the tools

Non-state actors:

- Example: US deterring al Qaeda before 9/11 and now
- Issues:
    - Any government will be at a disadvantage when going against a group like al Qaeda b/c it is a set of nodes that do anything they want
    - Network does ideology, financing, but don't have rigid command and punishment structure
    - Any group within the network is agile – can have their own targeting plan, able to adapt to local conditions

- Recommendations
    - If can't deter, can try to contain (containment is another type of influence)
        - Need model or tools to describe containment strategies and try to see why some work or fail
    - Can try to accelerate demise of al Qaeda by encouraging fractionalization
        - Model of fractionalization in non-state actors
        - What types of exogenous factors increase fractionalization? Also a weakness of decentralized networks
    - Copycat effect
        - How do we model it?
    - Sterilize environment
        - Try to change operational environment to change ability of al Qaeda to spread; and support successful local efforts financially
        - Need tools to model spread
    - Modeling deflection
        - Changing potential terrorist target characteristics to make them less vulnerable (and understand how that causes a shift in likely targets)
    - Ideological battle, US should be quiet
    - Raise profile of SMEs and on-the-ground people: improve their access to decision makers (nobody was listening before 9/11 even though bin Laden's activities were clear to Sudanese experts)
- Issues:
    - Deflection: US and Israel deflected embassy attacks (analogy from criminal literature shows that police action deflects criminal activity to other areas)
- US deterring
    - Too many franchises under the umbrella, extreme decentralization makes them impossible to deter
- Recommendations
    - If can't deter, can try to contain (containment is another type of influence)
        - Need model or tools to describe containment strategies and try to see why some work or fail
    - Best to let regional actors in the Middle East – they have better ways to influence
        - Watch what is working in Saudi Arabia, etc.
        - Means models must be broad (numerous countries)

The group returned to a general discussion with the following points:

- Whole range of possibilities for influencing makes sense
    - Deflect, deter, influence, attract, etc.
- Unintended consequences
- Building tools – the next workshop?
    - What kinds of tools are being built?
    - Do we know how to build models?

Expressed needs:

- Particular questions
    - Deterring hacking
    - Deterring violent acts by small groups
    - Deterring drug trafficking
    - Deterring states from unwanted social actions
    - Deterring non-state actors
- Supporting research needs

    - Cognitive models (of who you are trying to deter)
    - Does work in social sciences on deterring criminal activity apply to other actors?
    - Historical case studies (e.g., studies of pre-WWI telegrams)
    - Understanding intent, motivations and things valued by hackers
    - Does surveillance deter small groups
    - Influencing organized crime groups
    - Understanding and defining corruption
    - Defining economic alternatives for organized crime members
    - Understanding containment strategies for non-state actors
    - Understanding fractionalization of non-state actors
    - Understanding fragility of governments
    - Influencing states
- Model architecture needs
    - Small and focused models (not mega models)

2.3.2 COIN

Membership:

- Jack Goldstone, George Mason University (chair)
- Brett Pierson, J8 WAD (co-chair)
- Chuck Barry
- David Carment
- Conrad Crane
- Richard Cunningham
- Jennifer Edwards
- Roger Hillson
- Larry Kuznar
- Lauren Lee
- Michael Manno
- Dennis McBride
- Anne McGee
- Lisa Moya
- Richard Pei
- Victoria Romero
- Al Sciarretta
- Stephen M. Shellman
- Barry Silverman
- Al Sweetser
- Mike Vlahos
- Paul Wise
- Paul Works

Presentations:

CDR Brett Pierson, has served as the Commanding Officer of VFA-147 and is now at The Joint Staff/J8 Warfighting Analysis Division. He presented "The Hairball that Stabilized Iraq: Modeling FM 3-24."

In December 2005, an Army-Marine Corps writing team began revising the existing Army field manual on Counterinsurgency. Guided by LTG David Petraeus and LTG James Mattis, the group strove to balance the lessons of the past with contemporary insights and future projections. Early in the process the team wrestled with

the overall approach to be taken. One option was an enemy-centric approach that would emphasize the elimination of opposing combatants as the key to long term success. Realizing that such activities were an important element of any COIN strategy, the team decided that persistent success could only come from a population-centric approach which aimed to gain the support of the people for the counterinsurgent. From that decision flowed a broad comprehensive doctrine emphasizing a whole range of activities beyond just security, involving a set of intertwined and supporting Logical Lines of Operation.

CDR Pierson then explained the lines that show the doctrine and comprise the model of FM 3-24, shown in Figure 8.

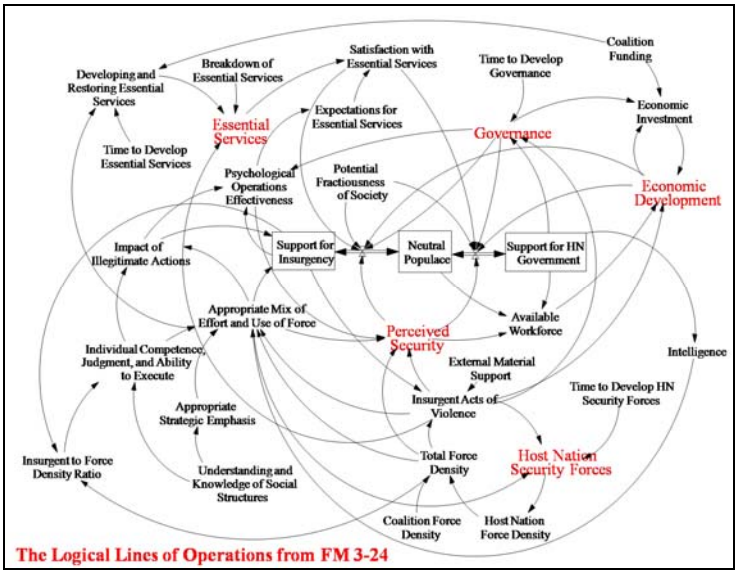

Figure 8. The FM 3-24 "Hairball"

Dr. Jack A. Goldstone, Virginia E. and John T. Hazel Jr. Professor of Public Policy and Eminent Scholar, George Mason School of Public Policy, presented "Modeling Macro-systemic Change for Counter-insurgency."

The systems model presented by CDR Pierson gives a good sense of the complexity of the relationships involved in suppressing counter-insurgencies. One must pay attention to the dynamic relationships driving the insurgents, affecting the broader populace, determining the effectiveness of the military and police, and underlying the stability or instability of the local and national governments. This is a multi-player game with changing conditions, and thus one of hardest situations to model with simple rules and equilibrium outcomes. According to Goldstone, reconstruction rests on four major pillars: security provision, economic reconstruction (jobs and incomes), political reconstruction (self-sustaining and administratively effective government), and social service delivery (health, education, sanitation, energy, transport). However, Goldstone finds the usefulness of the model is limited to its schematic representation and the support it gives to decision makers in building a set of categories around which to frame their own mental models, rather than any use in running the model on a computer.

Goldstone described an eight-fold matrix, in which each pillar is tracked by a cluster of measurements of which some aim to track changes in security, economic growth, services, and government, while others aim to track the fairness of those changes through distributional measures. However, global metrics are meaningless in specific cases. He said that each country case requires its own set of metrics. He did suggest the following metrics:

(1) Security: Body-counts, but not where more bodies of insurgents is good. Rather, body-counts caused by insurgent and government action are both bad.

(2) Governance: The critical overall element of governance is not participation, or equality, or democracy – it is trust. If one can get truthful answers to a single question: "How much do you trust the government to protect you and act responsibly?" one can measure governance much more effectively than by looking at constitutions or officials' actions.

(3) Economics: Economists have taught us that the key to economic stability is not current data, but expectations.

(4) Social Services: The key to such services is not simply to provide them, but to make sure that they can be sustained by the local or national government once foreign support is withdrawn.

Discussion Topics:

- Additional information needed for COIN
  - Better definition of COIN
    - Include situation in which country has weak or no government
    - Coordinate definition with other related areas: counterterrorism, SSTRO
      - Terminology problem: Too many terms that overlap; have semantic inflation
  - Better understanding of need for COIN tools above/below brigades
    - How do we delineate which tools are for the right people
      - E.g., BDE Cdr needs a community model to see possible issues at his level
    - Solicit feedback from small units about information needs
      - FM 3-24 model is a higher level model, need simpler tools for small units
  - If we allowed people to look domestically at conflict, would we get farther along to build the methodologies and the underlying functions of the models
    - How would it be different for non-domestic modeling?
- FM 3-24 Model
  - Uses system dynamics to model COIN
  - Need to address agent-based models in the model
  - Has not been validated with real-world data
  - What type of research is needed to make this a practical tool?:
    - Not an enemy-centric model (e.g., Al Qaeda did a lot of things wrong)
    - Program is hard-wired from US viewpoint – if you don't get with the U.S. program then you're an enemy
  - Model has three terms that need FAR better definition and recognizable measures
    - Understanding and knowledge of social structures
    - Appropriate mix of effort and use of force
    - PSYOPS effectiveness
  - Need for understanding local legitimacy
  - Need better understanding of why/how people move in groups not as individuals from one state (e.g., neutral) to another (e.g., pro-government)
  - Need to understand the impact of criminal element
  - Need to include inter-Agency involvement (the DI_E pieces)
  - Need to design models to be able to handle more than one insurgency at a time
    - Non-state actors; religious sects; criminal
      - May attack each with a different line (military, diplomatic, economic)
  - FM 3-24 model is focused on reduction of violence – need other assessment of other insurgent actions and outcomes
  - Need to "unpack" what is included in "Support Insurgency"
- Other considerations
  - Consider using psychologists from industry
  - Need to be more open about what we are doing – pos. image

        - Proceed with caution to prevent anti-DoD view
    - Need closer relationships with Non-DoD organizations and NGOs

Expressed needs:

- Particular questions - none
- Supporting research needs
    - Need for understanding local legitimacy
    - Need better understanding of why/how people move in groups not as individuals from one state (e.g., neutral) to another (e.g., pro-government)
    - Need to understand the impact of criminal element
    - Need to include inter-Agency involvement (the DI_E pieces)
    - Ability to model "trust"
    - Ability to add "governability" in the analysis
    - MOPs and MOEs for assessing progress
    - Know how people will react to an action
    - Understand/know about social structures: leaders/networks/norms
    - Data on local social structures
    - Environmental data that influences HSCB
    - Include medical data (e.g., HIV positive)
- Model architecture needs
    - Need to design models to be able to handle more than one insurgency at a time
        - Non-state actors; religious sects; criminal
            - May attack each with a different line (military, diplomatic, economic)
    - Models that are
        - Tailorable
        - Updated within a resource repository
        - Complex and adaptive while running
    - Bounds for complex, adaptive models
    - Hybrid models with fine grain locations for addressing particular issues
    - A systems architecture so different models can inform each other
    - Integration of data, models, and systems (how do the 4 clubs interact?)
        - Design to allow output of one model (e.g., agent-based) to feed the system dynamics of another system component
        - Need mapping of data across models
            - Include hand-shake across modeling modalities
        - Supporting data needs some agreed on and clearly defined objectives
        - Need cross-disciplinary understanding across modelers and social scientists
        - Need an integrated DIME model
    - Need bits and pieces of models that can used by all and then build from there
        - Framework for tailoring the architecture
    - Data standards, data storage, data mining, data extraction/discovery tools
    - VV&A
        - How do we VV&A tools in a world of competitive analysis
            - For example, joint output that opposes a Service may be discredited by a pro-Service SME
            - How to get something useful to a 3-Star that will withstand scrutiny
        - Need for better evidence-based assessment
        - Need access to social science people who WANT to help
        - How often do we update the model and VV&A it?

2.3.3 CT

Membership:

- Guermantes Lailari, USAF (chair)
- Dipak Gupta, San Diego State University (co-chair)
- Eli Berman
- Deanna Caputo
- Claudio Cioffi-Revilla
- Jesse Citizen
- Gary Citrenbaum
- Lisa Costa
- Jennifer Edwards
- Brian Efird
- Teresa Embury
- Ari Greenberg
- Margaret Hayes
- JC Hertz
- Max Lorenzo
- Jimmie McEver
- Charlene Milliken
- Will Moore
- Matt Nickens
- Maureen O'Mara
- Michael Ottenberg
- Peter Pham
- Jerrold Post
- Kevin Roney
- Bob Sheldon
- Ted Woodcock

Presentations:

Lt Col Guermantes Lailari, self-described career Air Force officer, presented "The Challenges of Modeling and Simulating Terrorism and Counterterrorism."

According to Lailari, the key point in M&S is the validation process. With this in mind, Lailari's presentation portrayed the various assumptions about M&S, what it can bring to the fight and what it cannot (capabilities and limitations). Lailari went on to discuss various technical aspects of terrorism – its means and targets.

Dr. Dipak K. Gupta is a Distinguished Professor in the Department of Political Science at San Diego State University and the Fred J. Hansen Professor of Peace Studies. He is also the Director of the International Security and Conflict Resolution, a multidisciplinary undergraduate program. His areas of expertise include ethnic conflict, collective action, public policy analysis, and quantitative methods. Dr. Gupta presented "Modeling the Dynamics of Terrorist Movements: A Macro Interactive Perspective."

According to Gupta, the level of violence from terrorism and insurgency is the outcome of a dynamic interaction between a dissident group -- which strategically use violence -- and the target government, which offers to engage it with force. The past quarter of a century saw an ever-increasing cascade of empirical studies showing the link between macro economic and social structural variables to the level of conflict in a society. Despite popular belief that poverty, income inequality, and lack political freedom cause terrorism, the econometric studies have come up largely empty handed. The reason for this apparent lack of correlation rests with the fact that the while

the structural variables offer the necessary condition for political violence, the sufficient cause rests with the ability of a political entrepreneur to take the aspects of frustration and frame the grievances in terms of a matter of collective identity, complete with a plan of action. The introduction of an external catalytic agent robs empirical models of predictive capabilities. However, while prediction may be problematic, a careful evaluation of the factors that contributes to the terrorism increasing forces (TIF) and terrorism attenuating forces (TAF) opens up new avenues for its management.

Discussion Topics:

- Multi-disciplinary approach
  - Encourage the marketplace of ideas
- A = Ultimate Outcome:
  - Decreasing violence and increasing governance
- B = Interim Outcome: theory dependent (social sciences)
- C = Research Question (RFP)
- Organize CT goals by ultimate and interim outcomes (C → B → A)
  - For example: interim: moderating violence, encouraging defection
- Establishing causal relationships to achieve the ultimate outcome
- CT Buckets
  - Terrorism
  - Counterterrorism
  - State
  - Non-State
  - Other States
- Overlap

Expressed needs:

- Particular questions
  - How to decrease violence and increase governance
  - How to moderate violence, encouraging defection
- Supporting research needs - none
- Model architecture needs - none

2.3.4 SSTRO

Membership:

- Paul West, USMA (chair)
- Richard Deckro, AFIT (co-chair)
- Cherie Beck
- Jonathan Beris
- Jeff Burkhalter
- Alok Chaturvedi
- Doug Clark
- Dave Davis
- Tom Ferlemen
- LeeEllen Friedland
- Rebecca Goolsby
- John Hummel
- Leroy "Jack" Jackson
- John Lawson
- Danielle Miller

- Brice Nicholson
- Jay Persons
- John Salerno
- Barry Silverman
- Dan Snyder
- Eric Whittington
- Victor Wiley

Presentations:

Dr. Paul D. West, Assistant Professor in the Department of Systems Engineering, United States Military Academy, where he teaches systems engineering, decision analysis, engineering economics, and modeling and simulation. West presented "Human, Social, and Cultural Behavior Modeling for Stability, Security, Transition, and Reconstruction Operations."

West presented concepts and issues in HCSB modeling for SSTRO, examined several tools in development or use, and outlined a new approach, called Dynamic Natural Attribute (DNA) modeling, for generating unique computer-generated entities.

Dr. Richard F. Deckro, Department of Operational Sciences, Air Force Institute of Technology, presented "Issues in Stability, Security, Transition and Reconstruction Operations."

Deckro provided an overview of some of the issues present in conducting stability, security, transition and reconstruction operations in today's operational environment. He reviewed several key directives, reports, and definitions and discussed a number of potential problem areas as areas for future research.

Discussion Topics:

The discussion was oriented on the question of what should models do in 2018.

- Assure that we understand the micro-climate of an area before entry, the linkages between elements of SSTRO and how they feed into one another (inputs/outputs)
    - Maintaining robustness of the model in a dynamic environment.
    - Avoid fighting not only the last war, but the last campaign?
- Prioritize SSTRO to serve total U.S. interests (e.g., DoD, DOS) as well as host nation, coalition, and broader international community
- Balance transition to indigenous groups (clans, tribes, regional, or national), maintaining integrity of host nation decisions while supporting U.S. interests.
    - What if they democratically vote in a theocracy?
    - How do we not impose our will on a free and democratic society?

The group identified several limiters to SSTRO modeling

- Ability to obtain, organize, and access data (e.g., metadata)
- Policy issues for open data access
- Fidelity requirements (these are unknown)
- Available resources
- Lines of authority
- Clash of cultures between models (e.g., ethics by discipline; focus)

Out of the discussion, several key insights emerged:

- Need new look at the problem from new eyes
- Need cross-disciplinary theory of SSTRO
    - If you don't know where you are going, it does not matter how you get there
    - How to prioritize SSTRO

- Model requirements
  - Model must consider NGO, Coalition, and host nation factors at multiple scales
  - Model must be sufficiently flexible and robust to respond to unknown future national security interests
  - Data availability; open shared repository as appropriate. Meta data protocol; require in BAA?
  - Need appropriate sensitivity analysis
- SSTRO "ownership" is bigger than DoD – It must span DoD, DOS, DHS, providing for
  - Common definitions
  - Database architecture management
  - Unity of effort
  - Establishing a Community of Interest, communicating electronically

Expressed needs:

- Particular questions
  - Understanding the operation
  - Prioritizing resources to perform the operation
  - Balancing flow through the SSTR process
  - Assure that we understand the micro-climate of an area before entry, the linkages between elements of SSTRO and how they feed into one another (Inputs/outputs)
  - Balance transition to indigenous groups (clans, tribes, regional, or national), maintaining integrity of host nation decisions while supporting US interests
  - Prioritize SSTRO to serve total US interests (e.g., DoD, DOS) as well as host nation, coalition, and broader international community
- Supporting research needs
  - Need cross-disciplinary theory of SSTRO
  - Accepted measures of effectiveness and performance
  - Clearly defined initial state
  - Clearly defined end state – What does success look like?
  - Thorough understanding of the underlying theories
    - Social
    - Physical
- Model architecture needs
  - Representation of a wide spectrum of cultures and institutions (formal and informal)
  - Representation at multiple scales for Blue, Red, Green
    - Temporal
    - Spatial
    - Demographic
  - Representation of behaviors during conflict, disaster, etc
  - Flexibility in representing different types of operations supporting U.S. interests
  - Criteria for thresholds to determine when transitions occur between S, S, T, and R
  - Criteria for distinguishing friendly locals from hostile
  - Representation of inter-organizational dynamics
  - Representation of situational awareness
  - Representation of dynamic, competing views/needs/priorities by all groups
  - Analytical capability to evaluate balance/ tradeoff options and conduct sensitivity analysis
  - Collaborative planning capability that spans neighborhood to national (possibly multi-national) level
  - Architecture the supports PMESII M&S interoperability and reuse
  - "Service bus" for data repositories
    - Provides management and error checking
  - Dynamic Data Driven Application Systems with real-time forecasting

- Ability to obtain, organize, and access data (e.g., metadata)
- Policy issues for open data access

3. FUTURE HSCB TASKS

The workshop participants were asked to suggest future HSCB tasks. These suggestions have been organized into five groups:

- Metadata, Metamodels, and Support Structures,
- Collect Data,
- Validate Existing Models,
- Build HSCB Models, and
- Education.

3.1 METADATA, METAMODELS, AND SUPPORT STRUCTURES

3.1.1 Identify Data and Its Sources

HSCB models will have wide variations in their data requirements. Some of the data will need to be current and detailed data for a specific situation. However, some data requirements can be met by historical data or from analysis of historical data (e.g., trends). Numerous data sources exist; however, some are derivative, with the potential for introduced errors, and some are derivative with corrections added. Model users will need identification and descriptions (metadata) for the various sources. In addition to the descriptions of the data items, descriptions and explanations of the range of methodologies that are used to gather data (from true experimental through naturalistic qualitative observation) will aid in informing users about the choices to be made.

Data on human behavior related to non-traditional challenges is a DoD-wide problem. Although DoD is making significant investments that often yield data that would be useful to other users within DoD, it can be difficult to find. Having the three major DoD investment areas in social science (HSCB, Minerva, and Human Terrain) adopt a common metadata standard for data generated through their projects would benefit many users.

Data Definition Project:

- Start with PITF data gathering project and extant data list
- Consider whether HSCB modeling requires a larger data set
- Define metadata requirements
- Parcel out conceptual islands for validation of concepts-measurements
- Gather and analyze data
    - Commission searches through social sciences professional societies
    - Hold a conference to refine metadata and data V&V
    - Commission a multi-disciplinary group to perform rough V&V for metadata tagging purposes

3.1.2 Identify the Theories of the Social Sciences

Several people bemoaned the lack of a set of codified theorems, generalizations, and “rules” in social science. Others noted that there are theories, but few of them have been validated empirically. In fact, in anthropology alone there are uncounted theories. They are based on observed behavior, but few enjoy unanimous acceptance. There is also the issue of fragmentation within the field, which means that nowadays anthropology and probably the other social sciences are producing fewer generalists and more people with very narrow areas of expertise. This works against the production of broad theories.

Theory Definition Project:

- Start with extant theory list

- Define metadata requirements
- Gather and analyze theories to models
    - Commission searches through social sciences professional societies
    - Hold a conference to refine metadata and theory V&V
    - Commission a multi-disciplinary group to perform rough V&V for metadata tagging purposes

Theory Validation Project:

If a list of validated theories or generalizations is seen to be necessary, then scholars should be paid to gather the studies that validate or refute theories. This would be a long-range effort that might not yield as much fruit as could be hoped. But a start could be made.

3.1.3 Identify the Methods of OR and the Social Sciences Relevant to HSCB Modeling

HSCB models will inevitably be composed of both social science theories and OR methods. Some OR methods will be clearly applicable to HSCB modeling, others may be clearly inapplicable; however, many methods may be useful in some context, but will require some thought to identify the proper contexts.

Methods Definition Project:

- Start with the Encyclopedia of Operations Research and Management Science
- Define metadata requirements
- Gather and analyze methods
    - Commission searches through INFORMS and MORS
    - Hold a conference to refine metadata and method V&V
    - Commission a multi-disciplinary group to perform rough V&V for metadata tagging purposes

3.1.4 Identify the HSCB Models

Numerous models claim to be useful in the DIME/PMESII domain; however, the extant lists of such models do not contain enough information to determine in which part of the domain they might be useful. This effort might be coordinated with the VV&A area, below.

Models Definition Project:

- Start with the extant list of DIME/PMESII models (Hartley, NRL, JFCOM, OSD PA&E)
- Define metadata requirements (start with DIME/PMESII Model VV&A Tool and above sources)
- Commission a multi-disciplinary group to perform rough V&V for metadata tagging purposes

3.1.5 Identify the MOMs for HSCB Modeling

Proper Measures of Merit (MOMs) are critical for useful HSCB modeling. Clearly using a bad MOM can lead to incorrect decisions. However, it may be impossible or very difficult to model some MOMs directly. It will take some thought to determine whether it is better to model a particular MOM imperfectly or model several MOMs fairly well and infer the desired MOM.

MOMs Definition Project:

- Hold a MOMs Workshop (after defining data, theories, methods, and models)
    - Outcomes vs outputs vs inputs measures [counting # of flyers distributed is not same as measuring the impact of the information operation]
    - Desired MOMs vs availability of data vs model conversion of data to MOMs

3.1.6 Create a Common Lexicon

A major requirement for HSCB modeling is a vocabulary to promote a common understanding of social science and its disciplines in order to drill down to determine what potential expertise, data, tools, theories, methods, and models may be required for the development of particular tools. There are two candidate methodologies for organizing and maintaining a common vocabulary or lexicon: the Data Documentation Initiative (DDI) and the Unified Medical Language System (UMLS).

- The DDI 3.0 is an international XML metadata standard for social science data and datasets. Members in the DDI Alliance include major U.S. research universities (Berkeley, Harvard, Stanford, Yale, Cornell, MIT, Princeton, Wisconsin, UCLA, and others) as well as several European social science data archives. DDI development was supported by a grant by the National Science Foundation (NSF).

- The alternative is to use the National Library of Medicine's UMLS, with its Metathesaurus, Semantic Network, and SPECIALIST Lexicon, as a basis for the effort. UMLS was developed because of the critical need for accurate communication of medical concepts.

Common Lexicon Project:

- Investigate candidate methodologies for organizing and maintaining a common vocabulary or lexicon.
- Adoption one of the methodologies.
- Begin the process of creating the common lexicon using the methodology.
- Encourage adoption by all HSCB projects and by Project Minerva and Human Terrain projects.

3.1.7 Identify the Proper Data Library Concept

Data on human behavior related to non-traditional challenges is a DoD-wide problem. Although DoD is making significant investments that often yield data that would be useful to other users within DoD, it can be difficult to find. A data and metadata registry for HSCB data would also permit researchers in FFRDCs, academia, and industry easier access to data that may prove important to the further development of basic and applied science to support HSCB modeling.

Data Library Project:

- Hold a Data Library Concept Workshop (after defining data, theories, methods, and models)
    - Consider the potential problems of a Data Library
    - Consider the options: central library, virtual library (distributed), government vs academic vs joint
    - Consider the legal issues
    - Consider the data maintenance, creation, VV&A, tagging, and funding issues

3.1.8 Government Office

Create a governmental activity that is responsible for and has authority over HSCB modeling. This activity might be a completely new organization or it could be created within an existing organization by adding responsibilities, authority and funding. Possible existing organizations are the M&S CO within DDR&E and the Simulation & Analysis Center (SAC) or Joint Data Support (JDS) within OSD PA&E. All of these suffer from being part of DoD, which might cause difficulties within other parts of the government.

However, the presence of scientific experts who could provide expertise users developing models and tools that involve social science knowledge would be useful. There is a critical gap in social science expertise in the development of DoD models and tools. Many efforts suffer from substantial inclusion of credible theory or data, and many program managers overseeing model development are not familiar enough with the social sciences to

even know where to look for expertise. Further, interaction with scientific experts should increase the social science "literacy" of DoD personnel and contractors using HSCB tools over time. It may also be beneficial to have designated, interdisciplinary social science teams for specific issue areas of interest to DoD, such as stability, security, reconstruction, and transition (SSTR).

If many of the scientific positions were IPAs, this would continually refresh the scientific base and currency on the latest research. In addition to benefiting individual users, an office of interdisciplinary experts consulting frequently with many parts of DoD would have the visibility into activities to better recommend other HSCB investments that address common problems. There is also the benefit that such an office could judge the quality of products being contracted out through the HSCB process.

Government Office Project:

- Establish an SSTR research program (near term: examine MPICE and the ISSM)
- Establish other specialty areas that are important to several communities
- Prioritize gaps in basic research and primary data collection that would benefit a wide number of DoD users

3.1.9 Create a Code of Best Practice for HSCB Modeling

Contact Names: Dr. Stuart Starr, Dr. Dean Hartley, and Mr. Al Sciarretta

Commonality: The Acquisition, Training, Analysis and Experimentation communities, within and among Services, and possibly others, all use M&S, yet many users lack knowledge of best practices in key areas. This lack of knowledge is particularly notable in the areas of: data models and standards; creation and orchestration of live, virtual, and constructive simulation; reuse of M&S; verification, validation, and accreditation (VV&A); selection of Measures of Merit; selection and application of experimental designs to guide the use of M&S; the tradeoffs associated with alternative architectural approaches (e.g., DIS, HLA, TENA); and the social skills needed to identify properly the problem to be addressed, identify the significant stakeholders, and obtain buy-in for the project plan. These shortfalls are most seriously felt in project lead positions where each of these areas must be addressed, yet the time and effort of each must be balanced against a budget and the overall success of the project. In the absence of that knowledge, there is widespread failure to make the best use of M&S in its creation and application. Further, the absence of that knowledge by decision makers permits occasional abuses.

User/Customer: All DoD Components, including representatives from the aforementioned communities, and the defense industrial base.

Deliverables: The deliverables of this proposed effort consist of documentation and dissemination of the COBP for M&S. The deliverables are described as unitary items; however, they are segmented as follows: common elements, analysis specific elements, acquisition specific elements, training specific elements, and experimentation elements.

- A concise set of guidelines to convey M&S best practices to the users of M&S and decision makers who receive the results of the application of M&S.
    - A brochure, summarizing major insights, which can be disseminated to professional associations (e.g., MORS, INFORMS, ITEA).
    - A check list for a decision maker, to inform them of community best practices.
    - An executive summary of the COBP for publication in Phalanx and other professional publications.
- A COPB manual. This manual will be a richly annotated document on best practices that can be used in curricula at universities.
- An intensive campaign to disseminate widely the guidelines to the targeted audiences. The material from the book will be used to delivery tutorials at key professional associations (e.g., MORS, INFORMS,

ITEA, NDIA) and professional military education opportunities (e.g., CAPSTONE). It will be provided to teachers at key schools that teach M&S, leveraging MORS' Education Colloquium

Functions: As identified in community business plans, the Department needs a holistic, well-informed assessment of the issues and choices in this area, to include literally best practices, where they can be identified, and "better" practices, where distinctions can be made between good and bad practices but the truly best practices cannot be determined. This project will assess the issues and choices and identify the category to which each of the various "best" practices belong.

Constraints: To solicit innovative ideas and build ownership for the proposed path ahead, the project must be done in an open, objective and unclassified manner. As they become available, draft deliverables will be distributed for review and comment by the various user communities. An interim report(s) will be completed, followed by refinement, final invitation for comments, and production of the final deliverables.

Work Description: The associated tasks for the deliverables are provided below. The tasks are described as unitary items; however, they are segmented as follows: common elements, analysis specific elements, acquisition specific elements, training specific elements, and experimentation elements.

- Task 1. Review existing codes of best practice.
- Task 2. Based on that review, derive key lessons and select an appropriate framework for the COBP. One possible framework is to structure the COBP around the M&S lifecycle (e.g., initial data activities; model creation; model development; M&S application; data, information use; treatment of residual issues (e.g., model reuse)).
- Task 3. Once the framework is selected, systematically identify best practices associated with the use of M&S to support basic functions. Although the main focus of the project will be on best practices for M&S that are relevant for all communities, the study will also identify community unique best practices in analysis, acquisition, planning, testing, training, experimentation areas to the extent that funding permits.
- Task 4. Codify best practices based on key community products, discussions with subject matter experts, and the experience of the study team.
- Task 5. Submit these preliminary products to a Greybeard Panel for review.
- Task 6. Based on feedback from the Greybeards, refine the enumerated best practices and identify residual issues that require additional research.
- Task 7. Document the results of these analyses in multiple products.
- Task 8. Conduct a campaign to disseminate widely its products and insights.

Success Criteria: Success will be judged by support for, and commitment to the COBP for M&S by the using communities.

- A key metric will be the number of users of M&S who are exposed to the COBP through the deliverables cited above.
- A second metric will be the number of decision makers who are exposed to the COBP through the deliverables cited above.
- A third metric will be the availability of the documentation as living documents on at least one web site.

Recently, key decision makers have mandated that users employ COBPs to guide their activities. For example, the ASD (NII) and the UK MoD have recently mandated that C2 assessments must adhere to the NATO COBP for C2 Assessment. Ultimately, we would seek to have key decision makers mandate that analysts employing M&S adhere to the COBP for M&S for Analysts.

3.2 COLLECT DATA

One of the most important areas that the HCSB effort can contribute to is data collection; however, not just any data collection. In particular, we need more information on insurgency and COIN operations. Brett Pierson has

designed a systems dynamics model that articulates the causal processes outlined in the FM 3-24 COIN manual. While this model highlights important causal connections, it has not been evaluated with real data. One of the most important ways forward is to call for the collection of data important to evaluating COIN operations.

Within this model there are five major embedded variables: essential services, governance, economic development, perceived security, and host nation security forces. Each of these concepts affects and is affected by other important variables. Some of these include psychological operations effectiveness, appropriate strategic emphasis, impact of illegitimate actions, and satisfaction with essential services. We probably have relatively few good ways to operationalize these concepts and the others that populate the model. In order to know if this model tells us important things about COIN operations and the right levels of force, economic activity, governance, etc. to implement, we need to generate quality data for each of these concepts and use the data to test the model using various quantitative methods (agent based models, statistics, etc.). More importantly, we should generate new methods and leverage old ones in terms of the data collection efforts. With advances in computing technologies we should explore new ways of collecting information using automated and computerized techniques. We need data in near-real time in order to feed this model and others developed to truly understand what works and what does not in COIN operations.

Collect Historical Data on COIN Project:

- Historical data on insurgencies and counter-insurgencies.
- Create new technologies to generate new data on insurgency and counter-insurgency

3.3 VALIDATE EXISTING MODELS

Verification, Validation & Accreditation (VV&A) as a unified activity is required by the Department of Defense (DoD); however, it is either rarely done or rarely reported. Further, where it is reported, the details are often omitted.

The recommendations from the VV&A Working Group are based on a statement of value for exposure of the details of VV&A, not only for models, but also for data, theories, and methods. For years (going back at least to 1974), various elements within the DoD has been cataloging models. These catalogs characterize the models using a fairly short list of tags, such as stochastic or deterministic and closed form or human in the loop. More recently several organizations (including my own) have cataloged DIME/PMESII models. These catalogs have never achieved their full potential in utility because their tags don't go deep enough. They don't allow a user to find the model or models that best address that user's needs.

The VV&A Working Group created the beginning of a list of characteristics that, if known, would serve to support the identification of models (data, theories, and methods) that do address a user's needs. The Working Group further identified the V&V process as the proper process for determining the values of these characteristics for a particular item. However, to be useful, the characteristics need to be standardized, the V&V must actually be performed, and the results must be "published."

A project to perform sufficient V&V activities on a selected set of models to determine the values of the characteristics will require funding. Funding will also be required for the model developers to support their required participation in these activities. It is estimated that two to three weeks of concentrated work would be sufficient for each model. The DIME/PMESII Model VV&A Tool would be used to record the results.

The results of this project are not sufficient for the larger community needs; however, they are sufficient to determine the value of the approach. If the value is demonstrated to be large enough, DoD can require that all HSCB models undergo this process.

Validate Several Existing Models Project:

- Fund a small group (approximately 6 people) to organize, run, and report on the project.
- Organize characterization workshops, with paid participants.

    - Workshop 1 to define the necessary characteristics of models.
    - Workshop 2 to define the necessary characteristics of data.
    - Additional workshops for theories and methods might be needed.
- Validate several models and tools
    - Establish validation standards for HSCB products and the limits of acceptable use
    - Validate products of potential interest to a wide number of users, such as COMPOEX
        - COMPOEX
        - MPICE
        - ISSM
        - SEAS
        - FAST Toolbox
    - Report the results and supply a database that supports user search and retrieval of models that match user requirements

3.4 BUILD HSCB MODELS

Three different HSCB model building projects are described below.

3.4.1 Build A Model Using an Existing Argonne National Laboratory Framework

Situations that need HSCB models generally require multi-agency and inter-governmental responses. The Areas-of-Operation (AOs) where the activities occur include a landscape of physical (e.g., natural environment, infrastructure, military force structures, etc.), human, social, and cultural components that must be constructed and analyzed in an integrated, synergistic fashion against the particular goals and objectives of a given mission or operation.

Figure 9 provides an example of a representative landscape that has been constructed in support of studies undertaken by the Argonne National Laboratory. In the example shown, the problem involved analyses of the impact of regulations on an electrical infrastructure. In this example, the landscape consisted of a physical layer of the physical infrastructure of the electrical system being studied; three business layers that incorporated human and social aspects; and a regulatory layer that considered cultural issues (i.e., state level regulations.) As shown in the example, the individual layers are linked together, which means that an activity taken within one layer can have impacts that are felt by other layers.

The example shown represents an application for a specific problem domain. However, the concepts demonstrated in this example can be extended to HSCB modeling. The differences would lie at the conceptual level in the types of layers that would be required for a given problem and at the implementation level in the entities and their behaviors required for the problem, as well as the data sources required to describe and populate them.

In responding to HSCB needs, there would not be a “one size fits all” solution. Instead, a framework environment that permits the addition of easily integrated context-appropriate tools provides a robust solution to problem of constructing and analyzing human, social, cultural, and behavioral landscapes. Argonne has considerable experience in constructing and using human, social, cultural, and behavioral applications from a generalized framework perspective and these Argonne developed frameworks could be used in applications involving HSCB landscapes.

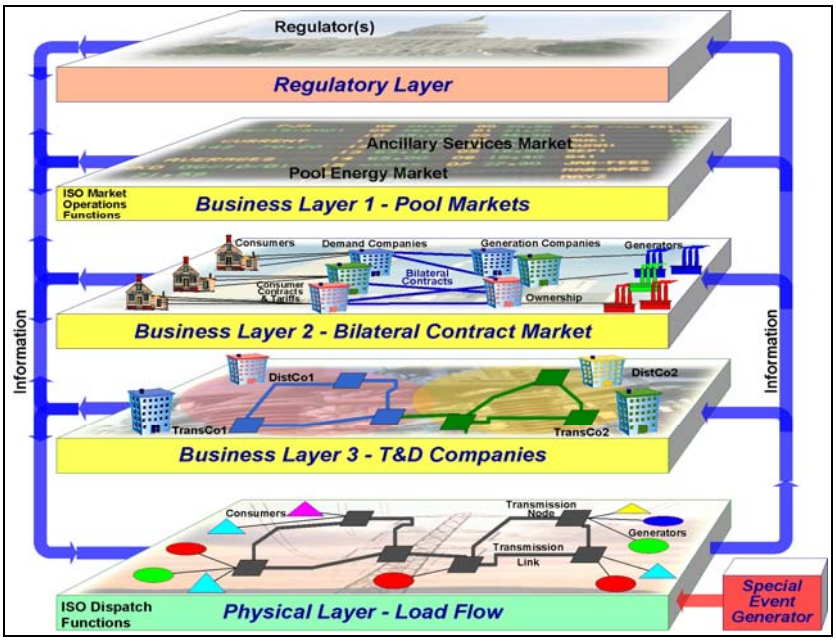

Figure 9. An Example of Landscape Layers Used to Analyze the Impact of Regulations on an Electrical Infrastructure

Figure 10 provides a high level summary of applications developed by Argonne that involve HSCB interactions. These applications were developed using two Argonne simulation development environments – the Dynamic Information Architecture System (DIAS) and Repast. DIAS is a subject domain independent flexible, extensible, object-oriented framework for developing and maintaining complex simulations. DIAS is patented, but is licensed royalty free to U.S. Government agencies and their contractors. Repast is a free, open source agent-based modeling and simulation library of tools designed to support the development of extremely flexible models of social agents.

Application	Description
CASCADE-CD	A complex adaptive systems application for use in developing and analyzing counter-drug interdiction strategies.
CASCADE-FA	A complex adaptive systems application for use in developing and analyzing Joint force campaign operations, with emphasis on time sensitive targeting.
CASCADE-ES	A complex adaptive systems application for the evaluation of stability and sustainability of societies under stress.
ENKIMDU	A simulation of ancient Mesopotamia for studying long-term human-environmental interactions.
Mae Phosop	An extension of the ENKIMDU simulation system to modern Thailand to obtain agroeconomic insights into the dynamics of rural economies.
EMCAS	A complex adaptive system model of electrical energy markets.

Figure 10. High Level Summary of Argonne Applications Involving Human, Social, Cultural, and Behavioral Interactions

3.4.2 Build Small Models Using Thick Ethnographies

There is an apparent difference of opinion about – or at least varying degrees of comfort with – the depth of social and cultural knowledge that should be built into the models. On one extreme is the type of thick description that

Partnow and Hartley their plenary paper. Close on its heels is the detailed inclusion of a number of psychological and sociological variables in Barry Silverman's presentation. At the other end are simplified models that make use of readily available economic and sociological statistics such as economic indicators and infant mortality. Somewhere in the middle lie the sociology-based studies of social networks. David Siegel suggested that his models, which could be placed toward the simplified end, but not at the extreme, indicate that one can eliminate thick description and still have valid and useful models. Still, his models are fairly limited in what they can predict. While there is room for all levels of social science engagement, the more inclusive end of the spectrum is the missing piece of the puzzle now. It is missing, despite its potential to produce description, identify causation, and predict behavior based on cultural values, practices, and beliefs.

Two questions inspired by Silverman's paper are, "Is it really possible and feasible to build models (other than pictorial representations) that include thick description? And is the endeavor so time consuming that it is neither cost effective nor useful?" Silverman's models were very involved, and yet (based only on his presentation) they were still incomplete – they did not include cultural information of the sort advocated in the Partnow/Hartley paper. Perhaps the question should be reframed: "What sorts of problems might HSCB be useful for?" The question should be broken into small units so that depth can be achieved. For instance, huge questions, such as, "Will this government topple under various circumstances?" might not be appropriate to a thick description-type model. A better problem for such a method might be, "How should US forces introduce elements of infrastructure to a particular locale?" Anthropology can contribute a great deal to the micro-level of modeling.

The involvement of more social scientists requires that social scientists become re-educated. Those who already employ statistical methods are prime candidates – however, the "purer" cultural anthropologists should not be discounted. Rather, actual working workshops in which ethnographers partner with modelers to build a few prototypes are needed. This will serve to train both sets of practitioners and will also be an opportunity to test the kinds of problems that are best served by HSCB models.

Build Small HSCB Models Project:

- Hold small, longer duration workshops
  - Ethnographers
  - Modelers
  - Build a prototype model

3.4.3 Build a Country Monitoring System

The figure below illustrates the architecture of a global country monitoring system. The local experts in each country and the regional experts make the data entries in their own offices. The local and regional users view the results in their own offices. The data are processed at a central location, using the Interim Semi-static Stability Model (ISSM), a proven tool for making inferences regarding the stability situation at the country or sub-country level, given input of a relatively small amount of observable data. The ISSM makes and tracks the inferences over time. It also provides for the addition of custom logic to create and track non-standard inferences.

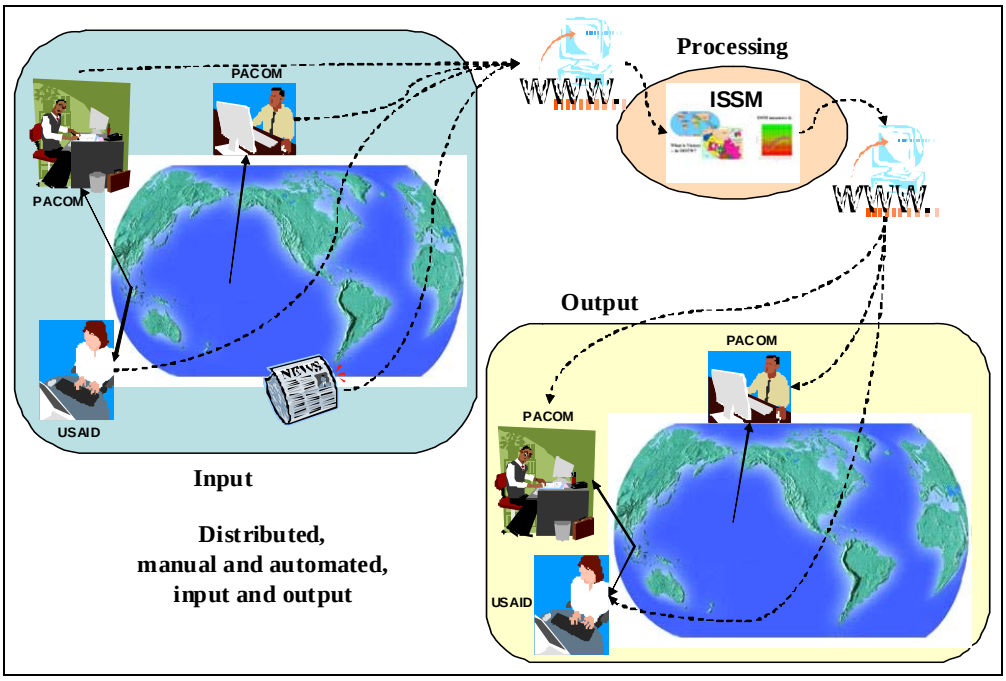

Figure 11. Country Monitoring System

This system minimizes the human costs of data entry, while maximizing the validity of the data through use of those with the best knowledge. The system provides incentives for the people who must feed it in the form of feedback of information about the country for which they are responsible and information about its neighbors.

As indicated in the figure, the system can be extended by adding automated feeds of certain information from the electronic news sources. This extension requires the use of computer parsing software, which is available from several sources.

Build Country Monitoring System Project:

- Construct architecture
- Modify applications software (ISSM)
- Create automated input subsystem
- Distribute and run test case

3.4.4 Build an Open Source Model Framework

The concept of this proposal is that we build the Impact Analysis simulation as an open model, with contributions from the entire Social Sciences community. The simulation architecture in the specification document describes the objects to be modeled and their general relationships; however, the specific relationships, political, financial, and social, should be determined by experts in the appropriate fields. Moreover, the structure of the model will call for potentially as yet poorly defined relationships, identifying needed research.

This simulation would be a "medium-weight" model. That is, it should have a smaller footprint and lesser input requirements than SEAS, but larger than the ISSM. It should be constructed in a similar manner to open-source Linux, with a central core of support designers and programmers, and be open to contributions from anyone.

We would start with architecture workshops, in which the decisions about the types of interactions, relationships, and modeling styles (e.g., stochastic elements) would be made – but not decisions on the theories and algorithms that should be used to implement the relationships. At this point, we could build the model's framework – that is

the simulation engine, output map displays, input and output data stores, and so forth, and implement the result in code. We would have to be careful to make the attributes for the objects to support additions, as we could not be certain what attributes would be needed to support instantiated theories.

At this point the application programming interface (API) would be exposed to the community at large. Social Scientists could propose theories to instantiate selected relationships or interactions. They could team with modelers to implement the theories in code that could be added to the model. They would have the option of calling for additional attributes to be added to support the code. They would also be required to provide data descriptions and, if possible, current sources for the data needed for their theory. Naturally, they would also be required to supply complete documentation. Multiple theories could be implemented to model a single relationship, where no single theory is known to be correct.

The core team would provide configuration management and verification & validation (V&V).

This project should be denoted as a long-term R&D project to provide a test-bed for HSCB theories and a source for prioritizing the needs for basic research in HSCB theories. As competing theories are implemented, they could be tested against each other and against the real world. Also, as parts of the model are implemented, it would become clear which parts are being left vacant, indicating areas of need.

3.5 EDUCATION

Educate Modelers: Based on this two-day workshop, it appears to me that the "modeling community" is primed to accept social scientists, at varying levels of involvement. I believe their acceptance will gradually grow with more information and more workshops of this type. I was struck by the fact that my very basic anthropological outline was seen as a new approach by many of the engineers in the room. I imagine there are many other modelers who will need to be introduced to the social sciences in a similar, simplified, manner.

Educate Social Scientists: Because HSCB modeling is not well known in anthropological circles, an effort has to be made to invite scholars in. This can be accomplished through papers at professional conferences, as well as invitations to the type of workshop suggested above. Those people already involved should use their established social and professional networks to recruit others, with continuing efforts to extend those networks.

- The involvement of more social scientists requires that we become re-educated as well, for the reasons noted in a paragraph above. Those who already employ statistical methods are prime candidates – but I don't think the "purer" cultural anthropologists should be discounted. Rather, I would recommend actual working workshops in which ethnographers partner with modelers to build a few prototypes. This will serve to train both sets of practitioners and will also be an opportunity to test the kinds of problems that are best served by HSCB models.

- Getting more social scientists involved seems to be an issue. Based on the participation in this workshop, it is apparent that some sociologists, economists, psychologists, and anthropologists are already involved, but far more (particularly anthropologists) should be part of the endeavor. Factors currently limiting anthropologists' participation include:
    - This is not a career track that is well known within the profession.
    - Unless employment is assured at some level, it is not likely to become a standard career track for anthropologists
    - There is a mismatch between the study and practice of anthropology and HSCB. One area of dissonance is the use of statistical methods. Although some subfields of anthropology regularly use statistics (archaeology, economic anthropology, ecological anthropology), most cultural anthropologists have not used statistics since their graduate school days, and do not find it appropriate to ethnographic description. In fact, statistical data is generally considered less valuable than other types, showing effects rather than underlying causes.

Build Small HSCB Models Project:

- Hold small, longer duration workshops
    - Ethnographers
    - Modelers
    - Build a prototype model

4. SYNTHESIS

The purpose of a workshop is to elicit something from the participants. This process has been referred to as attempting to "herd a bunch of cats." In general, the brighter the participants, the more valuable are the results; however, it is also generally true that brighter participants are harder to herd. The purpose of a synthesis group is to identify, capture and organize the results of a workshop. Each working group produces some organization of its results; however, there may be valuable utterances that are expressed in a working group that are not well connected to that group's purpose. The embedded members of the synthesis group attempt to capture these. Further, there may be themes that are common across the groups that should be connected. Finally, the synthesis group looks for opportunities to find synergies from the working group results, synthesizing results that would not be apparent from a bare reading of the individual group's results.

Figure 12 shows the organization of the results of the workshop that directly addressed its purpose: characterizing the capabilities needed to perform effective HSCB modeling in support of operational users and senior decision makers. The drivers are the questions that operational users and senior decision makers want answered. From these flow the implied needs in both the social sciences and the modeling domains. From these flow indirect needs. The practice of Operations Research is shown linking these needs together.

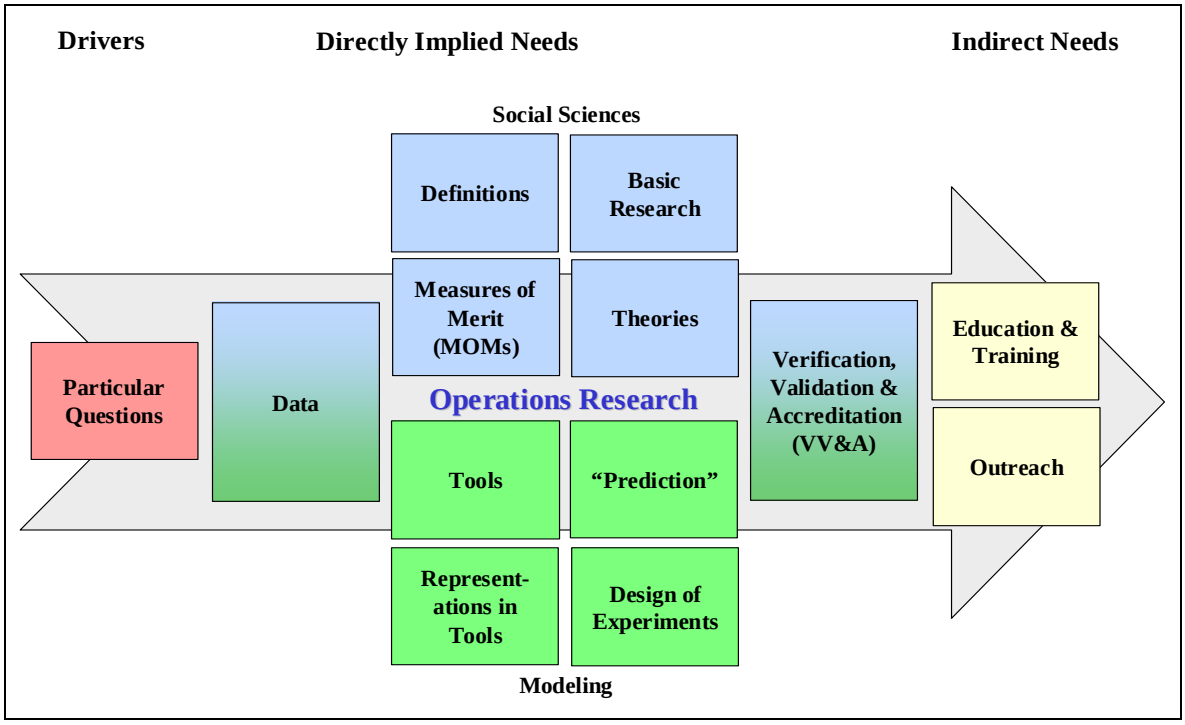

Figure 12. Organizing the HSCB Modeling Needs

4.1 PARTICULAR QUESTIONS

Observation: Many questions can be categorized as Predict something, Support an activity, Balance competing activities, Prioritize among competing options, or Understand something

- Predict
    - General prediction & forecasts
    - refugee flow during political crises: inadequate
    - the flow of contagions through the population-density map of a society: good
    - effects on societies institutions of long-term epidemic PTSD: inadequate
    - when cultural change will be regarded as authentic
    - best COA
- Support
    - Theater Security Cooperation Plans (TSCPs)
    - situational awareness
    - Identifying enduring, reoccurring questions that arise in military operations
- Balance
    - flow through the SSTR process
    - transition to indigenous groups (clans, tribes, regional, or national), maintaining integrity of host nation decisions while supporting US interests
- Prioritize
    - resources to perform the operation
    - Given limited $$, what part of DIME should we invested in?
    - SSTROs to serve total US interests (e.g., DoD, DOS) as well as host nation, coalition, and broader international community
- Understand
    - exploration (branches/sequels) and discovery & exploration of black swans
    - the operation
    - If the military does a task (for example, give water in an SSTR task), what are the implications from a societal point of view?
    - What to look for in a village you are going through?
    - Understand failed states
        - History
        - Economy
        - Political contents
        - Ecological and demographic factors
        - Natural resources, both for internal use and as exports
        - Military and paramilitary forces
        - Culture and linguistic situation
        - Racio-ethnic dimensions
        - Religious factors
        - Gender and social order
        - External influences on all of the above, e.g., globalization
    - Legitimacy
    - Motive/intent, Goals (explicit, implicit, public, private)
    - Leadership profiles
    - Family structure/dynamics
    - Peer influences
    - Why people become insurgents?
        - Why are people X becoming Insurgent Y in location Z?
        - Which of these people are becoming insurgents?
        - How do I “reverse this”? How long? What will it take?
        - How are the red team going to respond to our actions? Who is the red team?
    - What are the consequences including unintended of our actions?

- the micro-climate of an area before entry, the linkages between elements of SSTRO and how they feed into one another (Inputs/outputs)
- How to decrease violence and increase governance
- How to moderate violence, encouraging defection
- Deterring hacking
- Deterring violent acts by small groups
- Deterring drug trafficking
- Deterring states from unwanted social actions
- Deterring non-state actors
- What are the system drivers / interaction mechanisms of the results.

4.2 SOCIAL SCIENCE NEEDS

The social sciences portion of the HSCB needs is organized into Definitions, Measures of Merit, Basic Research, Theories, and Data. The data needs actually span both social sciences and modeling; however, they are placed in this section for convenience.

4.2.1 Definitions

Observation: Many HSCB-related definitions are too vague, ambiguous (e.g., "counterinsurgency") and many are discipline specific and not widely understood

- terminology among the social sciences
- Develop more specific definitions to drive action
- terminology – common ontology is too restrictive
- Central Library with concepts, variables, metadata (Data dictionaries, semantic descriptions, ontologies)
- HSCB modeling requires standards and definitions of common terms for both OR and social science communities
- Standards for data lexicon, semantics, and ontology
  - Must include metadata & HSCB protocols
  - Must be developed within the real-world context of the model

4.2.2 Measures of Merit (MOMs)

Observation: We do a poor job in formulating Measures of Performance and Measures of Merit for HSCB, and developing the relationships (cause and effect) that link them

- We need to tailor the MoMs to HSCB problems of interest and develop relationships that link them
- We need to display HSCB MoMs to operational users and senior decision makers in a fashion that conveys appropriate levels of uncertainty and risk
- Accepted measures of effectiveness and performance
- Concepts to outcomes (measures of merit) connections
- Clearly defined initial state, Clearly defined end state – What does success look like?
- MOPs and MOEs for assessing progress

4.2.3 Basic Research

Observation: Many critical HSCB areas are not well understood at the social sciences level

- Understand interior cognitive models
- Knowledge, data, and algorithms that account for the effects of influencers (operational activities) on the attitude/behavior of the civilian population based on ethnic, tribal, cultural, religious, and political considerations

- local legitimacy
- why/how people move in groups not as individuals from one state (e.g., neutral) to another (e.g., pro-government)
- impact of criminal element
- Ability to model "trust"
- Ability to add "governability" in the analysis
- how people will react to an action
- social structures: leaders/networks/norms
- inter-Agency involvement (the DI_E pieces)
- Historical case studies (e.g., studies of pre-WWI telegrams)
- intent, motivations and things valued by hackers
- defining corruption
- containment strategies for non-state actors
- fractionalization of non-state actors
- fragility of governments

4.2.4 Theories

Observation: In selected areas of social science, there are excessive numbers of theories (e.g., Barry Silverman noted several theories that purport to characterize "the root causes of terrorism"). However, there are key areas where needed theories are lacking or are too particular or too general

- When multiple theories exist, we need codes of best practice / guidelines on which theory to use, when
- We need to develop additional social science theories to address issues of interest for national security
- HSCB that drive how the models function?
- Need cross-disciplinary theory of SSTRO
- Physical underlying theories
- that translate civilian attitudes into levels of cooperation with friendly forces and result in corresponding levels of HUMINT provided by the civilian population
- to account for discrimination between civilian and adversary actors based on presented physical and behavioral signature (e.g., insurgent in civilian clothing)
- that account for how affiliations and support for other actors change based on the application of influencers (e.g., friendly operations, government activities, adversary operations)
- account for changes in target audience attitudes caused by the application of PSYOPS
- that reflect adversary HUMINT networks (e.g., attributes of the HUMINT network, how the network is formed, how the network adjusts if a node or element is removed, what adversary activities tend to facilitate or discourage the population's provision of HUMINT)
- to account for unique adversary PSYOPS techniques and the effect of those techniques on the target audience
- to represent the effects of CMO on the attitudes of the civilian population (or other target audience)
- the effects of essential services (or lack thereof) on civilian population's attitudes/behaviors
- accounting for the effect of governmental corruption on governmental institutions and on the civilian population's attitudes/behaviors
- reflecting the attitudes/behavior of actors (e.g. civilian population) based on the state of physical infrastructure used by the actors
- accounting for non-homogeneous groups of actors. This is particularly problematic when group members have overlapping affiliations (e.g. a single actor or group belongs to multiple groups - religious groups, ethnic groups, political groups, tribal groups, etc.)
- accounting for levels of civilian support for and the provision of physical or monetary resources to adversaries

- accounting for the performance/effectiveness of actor organizations based on the level of cooperation between those organizations (e.g. USAID and local government)
- accounting for the behavior of actors (e.g. civilian population, religious leaders) based on their level of support for the existing government
- accounting for the legitimacy of the existing government as viewed from outside the nation by external groups and the effect of international legitimacy on government effectiveness
- accounting for the of the state of the existing legal system and its impact on the attitudes/behaviors of the civilian population
- how the civilian attitudes/behaviors change as the economic conditions change
- the effects of media activity on the attitudes/behaviors of actors
- the effects of friendly operations on media themes and activity
- Cognitive models (of who you are trying to deter)
- Does work in social sciences on deterring criminal activity apply to other actors?
- Does surveillance deter small groups
- Influencing organized crime groups
- Influencing states
- Defining economic alternatives for organized crime members

4.2.5 Data

Observation: HSCB data are diffused, difficult to find and access. HSCB data lack necessary information to support analysis (e.g., adequate metadata, indications of pedigree). [Standard/original source] data sets are never really ready for use – they require clean up to fit the current need.

- Data, what exists? What doesn't exist?
- Data needs to be validated
- Central Library with defined granularity & validation, needs to include qualitative data as well as quantitative data Data Integrity, Consistency, Maintenance, and Dissemination are required
- Develop appropriate HSCB taxonomies, ontologies,…
- Perform an assessment of the desirability of a Central HSCB Data Repository (issues: classification, access, open source data, legal, granularity, qualitative data, maintenance, dissemination)
- Implement efforts to tailor HSCB data to satisfy the intended purposes
- Permanent repository of rules/relationships like Cyc for the social sciences
- Reliability and Validity Tests of operational qualitative and quantitative variables must be performed
- Legal issues regarding data collection and storage need to be identified
- Data on local social structures
- Environmental data that influences HSCB
- Include medical data (e.g., HIV positive)
- translating civilian attitudes into levels of cooperation with friendly forces and result in corresponding levels of HUMINT provided by the civilian population
- accounting for discrimination between civilian and adversary actors based on presented physical and behavioral signature (e.g., insurgent in civilian clothing)
- accounting for how affiliations and support for other actors change based on the application of influencers (e.g., friendly operations, government activities, adversary operations)
- accounting for changes in target audience attitudes caused by the application of PSYOPS
- reflecting adversary HUMINT networks (e.g., attributes of the HUMINT network, how the network is formed, how the network adjusts if a node or element is removed, what adversary activities tend to facilitate or discourage the population's provision of HUMINT)
- accounting for unique adversary PSYOPS techniques and the effect of those techniques on the target audience

- representing the effects of CMO on the attitudes of the civilian population (or other target audience)
- the effects of essential services (or lack thereof) on civilian population's attitudes/behaviors
- accounting for the effect of governmental corruption on governmental institutions and on the civilian population's attitudes/behaviors
- reflecting the attitudes/behavior of actors (e.g. civilian population) based on the state of physical infrastructure used by the actors
- accounting for non-homogeneous groups of actors. This is particularly problematic when group members have overlapping affiliations (e.g. a single actor or group belongs to multiple groups - religious groups, ethnic groups, political groups, tribal groups, etc.)
- accounting for levels of civilian support for and the provision of physical or monetary resources to adversaries
- accounting for the performance/effectiveness of actor organizations based on the level of cooperation between those organizations (e.g. USAID and local government)
- accounting for the behavior of actors (e.g. civilian population, religious leaders) based on their level of support for the existing government
- accounting for the legitimacy of the existing government as viewed from outside the nation by external groups and the effect of international legitimacy on government effectiveness
- accounting for the of the state of the existing legal system and its impact on the attitudes/behaviors of the civilian population
- civilian attitudes/behaviors based on existing economic conditions and how the attitudes/behaviors change as the economic conditions change
- the effects of media activity on the attitudes/behaviors of actors
- the effects of friendly operations on media themes and activity

4.3 MODELING NEEDS

The modeling portion of the HSCB needs is organized into Tools, Representations in Tools, Prediction, Design of Experiments, and VV&A. VV&A actually spans both modeling and social sciences; however, it is placed here for convenience.

4.3.1 Tools

Observation: There is no such thing as a "silver bullet" model that will satisfy all of our HSCB modeling needs. Existing HSCB tools are too limited in their scope (e.g., counterinsurgency tools can not address multiple insurgencies, simultaneously). We must understand the limits to prediction when addressing HSCB issues

- We require an expanded set of HSCB tools
- The proper architecture/framework is an open question; however, there are many suggestions
    - The suite of tools should include a balanced mix of techniques that take advantage of the strengths of the tools while ameliorating their weaknesses (e.g., system dynamic models; agent based models; wargames)
    - Consideration should be given to creating a "collaborative environment" in which selected models can be linked/federated and evaluated (particularly with respect to "precision")Service oriented architecture
    - Do we want a GIG (global information grid) service of DIME/PMESII. We want something that plugs in a question and spits out an answer relative to the population.
    - Hierarchical modeling to navigate across theories, models and levels of analysis
    - Hybrid models with fine grain locations for addressing particular issues
    - holistic architecture (level TBD) versus vignette/scenario driven. Which is most appropriate for deriving needs for these models?

- HSCB Model Architecture requires flexibility to integrate / aggregate domains; e.g., integrate social-religion-political domains when dealing with the Muslim world
- Define / design a family (framework) of HSCB models that can be integrated and federated to model specific scenarios and casual effects
- Adopt a model framework that can accommodate meta-model and meta-data aggregation and disaggregation
- A systems architecture so different models can inform each other
- Integration of data, models, and systems (how do the 4 clubs interact?)
  - Design to allow output of one model (e.g., agent-based) to feed the system dynamics of another system component
  - Need mapping of data across models
    - Include hand-shake across modeling modalities
  - Supporting data needs some agreed on and clearly defined objectives
  - Need cross-disciplinary understanding across modelers and social scientists
  - Need an integrated DIME model
- Need bits and pieces of models that can used by all and then build from there
  - Framework for tailoring the architecture
- Tailorable and adaptable HSCB models
  - Focus on identification of common factors as a baseline for HSCB models (e.g., ODU/VMASC Insurgency Studies of Columbia and Nigeria found 60 of 125 insurgency factors to be common)
  - Easily change/add non-common factors
- Models that are
  - Tailorable
  - Updated within a resource repository
  - Complex and adaptive while running
- Architecture that supports PMESII M&S interoperability and reuse
- "Service bus" for data repositories
  - Provides management and error checking
- Dynamic Data Driven Application Systems with real-time forecasting
- Need a resource repository for HSCB models and data
- Need quantitative and qualitative models
- Small and focused models (not mega models)
- Support multi-modal vision of situations
- Representation at multiple scales for Blue, Red, Green
  - Temporal
  - Spatial
  - Demographic
- To make models efficient & cost effective. Minimize model development costs, runtime and overhead (admin, user, and developer).
- Collaborative planning capability that spans neighborhood to national (possibly multi-national) level
- Analytical capability to evaluate balance/ tradeoff options and conduct sensitivity analysis

- Data connections
  - How to handle proprietary information?
  - How to handle "personal" information (privacy and use of information)?
  - Standardized, interoperable data. Needs to be available on point to the end user and automatically enforced. Knowledge of what model does not do.
  - Data and models should co-evolve
  - Ability to obtain, organize, and access data (e.g., metadata)
  - Policy issues for open data access

    - Data standards, data storage, data mining, data extraction/discovery tools
- Theory connections
    - Model that accommodates all theories, or knows why not
    - To replicate real world activities and instantiate HSBC theory/protocols/methods
- Metrics connections
    - Identify output metrics relevant to make decisions
    - models should measure outcomes and not inputs. Not by what you do, but by what happens when you do it.
    - Criteria for thresholds to determine when transitions occur between S, S, T, and R
    - Criteria for distinguishing friendly locals from hostile
    - Bounds for complex, adaptive models

4.3.2 Representations in Tools

Observation: The entire DIME/PMESII spectrum needs to be represented. However, each individual tool need not cover the entire spectrum.

- model of ourselves
- Situational awareness of all parties
- feedback between micro and macro
- Scalable organizational performance model of social institutions [city/town]. (MPICE).
- 'external' influences (e.g., ever-changing views/norms, local/societal demographics, and processes of individuals and societies) that in turn influence both physical and cognitive environments.
- Representation of a wide spectrum of cultures and institutions (formal and informal)
- Representation of behaviors during conflict, disaster, etc
- Flexibility in representing different types of operations supporting U.S. interests
- Representation of inter-organizational dynamics
- Representation of situational awareness
- Representation of dynamic, competing views/needs/priorities by all groups
- Need to design models to be able to handle more than one insurgency at a time
    - Non-state actors; religious sects; criminal - May attack each with a different line (military, diplomatic, economic)
- Don't use internal political boundaries, but use cells with flows among cells

4.3.3 "Prediction"

Observation: Not all models need to "predict" things. "Prediction" may mean likelihoods of occurrence of multiple possible events. "Forecasting," as in forecasting the weather, conveys the concept better than does the term "prediction."

- Generate insightful multi-factor commentaty and evaluation
- Provide content-rich recommendations for plans and policies
- Provide probabilistic statements, screened by subject matter experts
- "Prediction" should be replaced with "forecasting," with emphasis on possible, multiple futures
- Hard prediction of events
- Soft prediction of likelihoods
- Exploration of possibilities
- Situational awareness and understanding

4.3.4 Design of Experiments

Observation: Many users of HSCB M&S do not understand how to derive statistically meaningful insights from their tools.

- We should draw on the insights developed at NPS for M&S characterized by large numbers of variables to characterize the interesting parts of response surfaces using innovative experimental designs (e.g., focused fractional factorial designs)

4.3.5 Verification, Validation and Accreditation (VV&A)

Observation: Most creators of HSCB M&S and selectors of data do not do an adequate job of V&V. We need to broaden the concept of V&V to theories and selection of Subject Matter Experts (SMEs). Precise definitions, levels of accomplishment, descriptions of pitfalls are not more important than **getting started with performing VV&A**. DIME/PMESII data V&V has similarities to combat model data V&V; however, significantly larger complexity of the data sets means the V&V is done at the variable level by [time span & country (or unit of analysis), conceptual definition].

- We need guidelines that enable us to perform V&V (for theories, tools, data, SMEs) credibly, with acceptable levels of resources
- Additional attention must be paid to the accreditation function
- Model assumptions should be evident
- Validation is required, in part by peer review
- Models, data, methods, & theories all need to be characterized with tags (done with a type of V&V), with visualization tool to find desired entries
- Best practices guide for VV&A of models and data
- How robust are results against uncertainty? Model incompleteness – other possible answers.
- How do modelers reduce uncertainty in "squishy" HSCB models?
- How much uncertainty reduction is feasible/sufficient?
- Subjective nature of models suggests data will be required for both V&V and to train the model?
- HSCB modeling would benefit from inclusion of Bayesian analysis with SMEs to take into account a combined scale/score
- Need a consistent approach to dealing with SME evaluations
- Need to identify / include multi-disciplinary & cross-disciplinary experts when conducting model review
- How do we VV&A tools in a world of competitive analysis
    - For example, joint output that opposes a Service may be discredited by a pro-Service SME
    - How to get something useful to a 3-Star that will withstand scrutiny
- Need for better evidence-based assessment
- Need access to social science people who WANT to help
- How often do we update the model and VV&A it?
- Establish / identify references & organizations to oversee (provide) validated models and data similar to those for warfare models (e.g., Joint Munitions Effectiveness Model)

4.4 INDIRECT NEEDS

Indirect needs include Education and Training and the related topic of Outreach.

4.4.1 Education and Training

Observation: It will take high performance, compatible, multidisciplinary teams (e.g., social scientists, operations analysts) to create and employ HSCB modeling. However, those diverse communities have a difficult time in

communicating. Communicating HSCB model assumptions and results to decision makers is even more difficult than for combat models. There is a minimal level of continuity of interest, below which HSCB modeling initiatives produce promising results, but later are forgotten. "Train as we fight" becomes much more important and difficult in HSCB environment.

- Augment the curriculum for social scientists and operations analysts to give them adequate education to enhance communication
- Bridge training/education/operations – all tailored to be the same, see book "Ender's Game".
- Create and sustain a HSCB Community of Interest (COI) (perhaps drawing on MORS Social Science COI) to foster high performance, multidisciplinary teams
- Either
    - construct converters of mathematical models to homilies or
    - Educate policy-makers, politicians, general public in mathematical models

4.4.2 Outreach

Observation: The HSCB community must include Interagency participants. HSCB modeling is of interest to our international partners.

- Expand the HSCB COI to include balanced interagency participants (e.g., NSC, USIP, DOS, DOJ)
- Participate in international forums that address HSCB modeling issues (e.g., NATO SAS initiatives on HSCB, Irregular warfare)

4.5 NEXT STEPS

This workshop was successful in generating a coherent set of detailed results because of careful planning and execution. It will be followed by two subsequent workshops that build on its achievements. In Workshop 2, the participants will be asked to characterize the state-of-the-art in HSCB modeling with respect to the twelve categories cited above. They will also be asked to compare the state-of-the-art to these needs to identify major gaps. Although the precise criteria have yet to be finalized, there is interest in assessing the risks associated with these gaps (e.g., their severity and frequency).

In Workshop 3, the participants will be asked to assess the resources that are needed to mitigate those gaps. Based on the risk assessments and resource needs, it should be feasible to identify "low hanging fruit" (e.g., significant gaps for which limited resources are needed) as well as vital gaps (e.g., gaps that are catastrophic or critical and occur frequently). The results of those deliberations will be used to generate an initial version of a Science & Technology Roadmap for HSCB modeling. It is anticipated that this roadmap will be a "living document" that evolves as we gain a deeper understanding of the problem.

Subsequently, the results of the workshops will be used to justify the allocation of resources for HSCB modeling to OSD and Congress. As necessary, follow-on workshops will be conducted to characterize progress and to re-evaluate priorities.

5. APPENDIX: THEORIES AND DATA SOURCES

Prior to, during, and after the workshop, the attendees supplied theories and data sources relevant to HSCB modeling. While not exhaustive, the lists provide a reasonable starting point for investigations. The descriptions of the theories and data sources were often taken directly from external sources and placed into the database and are sometimes quite lengthy. To conserve space and to avoid intellectual property problems, only short excerpts of the descriptions are printed here.

5.1 THEORIES

DisciplineName / Theory Name	Theory Description	Theory Citation	Conceptual Model Type	Description	Value
None					
NoJustification	Arbitrary or accidental choice	None	Nil	Uncodified	0
Not Modeled	Not included in the model	None	Nil	Uncodified	0
Anthropology					
AssymetricInfoNoTrus	Assymetric Info / No Trust / Terroristic Violence: groups fight because of lack of trust, terrorize one another to intimidate and gain	Schneider, Harold K., 1979 Livestock and Equality in East Africa : The Economic Basis for Social Structure. BLoomington, Indiana: Indiana University Press.; Bonhage-Freund, Mary Theresa, and Jeffrey A. Kurland, 1994 Tit-for-tat among the Iroquois: A Game Theoretic Perspective on Inter-Tribal Political Organization. Journal of Anthropological	SWAG	Scientific Wild Assed Guess	2
CircumscriptionTheor	People fight over resources that are scarce relative to population levels	Carneiro, Robert L., 1970 A Theory of the Origin of the State. Science 169:733-738.; 2002 Was the Chiefdom a Congelation of Ideas? Social Evolution and History	PeerRvw	Peer Reviewed Theory	3
CulturalGroupSelecti	Cultural Group Selection: only cultures with people who favor group survive. Leads to natural altruism toward in-group, xenophobia toward	Soltis, Joseph, Robert Boyd, and Peter J. Richerson, 1995 Can Group-functional Behaviors Evolve by Cultural Group Selection? Current Anthropology 36(3):473-494.; Richerson, Peter J., and Robert Boyd, 2005 Not by Genes Alone: How Culture Transformed Human Evolution. Chicago:	SWAG+	SWAG with some review	2.5
CulturalSuccess	Men fight to achieve culturally-defined success, in order to attract mates	Chagnon, Napoleon, 1988 Life Histories, Blood Revenge, and Warfare in a Tribal Population. Science 239: 985-992. ; Irons, William, 1979 Cultural and Biological Success. In Evolutionary Biology and Human Social Behavior. Napoleon Chagnon and William Irons, eds. Pp. 257-272. North Scituate, Masachussetts:	PeerRvw+	Well reviewed theory	3.5
EconomicDefendabilit	Economic defendability: people fight when resources are predictable and valuable	Dyson-Hudson, Rada, and Eric Alden Smith, 1978 Human Territoriality: An Ecological Reassessment. American	PeerRvw+	Well reviewed theory	3.5
FineArt Development	superfluity of food resources makes possible the development of fine arts		SWAG+	SWAG with some review	2.5
FraternalInterestGro	Fraternal Interest Groups: males in groups have common interests and fight to protect	Otterbein, Keith F., 1970 The Evolution of War: A Cross-Cultural Study. New Haven,	SWAG	Scientific Wild Assed Guess	2
ModernizationTheory	theory of social evolution closely related to dependency theory and development theory: Western countries are the most developed, development stages go from the traditional		PeerRvw	Peer Reviewed Theory	3
Neoevolution	a modern multilineal cultural evolution theory that stresses empirical evidence		PeerRvw	Peer Reviewed Theory	3
Origin of Government	As farming populations gathered in larger and denser communities, interactions between different groups increased and the social pressure rose until, in a striking parallel with star	David Christian, p. 245, Maps of	PeerRvw	Peer Reviewed Theory	3

DisciplineName / Theory Name	Theory Description	Theory Citation	Conceptual Model Type	Description	Value
PopulationDensitFood	Population Density - Food: when populations increase, pressure is placed on food resources;	Cohen, Mark, 1977 The Food Crisis in Prehistory. New Haven: Yale University Press.	SWAG	Scientific Wild Assed Guess	2
PostindustrialSociet	industrial societies are coming to an end and services and information are becoming more		SWAG+	SWAG with some review	2.5
ProteinHypothesis	people in tribal societies fight over protein sources, esp. hunting territories	Gross, Daniel, 1975 Protein Capture and Cultural Development in the Amazon Basin. American Anthropologist 77:526-549.; Harris, Marvin, 1974 Cows, Pigs, Wars, and Witches: The Riddles of Culture. New York: Random House.; Wilson, David J., 1999 Indigenous South Americans of the Past and Present: An Ecological Perspective. Boulder, Colorado:	SWAG+	SWAG with some review	2.5
SacredValues	Conflict over meterial issues and rationally motivated, but sacred symbols contested	Atran, Scott, Robert Axelrod, and Richard Davis, 2007 Sacred Barriers to Conflict Resolution. Science	WAG+	WAG plus some science	1.5
SigmoidUtilityTheory	Individuals and groups of individuals with common interest motivated by envy and greed with respect to others' social status	Friedman, Milton, and Leonard J. Savage, 1948 The Utility Analysis of Choices Involving Risk. Journal of Political Economy 4:279-304.; Cancian, F, 1972 Change and Uncertainty in a Peasant Economy. Stanford: Stanford University Press.; Kuznar, Lawrence A., 2001 Risk Sensitivity and Value among Andean Pastoralists: Measures, Models and Empirical Tests. Current Anthropology 42(3):432-440.; 2002 Evolutionary Applications of Risk Sensitivity Models to Socially Stratified Species: Comparison of Sigmoid, Concave and Linear Functions. Evolution and Human Behavior 23(4):265-280.; 2007 Rationality Wars and the War on Terror: Explaining Terrorism and Social Unrest. American Anthropologist 109(2):318-329.; Kuznar, Lawrence A., and William G. Frederick, 2003 Environmental	PeerRvw	Peer Reviewed Theory	3
Socialization	people learn violence	Whitings of HRAF	PeerRvw	Peer Reviewed Theory	3
Sociobiology	adapts neo-Darwinism to social evolution, positing that humans are products of both biological evolution and sociocultural evolution		PeerRvw	Peer Reviewed Theory	3
TradingRaiding	Intense interaction, disputes over trade, opportunities to steal motivate violence between	Keeley, Lawrence H., 1996 War before Civilization: The Myth of the Peaceful Savage. Oxford:	SWAG	Scientific Wild Assed Guess	2
TransCulturalDiffusi	concept that ideas, styles, religions, technologies, languages, etc. spread between individuals and thus through and between cultures		Accepted	Generally Accepted	4
UnilinealEvolution	concept that all societies pass through a single evolutionary process from the most primitive to		WAG	Wild Assed	1
WomanCapture	Men fight to capture women for wives; men fight over adultery	Chagnon, N., 1977 Yanamamo. New York: Holt, Rinehart and	PeerRvw+	Well reviewed theory	3.5
Business Management					
Bureaucracy	Theory of bureacracies: design them so they work despite the individual	Fayol, Henri	SWAG+	SWAG with some review	2.5
Parkinson's Law	Work expands to fill the time available	Parkinson, C. Northcote	SWAG+	SWAG with some review	2.5
Peter Principle	People rise to their level of incompetence	Peter, Laurence J.	SWAG	Scientific Wild Assed Guess	2
Satisficing	decision making where the first choice that is within the acceptable range is picked		PeerRvw	Peer Reviewed Theory	3

DisciplineName / Theory Name	Theory Description	Theory Citation	Conceptual Model Type	Description	Value
Theory X	Management style theory: people dislike work and must be coerced	McGregor, Douglas	SWAG	Scientific Wild Assed Guess	2
Theory Y	Management style theory: people seek	McGregor, Douglas	SWAG	Scientific Wild Assed Guess	2
Computer Science					
CoherenceThThought	Coherence theory of thought and action	Rescher, Nicholas. 1982. The coherence theory of truth. Washington, D.C.: University Press of America.; Rickheit, Gert and Christopher Habel. 1995. Focus and coherence in discourse processing. New York: W. de Gruyer; Tannen, Deborah. 1984. Coherence in spoken and written discourse. Norwood, N.J.: ABLEX Pub. Corp; Thagard, Paul. 2000. Coherence in Thought and Action. Cambridge,	PeerRvw	Peer Reviewed Theory	3
ContinuousSimulation	Continuous (actually time-stepped) simulation, with time units determining precision	Various	PeerRvw+	Well reviewed theory	3.5
DiscreteEventSimulat	Discrete event simulation of time	Various	PeerRvw+	Well reviewed theory	3.5
Greedy Algorithm	an heuristic algorithm that at every step selects the best choice available without regard to future		PeerRvw	Peer Reviewed Theory	3
Identical Variables	Connection is on a variable by variable basis, with exact semantic correspondence	None	Accepted	Generally Accepted	4
MixedContinDiscrete	Mixed continuous and discrete event simulation	Various	Accepted	Generally Accepted	4
Programmer'sDecisio	The programmer had to make an	None	WAG	Wild Assed	1
RandomNumberGene	Random number generators do not generate truly random numbers. The quality of the generator determines the nearness to true randomness and the policies for using the generators when many		PeerRvw+	Well reviewed theory	3.5
Simulated Annealing	computational method that is inspired by the annealing process (cf. annealing glass). Uses the		Accepted	Generally Accepted	4
Static model	No time representation	Various	PeerRvw	Peer Reviewed Theory	3
Tabu Search	a metaheuristic that guides a local heuristic search procedure to explore the solution space		Accepted	Generally Accepted	4
Data Issues					
Likert Scales	Subjective evaluations using Lickert Scalses	Various	PeerRvw	Peer Reviewed Theory	3
Economics, Macro					
Economics, Micro					
Preference Theory	studies the fundamental aspects of individual choice behavior, such as how to identify and quantify an individual's preferences over a set of alternatives and how to construct appropriate		PeerRvw+	Well reviewed theory	3.5

DisciplineName / Theory Name	Theory Description	Theory Citation	Conceptual Model Type	Description	Value
Prospect Theory	A prospect is a contract {x1,p1;...;xn,pn} that yields outcome xi with probability yi. Prospect theory is a descriptive theory of choice explaining common attitudes toward risk that	Daniel Kahneman and Amos Tversky. Prospect theory: an analysis of decision under risk. Econometrica, 47(2):263-292,	PeerRvw	Peer Reviewed Theory	3
Supply and Demand	Supply versus Demand Curve	Various	Accepted	Generally Accepted	4
Utility Theory	study of preferences structures and the ways to represent the preferences quantitatively		Accepted	Generally Accepted	4
Education					
BehaviorConditioning	Classical conditioning (sometimes referred to as Pavlovian conditioning) is a technique used in behavioral training in which a naturally occurring stimulus is paired with a response. Next, a	Pavlov, Skinner	PeerRvw	Peer Reviewed Theory	3
Constructivism	learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The learner selects and transforms information, constructs hypotheses,	Bruner, 1960, 1966, Piaget, Vgotsky	PeerRvw	Peer Reviewed Theory	3
OperantConditioning	Operant conditioning (sometimes referred to as instrumental conditioning) is a method of learning that occurs through reinforcement and punishments for behavior. Through operant		PeerRvw	Peer Reviewed Theory	3
SocialCognitiveLearn	Social Cognitive (Learning) Theory (Bandura)--Theory posits that people learn from one another, via observation, imitation, and modelling and do not necessarily need direct	Bandura	PeerRvw	Peer Reviewed Theory	3
Engineering, Civil					
Engineering, Other					
Control Theory	Differential & difference equations, stochastic processes, etc., to steer dynamical systems		Accepted	Generally Accepted	4
Geography, Human					
Geography, Physical					
Arc-Node network	Planar representation of significant points	Various	SWAG+	SWAG with some review	2.5
DTED-0	Digital Terrain Elevation Data 0 is about 1	US Govt	PeerRvw	Peer Reviewed Theory	3
DTED-1	Digital Terrain Elevation Data 1 is about 100	US Govt	PeerRvw+	Well reviewed theory	3.5
DTED-2	Digital Terrain Elevation Data 2 is about 30	US Govt	Accepted	Generally Accepted	4
Hex or Square grid	Planar representation depending on size of grid	Various	PeerRvw	Peer Reviewed Theory	3
Lat-Long coordinates	Planar dimensions taking acount of Earth's shape	Various	Accepted	Generally Accepted	4
No spatial coords	No spatial representation	Various	SWAG	Scientific Wild Assed Guess	2
XY coordinates	Planar dimensions with good local representation	Various	PeerRvw+	Well reviewed theory	3.5
History					
DemographicStructur	Demographic-structural theory: Population growth beyond the means of subsistence leads to declining levels of consumption and popular discontent, but this is not enough to destabilize	Turchin, Peter, "Arise 'cliodynamics'," Nature, Vol 454, No 3, 3 July 2008; Turchin, P. & S. Nefedov, Secular Cycles, Princeton	SWAG	Scientific Wild Assed Guess	2
Law					

DisciplineName

Conceptual Model

Theory Name	Theory Description	Theory Citation	Type	Description	Value
Linguistics					
Discourse Theory	A branch of ethnomethodology focusing on interactive communication.	Blommaert, Jan. 2005. Discourse: A Critical Introduction. New York: Cambridge University Press; Tannen, Deborah and James E. Alatis. 2003. Linguistics, language and the real world : discourse and	Accepted	Generally Accepted	4
SemanticDifferential	Osgood's semantic differential was designed to measure the connotative meaning of concepts. The respondent is asked to choose where his or her position lies, on a scale between two bipolar	Osgood, C.E., Suci, G., & Tannenbaum, P. (1957) The measurement of meaning. Urbana, IL: University of Illinois Press Snider, J. G., and Osgood, C. E. (1969) Semantic Differential Technique: A Sourcebook. Chicago: Aldine. Osgood, C. E., May, W. H., and Miron, M. S. (1975) Cross-Cultural Universals of Affective Meaning. Urbana, IL: University of Illinois Press Krus, D.J., & Ishigaki, Y. (1992) Kamikaze pilots: The Japanese and the	PeerRvw	Peer Reviewed Theory	3
Medicine					
DALY Model	Disability Adjusted Life Years (DALY). DALYs measure the gap between the average person's life across many different levels of health and a theoretical perfectly healthy life. The gap is	Mathers CD, Vos T, Lopez AD, Salomon J, Ezzati M (ed.) 2001. National Burden of Disease Studies A Practical Guide. Edition 2.0 Global program on Evidence for Health Policy. Geneva: World	SWAG+	SWAG with some review	2.5
SIR Model	SIR (Susceptible – Infectious – Recovered) model.SIR model illustrates the transition of a healthy person to a sick person to a dead person (or recovered person) by a generic disease	W. O. Kermack and A. G.	PeerRvw	Peer Reviewed Theory	3
SIS Model	Susceptible-Infectious-Susceptible (SIS) models adapted from the SIR model		SWAG+	SWAG with some review	2.5
Meteorology					
Meteorology	Effects of atmospheric conditions on general	Various	SWAG+	SWAG with some review	2.5
Military Science					
BonderFarrell	Bonder-Farrel attrition at the item level	Bonder & Farrell	PeerRvw+	Well reviewed theory	3.5
FM 3-24	Counterinsurgency manual	US Army 12/06	PeerRvw+	Well reviewed theory	3.5
HartleyLogLinearLaw	Attrition at the aggregated level	Hartley	PeerRvw	Peer Reviewed Theory	3
LanchesterLinearLaw	"Area Fire" attrition at the aggregated level	Lanchester	SWAG+	SWAG with some review	2.5
LanchesterSquareLaw	"Aimed Fire" attrition at the aggregated level	Lanchester	SWAG+	SWAG with some review	2.5
Small Wars Manual	Counterinsurgency	USMC 1940	PeerRvw+	Well reviewed theory	3.5

DisciplineName Theory Name	Theory Description	Theory Citation	Conceptual Model Type	 Description	 Value
Operations Research					
A*	A-star search algorithm finds the least-cost path from a given initial node to one goal node (out of one or more possible goals). It uses a distance-plus-cost heuristic function (usually	1968 by Peter Hart, Nils Nilsson, and Bertram Raphael	Accepted	Generally Accepted	4
AHP	Analytic Hierarchy Process derives ratio scales from both discrete and continuous paired comparisons in multilevel hierarchic structures.	Saaty	PeerRvw+	Well reviewed theory	3.5
Bayes' Theorem	Bayes' theorem relates the conditional and marginal probabilities of events A and B, where B has a non-vanishing probability:	various	Accepted	Generally Accepted	4
BayesianDecisionThe	Uses Bayes Rule to update probability based on new evidence		Accepted	Generally Accepted	4
BoundedRationality	A theory of choice making that says the reason people don't make fully rational choices is they lack the knowledge and computational skill to do	Simon, 1955, 1979; Gigerenzer, Gerd and Reinhard Selten. 2002. Bounded Rationality: The Adaptive Toolbox. Cambridge, MA: MIT Press; Rubinstein, Ariel. 1997. Modeling Bounded Rationality. Cambridge, MA: MIT Press; Simon, Herbert Alexander. 1982. Models of bounded rationality. Cambridge, MA: MIT	Accepted	Generally Accepted	4
Cluster Analysis	A generic term for various procedures used to objectively group entities based on similarities		Accepted	Generally Accepted	4
CostEffectivenessAna	Cost Effectiveness Analysis compares costs, benefits and risks of alternative solutions.		Accepted	Generally Accepted	4
DEA	Data Envelopment Analysis (DEA) is finding the efficient frontier of economic alternatives		Accepted	Generally Accepted	4
Decision Tree	pictorial description, nodes & arcs, of connections among decisions and chance events - must be tree shaped. Evalutes to best expected		Accepted	Generally Accepted	4
Dempster-	The Dempster-Shafer theory is a mathematical theory of evidence[1] based on belief functions and plausible reasoning, which is used to combine separate pieces of information (evidence) to	various	Accepted	Generally Accepted	4
Dijkstra's algorithm	For a given source vertex (node) in the graph, the algorithm finds the path with lowest cost (i.e. the shortest path) between that vertex and every other vertex. It can also be used for	Edsger Dijkstra in 1959	Proved	Scientifically Proved Theory	5
DynamicProgrammin	both an approach to problem solving and a decomposition technique where there is a sequence of interrelated decisions. Uses recursive	Bellman, 1957	Accepted	Generally Accepted	4
ExponentialSmoothin	a technique for revising an estimate of the average of a time series to extrapolate as a forecast. New forecast=(1-alpha)*old forecast +		Accepted	Generally Accepted	4
Game Theory	various types of games, with various rules	Bennett, Peter G. 1995. "Modeling decisions in international relations: Game theory and beyond." Mershon International Studies Review 39:19-52; Neumann, John Von and Oskar Morgenstern. 1944. Theory of Games and Economic Behavior. Princeton, NJ: Princeton University Press; Parsons, Simon and Michael Wooldridge. 2002. "Game theory and decision theory in multi-agent systems." Autonomous Agents and Multi-Agent Systems 5:243-254; Vane, Russell R. 2001. "Hypergame theory for DTGT agents." in Game Theoretic and Decision Theoretic Agents: AAAI Spring Symposium,	PeerRvw+	Well reviewed theory	3.5
Graph Theory	study of interconnetions of various elements		PeerRvw+	Well reviewed theory	3.5
HiddenMarkovModels	statistical models comprising a Markov chian whose states are associated with some probability distributions - transition probabilities		PeerRvw+	Well reviewed theory	3.5

Influence Diagram	equivalent to symmetric decision tree		Accepted	Generally Accepted	4
Linear Programming	Optimal selection	Dantzig	Proved	Scientifically Proved Theory	5
Little's Law	relates the number of customers in a queueing system to the waiting time of customers for a		Proved	Scientifically Proved Theory	5
Markov Chains	a Markov Process whose state space is discrete while its time domain may be either continuous of discrete (Markov property means that probabilities of future events are completely		Proved	Scientifically Proved Theory	5
MAUT	Multi-Attribute Utility Theory (MAUT) is useful in quantifying the relative attractiveness of alternatives with multiple attributes, each with		Accepted	Generally Accepted	4
MCDM	Multiple Criteria Decision Making (MCDM) includes deterministic and stochastic outcomes and explicit (enumerated) decision alternatives or implicit (alternatives specified by constraints)		PeerRvw+	Well reviewed theory	3.5
Neural Networks	computational models inspired by networks of		PeerRvw+	Well reviewed theory	3.5
Portfolio Theory	method of selecting a portfolio of options using economic concepts		PeerRvw+	Well reviewed theory	3.5
Queueing Theory	Derivation of wait times, service times, etc. from structure of queues	various	Proved	Scientifically Proved Theory	5
RPD and ImageTheory	Both Recognitions-Primed Decision Making (RPD) and Image theory are models of choice making involving pre-existing knowledge structures against which situations are evaluated	Klein, 1993; Beach, 1990, 1993	PeerRvw+	Well reviewed theory	3.5
Search Theory	Theory of how to search for an object and expected results of the search	Search and Detection, Alan R. Washburn, MAS, ORSA (now	Proved	Scientifically Proved Theory	5
Time Series Analysis	most popular time series forecasting method is	Box, Jenkins and Reinsel (1994), Pandit & Wu (1974)	Accepted	Generally Accepted	4
Political Science					
ContingencyTheory	conflict is contingent on unusual or irregular conditions that cause disruptions in conventional politics. The contingent approach leads one to study the political, economic and social	Harry Eckstein. "Theoretical Approaches to Explaining Collective Political Violence." In T.R. Gurr (ed.) Handbook of Political Conflict, pp. 135-166.	SWAG+	SWAG with some review	2.5
InherencyTheory	The inherent perspective assumes that violent political conflict emerges out of low-level contentious interactions among a set of political players. This approach leads researchers to focus	Harry Eckstein. "Theoretical Approaches to Explaining Collective Political Violence." In T.R. Gurr (ed.) Handbook of Political Conflict, pp. 135-166.	SWAG+	SWAG with some review	2.5
Psychology					
Additude Functions	persuasion is highest when the message address the attitude function of listener (e.g., utilitarian function, social identity function)	DeBono, 1987; Prentice, 1987; Shavitt, 1990, Shavitt et al., 1992	PeerRvw	Peer Reviewed Theory	3
AffectControlTheory	Generalizations: 1) actors generate feelings appropriate to a social situation, 2) actors who can't maintain their feelings redefine their views	Heise, David R. 1979. Understanding Events: Affect and the Construction of Social Action. New York: Cambridge University Press.; —. 2006. Expressive Order: Confirming Sentiments in Social Actions. New York: Springer; MacKinnon, Neil J. 1994. Symbolic Interactionism as Affect Control. Albany, NY: SUNY Press; Smith-Lovin, Lynn. 1988. "Affect control theory: An assessment." in Analyzing Social Interaction: Advances in Affect Control Theory, edited by L. Smith-Lovin	PeerRvw+	Well reviewed theory	3.5
AttributionTheory1	Attribution theory is concerned with how individuals interpret events and how this relates to their thinking and behavior. Attribution theory assumes that people try to determine why	Heider, 1958	SWAG+	SWAG with some review	2.5

DisciplineName	**Conceptual Model**

Theory Name	Theory Description	Theory Citation	Type	Description	Value
AttributionTheory2	Kelley expanded on Heider's model and attempted to explain the cognitive process by which people generate internal or external explanations Kelley proposed that individuals	Kelley, 1967	SWAG+	SWAG with some review	2.5
AttributionTheory3	Weiner added an additional dimension to causal interpretation when he proposed that the stability of the cause is also included in individual's explanations of outcomes. The	Weiner, 1971	SWAG+	SWAG with some review	2.5
BehavioralTheory	Behavioral Theory (Skinner). Behaviorism is a theory of learning based upon the idea that all behaviors are acquired through conditioning. Conditioning occurs through interaction with the	Skinner	PeerRvw	Peer Reviewed Theory	3
BigFiveFactorModel	Started as Neuroticism-Extroversion-Openness Inventory (NEO-I), later revised as NEO Personality Inventory (NEO PI-R). Claims personality encompasses five major traits (with	Robert McCrae & Paul Costa, 1970s; Goldberg, 1994; critique	SWAG+	SWAG with some review	2.5
CognitiveDissonanceT	Cognitive Dissonance Theory (Festinger) Social psychologist Leon Festinger first proposed the theory in 1957 after the publication of his book When Prophecy Fails, observing the	http://en.wikipedia.org/wiki/Cognitive_dissonance, May 2008. Leon Festinger. A Theory of Cognitive Dissonance. Stanford University	SWAG+	SWAG with some review	2.5
ElaborationLikelihoo	Elaboration Likelihood Model (ELM) posits that attitude change can occur through either of tw different processing routes: central or peripheral. Central route processing produces attitude	Petty & Cacioppo, 1986; Petty & Wegener, 1999	PeerRvw	Peer Reviewed Theory	3
Ethnomethodology	Empirically-oriented study of microinteraction and its conceptual framework.	Garfinkel, Harold. 2006. Seeing Sociologically: The Routine Grounds of Social Action. Boulder, CO: Paradigm Publishers; Heritage, John. 1993. Garfinkel and Ethnomethodology. Oxford, UK: Blackwell Publishing; Hilbert, Richard A. 1992. The Classical Roots of Ethnomethodology: Durkheim, Weber and Garfinkel. Chapel Hill, NC: University of	PeerRvw	Peer Reviewed Theory	3
HeuristicSystematicM	Heuristic-Systematic Model (HSM) of social information processing divides message processing (for persuasion) into systematic and heuristic modes and describes what triggers each	Chaiken, 1980, 1987	PeerRvw	Peer Reviewed Theory	3
InoculationTheory	Inoculation theory concerns conferring resistance to persuation.	McGuire; Jamieson, 1992	SWAG+	SWAG with some review	2.5
InvolvementELM	Extension of Elaboration Likelihood Model (ELM) adds the effect of induced involvement in	Slater	PeerRvw	Peer Reviewed Theory	3
LanguageExpectancyTh	Language Expectancy Theory (for modeling persuasion) is an axiomatic theory that expounds on the effects of linguistic variations on message persuasiveness. It is a message-centered	M. Burgoon, 1995	PeerRvw	Peer Reviewed Theory	3
MMPI	Minnesota Multiphasic Personality Inventory (MMPI). A new and psychometrically improved version of the MMPI-2 has recently been developed employing rigorous statistical methods	Starke R. Hathaway, PhD, and J. C. McKinley, MD, originators, many contributors since	PeerRvw	Peer Reviewed Theory	3

DisciplineName			Conceptual Model		
Theory Name	**Theory Description**	**Theory Citation**	**Type**	**Description**	**Value**
Myers-Briggs	Myers-Briggs Type Indicator (MBTI) assessment is a psychometric questionnaire designed to identify certain psychological differences according to the typological theories of Carl	The Manual	SWAG+	SWAG with some review	2.5
Prototype Concepts	The empirical discovery that human concepts are organized radially, from the empirically	Neisser, Ulric. 1987. Concepts and Conceptual Development: Ecological and Intellectual Factors in Categorization. New York: Cambridge University Press; Rosch, Eleanor. 1978. "Principles of categorization." Pp. 27-48 in Cognition and Categorization, edited by E. Rosch and B. B. Lloyd. Hillsdale, NJ: Lawrence Erlbaum.; —. 1983. "Prototype classification and logical classification." Pp. 73-86 in New Trends in Conceptual Representation: Challenges to Piaget's Theory?, edited by E. K. Scholnick. Hillsdale, NJ: Lawrence Erlbaum; Wittgenstein, Ludwig. 1958. Philosophical Investigations : the English text of the third	Accepted	Generally Accepted	4
ReactanceTheory	Reactance Theory. It operates in three simple steps that are sequentially connected. People perceive an unfair restriction on their actions. A state of reactance is activated. Reactance is an	Brehm, 1966	SWAG+	SWAG with some review	2.5
Self-affirmationTheo	Self-affirmation theory. This theory explains how people will reduce the impact of a threat to their self-concept by focusing on and affirming their competence in some other area.	Steele, 1988	SWAG+	SWAG with some review	2.5
Self-awarenessTheory		Duval & Wickland, 1972	SWAG+	SWAG with some review	2.5
Self-completionTheor	Self-completion theory. Symbolic self completion theory argues that many of the activities that individuals enact—such as possessions they purchase—are intended to	Wicklund & Gollwitzer, 1982	SWAG+	SWAG with some review	2.5
Self-discrepancyTheo	Self-discrepancy theory. We are strongly motivated to maintain a sense of consistency among our various beliefs and self-perceptions. This causes problems as there are invariably	Higgins et al., 1987	SWAG+	SWAG with some review	2.5
Self-evaluatnMainten	Self-evaluation maintenance theory. The theory suggests that one's self-concept can be threatened by how other people behave. The level of threat depends both on how close the	Tesser, 1988	SWAG+	SWAG with some review	2.5
Self-monitoringTheor	Self-monitoring theory. The theory refers to the process through which people regulate their own behavior in order to "look good" so that they will be perceived by others in a favorable	Snyder, 1974	SWAG+	SWAG with some review	2.5
Self-perceptionTheor	Self-perception theory. It asserts that we develop our attitudes by observing our own behavior and concluding what attitudes must have caused them. Self-perception theory differs	Bem, 1972	SWAG+	SWAG with some review	2.5
Self-presentationThe	Self-presentation theory. Impression management is the process through which people try to control the impressions other people form of them. It is a goal-directed conscious or	Goffman, 1959	SWAG+	SWAG with some review	2.5
Self-verificationThe	Self-verification theory. The theory asserts that people want to be known and understood by others according to their firmly held beliefs and feelings about themselves. Because chronic self-	Swann, 1990	SWAG+	SWAG with some review	2.5
SocialCognitiveTheor	Social Cognitive Theory (formerly social learning theory). - Social cognitive theory provides a framework for understanding, predicting, and changing human behavior. The	Bandura 1977; Bandura 1986	PeerRvw	Peer Reviewed Theory	3
SocialComparison	The theory that people evaluate their opinions and abilities in comparison to other people. Many opinions and abilities cannot be evaluated without some sort of reference. The theory	Leon Festinger. A theory of social comparison process. Human Relations, pages 117-140, 1954.	SWAG+	SWAG with some review	2.5

DisciplineName / Theory Name	Theory Description	Theory Citation	Conceptual Model Type	Description	Value
SocialExchangeTheory	Social Exchange theory explains how we feel about a relationship with another person as depending on our perceptions of: a) the balance between what we put into the relationship and	Thibaut & Kelly, 1959	SWAG+	SWAG with some review	2.5
SocialFacilitation	Social facilitation. Tasks which we find easy, are done *better/quicker* in the presence of other people. The opposite is true for difficult tasks. This is because first, the presence of others	Tripp, 1918; Zajonc	SWAG+	SWAG with some review	2.5
TerrorMgmtTheory	Terror Management Theory. It is based on Ernest Becker's writings, in which the universality of death terror and the need to protect against it play an essential role.	Greenberg, Solomon, &	SWAG+	SWAG with some review	2.5
TheoryReasonedActio	Theory of Reasoned Action (TRA) was developed to explain volitional behaviors. It excludes spontaneous, impulsive, habitual, cravings driven, scripted or mindless behaviors.	Fishbein & Ajzen, 1975, 1980	PeerRvw	Peer Reviewed Theory	3
ThOfPlannedBehavior	Theory of Planned Behavior. Theory of Reasoned Action suggests that a person's behavior is determined by his/her intention to perform the behavior and that this intention is,	Ajzen & Fishbein, 1980	PeerRvw	Peer Reviewed Theory	3
TriangularThOfLove	The triangular theory of love.The theory characterizes love within the context of interpersonal relationships by three different components: intimacy, passion commitment.	Sternberg, 1986	SWAG+	SWAG with some review	2.5
TwoFactorTheoEmotio	Two-factor theory of emotion. When trying to understand what kind of person we are, we first watch what we do and feel and then deduce our nature from this. This means that the first step	Schachter & Singer, 1962	SWAG+	SWAG with some review	2.5
Science, Biology					
Evolution	Evolutionary Theory widely held notion that all life is related and has descended from a common ancestor: the birds and the bananas, the fishes and the flowers -- all related. Darwin's general	Darwin	Accepted	Generally Accepted	4
Science, Physical					
Sociology					
Arousal Theory	Arousal Theory. cost-reward theory suggests that people feel upset when they see a person in need and are motivated to do something to reduce the unpleasant arousal. People then weigh the costs		SWAG+	SWAG with some review	2.5
Comp.Org.Theory	Discipline focuses on theorizing about, describing, understanding, and predicting the behaviors of organizations and the process of organizing using formal approaches	Kathleen M. Carley and Lee Gasser. Multiagent systems: a modern approach to distributed artificial intelligence, chapter Computational Organization Theory. MIT Press,	SWAG+	SWAG with some review	2.5
Conflict Theory	Conflict theory argues that society is not about solidarity or social consensus but rather about competition. Society is made up of individuals competing for limited resources (e.g., money,	Conflict theory was elaborated in the United Kingdom by Max Gluckman and John Rex, in the United States by Lewis A. Coser and Randall Collins, and in Germany by Ralf Dahrendorf, all of whom were influenced by Karl Marx, Ludwig Gumplovicz, Vilfredo Pareto, Georg Simmel, and other founding fathers of European sociology.	PeerRvw+	Well reviewed theory	3.5
Forced Migration	people place tremendous value on their physical security and will abandon their property and relocate if they feel their security is threatened	Davenport, Christina A., Will H. Moore, and Steven C. Poe. 2003. Sometimes you just have to leave: Threat and refugee movements, 1964 – 1989.	SWAG+	SWAG with some review	2.5
ImpressionManageme	An extension of role theory, impression management is both a theory and process. The theory argues that people are constantly engaged in controlling how others perceive them. The	Erving Goffman, 1959	PeerRvw	Peer Reviewed Theory	3
InformtnlScialInflnc	Informational social influence occurs when one turns to the members of one's group to obtain accurate information. A person is most likely to use informational social influence in three	Sherif, 1935; Cialdini, 1993	SWAG+	SWAG with some review	2.5

DisciplineName			Conceptual Model		
Theory Name	**Theory Description**	**Theory Citation**	**Type**	**Description**	**Value**
Integration Theory	Recently, some sociologists have been taking a different approach to sociological theory by employing an integrationist approach - combining micro- and macro-level theories to	Ritzer & Goodman 2004	PeerRvw	Peer Reviewed Theory	3
Manifest&LatentFunc	Says there is a difference between manifest and latent functions, where manifest functions are the intended functions of a phenomenon in a social system and latent functions are the	Merton, 1957	PeerRvw	Peer Reviewed Theory	3
Micro-Generation	The theory that social interaction at all scales is ultimately microinteraction.	Collins, Randall. 1981. "On the microfoundations of macrosociology." American Journal of Sociology 86:984-1014; Hilbert, Richard A. 1990. "Ethnomethodology and the micro-macro order." American Sociological Review 55:794-808; Rawls, Anne Warfield. 1987. "The interaction order sui generis: Goffman's contribution to social theory." Sociological Theory 5:136-149; Stinchcombe, Arthur L. 2001. When Formality Works: Authority and Abstraction in Law	SWAG+	SWAG with some review	2.5
NormativeScialInflnc	Normative social influence. Normative social influence occurs when one conforms to be liked or accepted by the members of the group.	Asch, 1951	SWAG+	SWAG with some review	2.5
Public discourse	Study of the beliefs & ideologies in history and public policy, their dynamics and the resources that shape those dynamics.	Apter, David E. and Tony Saich. 1994. Revolutionary Discourse in Mao's Republic. Cambridge, MA: Harvard University Press; Converse, Phillip. 1964. "The nature of mass belief systems." Pp. 206-261 in Ideology and Its Discontents, edited by D. Apter. New York: Free Press; Wuthnow, Robert. 1989. Communities of Discourse: Ideology and Social Structure in the Reformation, the Enlightenment, and European	PeerRvw	Peer Reviewed Theory	3
Relative Deprivation	Relative deprivation is the experience of being deprived of something to which one thinks one is entitled. Schaefer defines it as "the conscious experience of a negative discrepancy	T. R. Gurr. Why men rebel. Princeton University Press,	SWAG	Scientific Wild Assed Guess	2
Role Theory	Role Theory posits that human behavior is guided by expectations held both by the individual and by other people. The expectations correspond to different roles individuals perform		PeerRvw	Peer Reviewed Theory	3
SocialConstructionis	Social constructionism is a school of thought introduced into sociology by Berger and Luckmann. Social constructionism aims to discover the ways that individuals and groups	Peter L. Berger and Thomas Luckmann in 1966 book The Social Construction of Reality	SWAG+	SWAG with some review	2.5

DisciplineName / Theory Name	Theory Description	Theory Citation	Conceptual Model Type	Description	Value
SocialEmotion	The theory that emotion underlies human reasoning and all social processes. These references draw upon multiple models.	Collins, Randall. 1981. "On the microfoundations of macrosociology." American Journal of Sociology 86:984-1014.; —. 1990. "Stratification, emotional energy and the transient emotions." Pp. 27-57 in Research Agendas in the Sociology of Emotions, edited by T. D. Kemper. Albany: SUNY Press.; —. 1993. "Emotional energy as the common denominator of rational choice." Rationality and Society 5:203-230.; —. 2004. Interaction Ritual Chains. Princeton, NJ: Princeton University Press; Lawler, Edward J. 2003. "Interaction, emotion and collective identities." in Advances in Identity Theory and Research, edited by P. J. Burke. New York: Kluwer Academic; Sallach, David L. 2008. "Modeling emotional dynamics: Currency versus field." Rationality and Society 20:343-365; Scheff, Thomas. 1994. "Emotions and identity: A theory of ethnic nationalism." in Social Theory and the Politics of Identity, edited by C. Calhoun. Cambridge,	PeerRvw+	Well reviewed theory	3.5
SocialIdentity	the psychological basis of intergroup discrimination. It is composed of four elements: Categorization: We often put others (and ourselves) into categories.	Henri Tajfel and John Turner	PeerRvw	Peer Reviewed Theory	3
SocialImpactTheory	Social Impact Theory. The theory predicts that as strength and immediacy increase within a group (up to about 4-5 people), conformity will also increase. The more important a group is and	Latane, 1981	SWAG+	SWAG with some review	2.5
StructuralFunctional	Structural-Functionalism focuses on the ways social institutions meet social needs. Attempts to explain social cohesion and stability of a society through the concept of solidarity. In more "primitive"	Durkheim, Hoult 1969, Auguste Comte, Radcliffe-Brown, Layton	PeerRvw+	Well reviewed theory	3.5
StructurationTheory	The notion of construction and reconstruction of the social system through human interaction based on rules and resources		SWAG+	SWAG with some review	2.5
SymbolicInteraction	Symbolic Interactionism is a theoretical approach to understanding the relationship between humans and society. The basic notion of symbolic interactionism is that human action	Herman and Reynolds 1994	PeerRvw	Peer Reviewed Theory	3
Subject Matter Expert					
HartleyDIME/PMESII	DIME/PMESII connections added by Hartley	Hartley, Dean S., III. Operations Other Than War (OOTW) Flexible Asymmetric Simulation Technologies (FAST) Prototype Toolbox: ISSM v4.00 Analysts'	SWAG	Scientific Wild Assed Guess	2
Hayes & Sands	DIME/PMESII connections defined in book	Hayes, Bradd C. and Jeffrey I. Sands. Doing Windows: Non-Traditional Military Responses to Complex Emergencies. CCRP,	SWAG+	SWAG with some review	2.5

5.2 DATA SOURCES

Data Source Name / Data Set Name	Data Description	Data Citation	Data Producer Validity Type	Description	Value
Anti-Defamation League					
AntiDefamationTerr	Anti-Defamation League Terrorism site	http://www.adl.org/terrorism/symbols/	SomeFlaws	A few flaws and some suspected	2.5
ARDA					
ARDA	The Association of Religion Data Archives (ARDA) strives to democratize access to the best data on religion. Founded as the American Religion Data Archive in 1997 and going online	http://www.thearda.com/Archive/Bro	ModA&P	Moderate accuracy &	3.5
Barro & Lee					
EducationAttainment	Provides comparative levels of educational attainment across 118 countries and 45 years, including no schooling, primary school, secondary school, and higher school. The dataset	CID-World Bank Data Surfer http://paradocs.pols.columbia.edu/dat avi ne/MainFrameSet.jsp; updates from Center for International Development at Harvard University http://www.cid.harvard.edu/ciddata/ci ddata.html	SomeFlaws	A few flaws and some suspected	2.5
CenterForNonproliferationStudies					
CNS	Center for Nonproliferation Studies (CNS) Terrorism, WMD and Emergency Preparedness The Center for Nonproliferation Studies (CNS) strives to combat the spread of weapons of mass	http://cns.miis.edu/research/wtc01/te rrwmd.htm	ModA&P	Moderate accuracy &	3.5
Central Banks					
Central	Economic and Socio Demographic Data at the National Level URL for Central Banks of most	http://www.bis.org/cbanks.htm	SomeFlaws	A few flaws and some suspected	2.5
CIDCM					
CIDCM	University of Maryland's Center for International Development and Conflict	http://www.cidcm.umd.edu/	ModA&P	Moderate accuracy &	3.5
ConnectednessMem	Connected Memberships in Inter-Governmental Organizations. These data provide an indicator for "connectedness," or how wellintegrated the state is with the international system and/or its	Monty Marshall, CIDCM, The University of Maryland	SomeFlaws	A few flaws and some suspected	2.5
Coup d'Etat Events	This data compiles basic descriptive information on all coups d'état occurring in countries with populations greater than 500,000 during the period 1960–2003. A coup d'état is defined as a	Monty G. Marshall and Donna Ramsey Marshall, Center for	SomeFlaws	A few flaws and some suspected	2.5
DirectMilitaryInterv	This compiled dataset focuses on identifying what countries or international organizations made the decision to intervene militarily in a specific country in a given year. If an actor was	Monty Marshall, CIDCM, The University of Maryland, 1999	FlawsKno	Known flaws in data production	2

Data Source Name / Data Set Name	Data Description	Data Citation	Data Producer Validity Type	Description	Value
GroupDisciriminati	The dataset contains indicators of group discrimination and separatism including group number, country and group names, political and economic discrimination indices, separatism	Ted R. Gurr, CIDCM, The University of Maryland, as updated by the Political Instability Task	SomeFlaws	A few flaws and some suspected	2.5
MajorArmedConflic	Major armed conflicts and conflict regions, 1946-2003 contains data on seven categories of armed conflicts: (IV) international violence, (IW) international war, (IN) international	Monty Marshall, CIDCM, The University of Maryland, 2002 Original data from Monty G. Marshall, "Major Episodes of	SomeFlaws	A few flaws and some suspected	2.5
Minorities at Risk	The Minorities at Risk database provides a combination of qualitative and quantitative information concerning all communal groups which meet the criteria for inclusion as a	Minorities At Risk Data Generation and Management Program (MARGene), used to access to data in the MAR dataset developed by Ted Gurr and associates (Gurr et al. 1993; Gurr 2000). Data available at http://www.cidcm.umd.edu/inscr/mar/	SomeFlaws	A few flaws and some suspected	2.5
Polity IV	coded annual information on regime and authority characteristics for all independent states (with greater than 500,000 total population) in the global state system and covers	http://www.cidcm.umd.edu/polity/	ModA&P	Moderate accuracy &	3.5
Correlates of War					
CorrelatesOfWar	Conflict Data: Inter and Intra State Correlates of War Project: 1816 -2006 State System membership, militarized disputes, formal alliances, national material capabilities. Not	http://www.correlatesofwar.org/	SomeFlaws	A few flaws and some suspected	2.5
CulturalDataSet	This data set records the size of ethnic groups, linguistic populations, and religious bodies in the Correlates of War interstate system for each decade from 1820 through 1990. In addition, it	Phil Schafer, University of Michigan	SomeFlaws	A few flaws and some suspected	2.5
Internat&CivilWar	Updates for these data are part of the Correlates of War 2 project. The updated data included here were derived from three separate datasets: COW Inter-State War Data, 1816-1997 (v3.0), COW	Correlates of War 2 homepage http://cow2.la.psu.edu/	SomeFlaws	A few flaws and some suspected	2.5
NationalMaterialCa	National Material Capabilities Data. This dataset codes for each international system member for each year between 1816 and 2001 demographic, military and industrial indicators. These	Correlates of War 2 homepage http://cow2.la.psu.edu/	SomeFlaws	A few flaws and some suspected	2.5
Council on Foreign Relations					
CouncilForgnRelati	Council on Foreign Relations	http://www.cfr.org/publication/9237/	SomeFlaws	A few flaws and some suspected	2.5
Crisis Group					
IntntlCrisisGroup	International Crisis Group an independent, non-profit, non-governmental organization, with over 110 staff members on five continents, working through field-based analysis and high-	http://www.crisisgroup.org/home/ind	ModA&P	Moderate accuracy &	3.5
DatabanksInternational.com					
Bank's Cross Nationa	Bank's Cross National Time Series Data Archive 1815-2006 Demographic, Economic, Development, Stability, Regime Duration data.	http://databanksinternational.com/	ModA&P	Moderate accuracy &	3.5
Earth Trends					
Earth Trends	A compilation of a variety of social. Economic and environmental data	http://earthtrends.wri.org/searchable_db/index.php?step=countries&cID[]=6&theme=5&variab	SomeFlaws	A few flaws and some suspected	2.5
Encyclopedia Brittanica					
GeoAnalyzer	GeoAnalyzer (Encyclopedia Brittanica), Country Snapshots offer statistics on demography, vital statistics, national economy, transportation and communication, education and health, and	http://geoanalyzer.britannica.com/	FlawsSusp	Suspected flaws in data production	3

Data Source Name / Data Set Name	Data Description	Data Citation	Data Producer Validity Type	Description	Value
Englebert					
StateLegitimacyAfri	Measures the developmental effects of the quality and extent of state legitimacy and related variables worldwide and within Africa. The dataset covers more than 100 countries from	Website of Pierre Englebert http://www.politics.pomona.edu/penglebert/ From Pierre Englebert, 2000. "State Legitimacy and Development in Africa," Lynne Rienner Publishers. Available at http://www.rienner.com/viewbook.cf	SomeFlaws	A few flaws and some suspected	2.5
Europa Publications					
AfricaSouthofSahar	Africa South of the Sahara	http://www-sul.stanford.edu/depts/ssrg/africa/ www.unesco.org/unesdi/index.php/eng/repertoire/tous "Africa South of the Sahara, Europa Publication	FlawsSusp	Suspected flaws in data production	3
EuropaWorldYearbo	Europa World Yearbook	www.europaworld.com/ "The Europa World Yearbook, London: England, Europa Publications	FlawsSusp	Suspected flaws in data production	3
FarEast&Australasia	The Far East and Australasia 1970-2000	Reference Library Book "The Far East and Australasia, London, Europa Publications, 1970-2000"	FlawsSusp	Suspected flaws in data production	3
MidEast&N Africa	The Middle East and North Africa 1948-59,	Reference Library Book "The Middle East and North Africa, London, Europa Publications, 1974-	FlawsSusp	Suspected flaws in data production	3
Fearon					
NoncontiguousState	This dataset includes an indicator of states defined as noncontiguous. Specifically, countries with territory holding at least 10,000 people and separated from the land area containing the	James D. Fearon and David D. Laitin, “Ethnicity, Insurgency, and Civil War,” paper presented at the 2001 Annual Meetings of the American Political Science Association, San Francisco, CA (August 2001). Data sent via e-mail	SomeFlaws	A few flaws and some suspected	2.5
Freedom House					
Freedom House	Freedom House 1972-2007 Civil, Political and Economic freedom and Press freedom	http://www.freedomhouse.org/template.cfm?page=15	FlawsSusp	Suspected flaws in data production	3
PoliticalRightsIndex	Measure of rights to participate meaningfully in the political process	http://www.freedomhouse.org/uploads/special_report/29.pdf	SomeFlaws	A few flaws and some suspected	2.5
Global Security.org					
GlobalSecurity	A news portal on security issues	http://www.globalsecurity.org/index.	FlawsSusp	Suspected flaws in data production	3
Global Terror Alert					
GlobalTerrorAlert	A private web site purporting to offer terrorism	http://www.globalterroralert.com/	FlawsKno	Known flaws in data production	2
Golder					
DemocraticElectoral	This dataset covers the electoral institutions used in all of the democratic legislative and presidential elections in more than 150 countries between 1946 (or independence) and 2000. The	Matt Golder, 2005 (forthcoming). "Democratic Electoral Systems Around the World, 1946-2000." Electoral Studies 24, 103–121. Data and paper available at http://homepages.nyu.edu/~mrg217/	SomeFlaws	A few flaws and some suspected	2.5

Data Source Name / Data Set Name	Data Description	Data Citation	Producer Validity Type	Description	Value
Harff & Gurr					
EliteCharacteristics	The codings on this set of variables are based on the class affiliations of the chief executive and, if information is available on his/her immediate associates. Variables coded include the ethnic	Barbara Harff, U.S. Naval Academy, as updated by the Political Instability Task Force	SomeFlaws	A few flaws and some suspected	2.5
Hartley					
BattleofBritain	18 Battle of Britain air battles	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	FlawsSusp	Suspected flaws in data production	3
BrasseyBattles	108 historical battles from Brassey	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	SomeFlaws	A few flaws and some suspected	2.5
CAA LWDB	627 historical battles from 1600 to 1944 from the Center for Army Analyses (CAA) Land	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	ModA&P	Moderate accuracy &	3.5
CivilWarBattles	49 Civil War battles	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	SomeFlaws	A few flaws and some suspected	2.5
Helm83	83 historical battles from Helmbold	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	FlawsSusp	Suspected flaws in data production	3
Helm92	92 historical battles from Helmbold	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	FlawsSusp	Suspected flaws in data production	3
HelmCW	19 Civil War battles from Helmbold (with duplications from different authorities)	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	SomeFlaws	A few flaws and some suspected	2.5
Inchon	19 combat days from Inchon Campaign of	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	FlawsSusp	Suspected flaws in data production	3
OsipovBattles	38 historical battles from Osipov	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	FlawsSusp	Suspected flaws in data production	3
ShortBattles	72 short historical battles	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	SomeFlaws	A few flaws and some suspected	2.5
WWIBattles	12 WWI battles	Predicting Combat Effects, Dean S. Hartley III, INFORMS/MAS, 2001, http://topicsinor.pubs.informs.org/pc	SomeFlaws	A few flaws and some suspected	2.5
Human Relations Area Files					
HRAFArchaeology	Database of prehistory of the world. The eHRAF Collection of Archaeology currently covers over 41 major archaeological traditions with more than 50,000 pages. Each tradition file also	Hosted at Yale. http://www.yale.edu/hraf/collections.	GoodA&P	Accuracy & precision slightly less than rqmts	4
HRAFWorldCulture	Previously HRAF Ethnography. http://www.yale.edu/hraf/collections.htm It is important to note that cultures in the microfiche and electronic versions of the HRAF Collection	Hosted at Yale. http://www.yale.edu/hraf/collections.	GoodA&P	Accuracy & precision slightly less than rqmts	4
Institute for Counter Terrorism					
InstForCounterTerr	Institute for Counter Terrorism	http://www.ict.org.il/	SomeFlaws	A few flaws and some suspected	2.5
International Historical Statistics					
IntnlHistoricalStati	"International Historical Statistics" Mitchell	Reference Library Books	FlawsSusp	Suspected flaws in data production	3
International Monetary Fund					
DirectionsOfTrade(	The complete DOT dataset includes approximately 55,000 country and area time series data covering the distribution of exports and imports by partner country for about 180	International Monetary Fund Publication Services (via CD-ROM)	SomeFlaws	A few flaws and some suspected	2.5

Data Source Name / Data Set Name	Data Description	Data Citation	Data Producer Validity Type	Description	Value
GovtFinanclStatistic	Economic and Socio Demographic Data at the National Level	www.imf.org/external/pubs/ft/gfs/manual/gfs.htm	SomeFlaws	A few flaws and some suspected	2.5
IntnlFinanclStatisti	International Financial Statistics (IFS) is the International Monetary Fund's principal statistical publication, published on CD-ROM monthly with data from January 1948. The CD-	http://www.imfstatistics.org/imf/logon.aspx International Financial Statistics and International Monetary Fund Standby Agreements	SomeFlaws	A few flaws and some suspected	2.5
International National Statistics					
IntnlNationalStatist	International National Statistics 1950-1993	"International National Statistics, UK, MacMillan Reference, LTD. 1998 [Europe; Africa, Asia & Oceana; The Americas, 1950-1993"	ModA&P	Moderate accuracy &	3.5
InternationalLabourOrganization					
LABORSTA	From the ILO LABORSTA service, these data cover strikes and lockouts from 1969–2003, including variables for event counts and numbers of workers involved. The ILO defines a strike as	ILO LABORSTA Internet http://laborsta.ilo.org/	SomeFlaws	A few flaws and some suspected	2.5
IntOrgForStandardization					
ISO3166	ISO 3166 is the international standard for country codes. ISO 3166 encompasses three parts. ISO 3166-1: This contains the codes that most users know as the ISO's country codes. This	International Organization for Standardization, Maintenance Agency for ISO 3166 Country Codes The short country names from ISO 3166-1 and the alpha-2 codes are made available by ISO at http://www.iso.ch/iso/en/prodsservice	ExcA&P	Accuracy & precision meet or exceed rqmts	5
IntTelecomUnion (ITU)					
TelecomIndicatorData	The World Telecommunication Indicators Database contains time series data for the years 1960, 1965, 1970 and annually from 1975-2001. The total dataset covers approximately	International Telecommunication	SomeFlaws	A few flaws and some suspected	2.5
IRIS, UnivOfMD					
IntnlCountryRiskG	This dataset was assembled by IRIS from hard copies of the International Country Risk Guide, a monthly publication of Political Risk services. Each variable's value for a given country and	Institute for Reform and the Informal Sector (IRIS), University	SomeFlaws	A few flaws and some suspected	2.5
Jamestown Foundation					
TheJamestownFoun	The Jamestown Foundation's mission is to inform and educate policy makers and the broader policy community about events and trends in those societies which are strategically	http://www.jamestown.org/	ModA&P	Moderate accuracy &	3.5
KEDS					
KEDS	Kansas Events Data System KEDS computer program that encodes news reports to generate data about the behavior of dissidents toward governments, governments toward dissidents,	Philip A. Schrodt, Shannon G. Davis and Judith L. Weddle. "Political Science: KEDS—A Program for the Machine Coding of Event Data." Social Science Computer Review.	ModA&P	Moderate accuracy &	3.5
Levy					
StateCapacitySurve	In 1999, the Political Instability Task Force decided to experiment with a new way to measure state capacity that relied on a survey of country experts. Under the direction of Marc	Marc Levy, CIESIN, Columbia	SomeFlaws	A few flaws and some suspected	2.5
Ludwig					
King of the	This data set contains information on the rulers of all countries during the 20th century, highlighting facets of political leadership that explore the motivations behind the desire to	Database for materials gathered for the book King of the Mountain: The Nature of Political Leadership	SomeFlaws	A few flaws and some suspected	2.5

Data Source Name / Data Set Name	Data Description	Data Citation	Data Producer Validity Type	Description	Value
Mickolus & Flemming					
ITERATE	International Terrorism: Attributes Of Terrorist Events (ITERATE) Data cover 1968–2003; variables describe attributes of terrorist events, including count of number of incidents per year,	Edward F. Mickolus and Peter A. Flemming (via e-mail)	SomeFlaws	A few flaws and some suspected	2.5
MIPT					
MIPTTerrorismKnow	MIPT Terrorism Knowledge Base	Developed by the National Memorial Institute for the Prevention of Terrorism (MIPT), the Terrorism Knowledge Base offers in-depth information on	SomeFlaws	A few flaws and some suspected	2.5
Nation Master					
NationMaster	NationMaster, statistics	http://www.nationmaster.com	SomeFlaws	A few flaws and some suspected	2.5
NATO					
NATO	Explains NATO's contribution to the fight against terrorism through military operations in Afghanistan, the Balkans and the Mediterranean and by taking steps to protect its populations	http://www.nato.int/issues/terrorism/index.html	SomeFlaws	A few flaws and some suspected	2.5
Northeast Intelligence Network					
NortheastIntlNetwork	Northeast Intelligence Network	http://www.homelandsecurityus.com/terrorgroups.asp	SomeFlaws	A few flaws and some suspected	2.5
NYU					
LogicOfPoliticalSur	The Logic of Political Survival attempts to address why leaders who produce peace and prosperity are turned out of office after only a short time, while those who produce corruption,	The Logic of Political Survival Data Source http://www.nyu.edu/gsas/dept/politics/data/bdm2s2/Logic.htm From Bruce Bueno de Mesquita, Alastair Smith, Randolph Siverson, James Morrow, 2002. "The Logic of Political Survival." The book is now available from MIT Press at http://mitpress.mit.edu./catalog/item/default.asp?sid=2D79498B-1CF9-	SomeFlaws	A few flaws and some suspected	2.5
OECD					
Internatnl	SOPEMI contains international migration data for OECD member countries and some non-member economies. The publication's Statistical Annex includes outflows and inflows of foreign	Organisation for Economic Co-Operation and Development	SomeFlaws	A few flaws and some suspected	2.5
PCS					
PCS	Project Civil Strife (PCS) uses computerized coding technology to generate disaggregated data useful for testing the hypotheses advanced by the new generation of intrastate conflict	Stephen M. Shellman, College of William & Mary	SomeFlaws	A few flaws and some suspected	2.5
Pew Research Center					
ThePewResearchCe	The Pew Global Attitudes Project is a series of worldwide public opinion surveys. More than 90,000 interviews in 50 countries have been conducted as part of the project. Includes	http://pewglobal.org/	SomeFlaws	A few flaws and some suspected	2.5

Data Source Name / Data Set Name	Data Description	Data Citation	Data Producer Validity Type	Description	Value
PoliticalInstabilityTaskForce					
IslamicFamilyLawIn	Covering approximately 45 countries, this dataset provides coded indicators describing type of personal code administration, family law as a source of political controversy, and type of	Commissioned for the Political Instability Task Force	SomeFlaws	A few flaws and some suspected	2.5
Islamism Dataset	This dataset contains several indicators of Islamism and factors related to Islamism for selected countries, including: Theological foundations of Islamism, Islamism as a religious	Commissioned for the Political Instability Task Force	FlawsKno	Known flaws in data production	2
ReligiousFractionali	Provides statistics through 2000 on percentage of population following various religions or religious practices. Also includes religion Herfindahl index and an indicator of whether	Commissioned for the Political Instability Task Force	FlawsKno	Known flaws in data production	2
WorldEthnicityData	This dataset captures the largest ethnic group in each selected country, ethnic groups represented in those countries as a percentage of total population, and also an ethnic diversity index.	Commissioned for the Political Instability Task Force	FlawsKno	Known flaws in data production	2
PRIO					
Armed Conflict	International Peace Research Institute, Oslo (PRIO), Department of Peace and Conflict Research, Uppsala University Armed conflict remains a serious problem in the post-Cold War	Mikael Eriksson and Peter Wallensteen, 2004. Armed Conflict 1989–2003, Journal of Peace Research 41(5); Nils Petter Gleditsch, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg, and Håvard Strand, 2002. Armed Conflict 1946–2001: A New Dataset, Journal of Peace Research 39(5): 615–637; Mikael Eriksson, Peter Wallensteen, and Margareta Sollenberg, 2003. Armed Conflict 1989–2002, Journal of Peace Research 40(5): 593–607. Data	SomeFlaws	A few flaws and some suspected	2.5
Regan					
ThirdPartyInterventi	These are recorded data on civil conflicts since 1945, and any associated interventions into those conflicts. These data were meant to provide a concrete view of the relationship	Patrick M. Regan. "Third Party Interventions and the Duration of Intrastate Conflict", Journal of Conflict Resolution, February 2002 (available from http://bingweb.binghamton.edu/%7E	SomeFlaws	A few flaws and some suspected	2.5
Relief Web					
ReliefWebHealth	ReliefWeb is the world's leading on-line gateway to information (documents and maps) on humanitarian emergencies and disasters. An independent vehicle of information, designed	http://www.reliefweb.int/rw/dbc.nsf/doc100?OpenForm	SomeFlaws	A few flaws and some suspected	2.5
Schmeidl & Jenkins					
DisplacementDatase	Estimates of the numbers of internally displaced people based on various sources (including the United Nations High Commissioner for Refugees, the U.S. Committee for Refugees, the U.S.	Susanne Schmeidl, York University, and J. Craig Jenkins, Ohio State	SomeFlaws	A few flaws and some suspected	2.5
Refugee Dataset	Annual totals of international refugees by country of origin, based on various sources (including the United Nations High Commissioner for Refugees, the U.S. Committee	Susanne Schmeidl, York University, and J. Craig Jenkins, Ohio State	FlawsKno	Known flaws in data production	2
SITE Institute					
SITE Institute	Summaries of materials distributed to SITE Institute intel subscribers. Includes terrorism library and links to terrorist web sites	http://siteinstitute.org/index.html	FlawsSusp	Suspected flaws in data production	3
SMEs					
Hartley, Dean		Hartley Consulting	ModA&P	Moderate accuracy &	3.5
Holdsworth, David	SOCOM Contractor	Alion Sciences	ModA&P	Moderate accuracy &	3.5

Data Source Name / Data Set Name	Data Description	Data Citation	Producer Validity Type	Description	Value
Southeast Asia Terrorism Portal					
SouthAsiaTerrorism	South Asia Terrorism Portal A link to reports, studies, etc focusing on South Asia terrorism	http://www.satp.org/default.asp	FlawsSusp	Suspected flaws in data production	3
StanfordUniversity					
EthnicStructureCultu	This dataset presents a list of some 820 ethnic groups in 160 countries that made up at least 1 percent of country population in the early 1990s. It includes a measure of ethnic	James D. Fearon, "Ethnic and Cultural Diversity by Country," Journal of Economic Growth 8, 2 (June 2003): 195-222 Data available at http://www.stanford.edu/group/ethnic	SomeFlaws	A few flaws and some suspected	2.5
LeadershipDuration	This database tracks leadership duration across a wide range of countries and time. Earliest data extend from 18th century through 1987. Data from 1955–1987 were originally retained for	Henry S. Bienen and Nicolas van de Walle, Of Time and Power: Leadership Duration in the Modern World, The Center of International Studies, Princeton University; as updated by the Political Instability	SomeFlaws	A few flaws and some suspected	2.5
START					
GlobalTerrorismDat	National Consortium for the Study of Terrorism and Responses to Terrorism (START). The Global Terrorism Database (GTD) is an open-source database including information on	http://www.start.umd.edu:80/data/gtd	ModA&P	Moderate accuracy &	3.5
Taylor					
Political&SocialIndi	This new edition of the World Handbook is composed of four files: aggregate data, daily political events, annual political events, and quarterly political events. The aggregate data file	Charles Lewis Taylor, Virginia Polytechnic Institute and State	FlawsSusp	Suspected flaws in data production	3
The DataWeb					
TheDataWeb	TheDataWeb is network of online data libraries that the DataFerrett application access the data through. Data topics include, census data, economic data, health data, income and	http://www.thedataweb.org/index.ht	FlawsSusp	Suspected flaws in data production	3
Transparency International					
TI Corruption Index	Transparency International Corruption Perception Index 1995 – 2007 Transparency across revenue, national accounts, perceived	http://www.transparency.org/policy_research/surveys_indices/cpi	ModA&P	Moderate accuracy &	3.5
UCDP					
MILC	Managing Intrastate Low-intensity Conflict (MILC) v. 1.0 1993-2004 Third party actions in	http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm	ModA&P	Moderate accuracy &	3.5
UCDP Battle-Deaths	UCDP Battle-Deaths Dataset v.4.1, 2002-2005 Conflict level and conflict year data on number of deaths in internal conflicts.	http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm	ModA&P	Moderate accuracy &	3.5
UCDP Dyadic	UCDP Armed Conflict Dyadic v.4-2006, 1989 – 2005 Dyadic version of the UCDP/PRIO armed	http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm	ModA&P	Moderate accuracy &	3.5
UCDP Non-State	UCDP Non-State Conflict Dataset v.1.1, 2002 – 2005 Data set on internal conflicts where neither warring party is the government	http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm	ModA&P	Moderate accuracy &	3.5
UCDP One-Sided	UCDP One-Sided Violence Dataset v.1.2 1989 - 2005 Intentional attacks on civilians by the government or third party.	http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm	ModA&P	Moderate accuracy &	3.5
UCDP Peace	UCDP Peace Agreement Dataset v. 1.0, 1989-2005 Data set that includes peace agreements signed by at least two warring parties.	http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm	ModA&P	Moderate accuracy &	3.5
UCDP Termination	UCDP Conflict Termination dataset v.2.0, 1946 – 2006 Conflict level and conflict year data.	http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm	ModA&P	Moderate accuracy &	3.5
UCDP/PRIO	UCDP/PRIO Armed Conflict v.4- 2007, 1946 – 2006 Conflict-year data within countries where at least one party is the government.	http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm	ModA&P	Moderate accuracy &	3.5

Data Source Name / Data Set Name	Data Description	Data Citation	Data Producer Validity Type	Description	Value
UN					
AfricanStatYearboo	"African Statistical Yearbook "[ALSO African National Statistics, ASN=ASY]"	https://unp.un.org/details.aspx?pid=1	FlawsSusp	Suspected flaws in data production	3
AQUASTAT	The Food and Agriculture Organization of the United Nations leads international efforts to defeat hunger. FAO is also a source of knowledge and information. AQUASTAT is	http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastat/dbase/index.s	SomeFlaws	A few flaws and some suspected	2.5
Asia&FarEast68-69	Statistical Yearbook for Asia and the Far	Reference Library Book "Statistical Yearbook for Asia and the Far East, Bangkok, Thailand, 1968-1969, United Nations"	FlawsSusp	Suspected flaws in data production	3
Asia&FarEast74-84,86	"Statistical Yearbook for Asia and the Pacific, United Nations, Bangkok, Thailand, Economic and Social Commission for Asia and the Pacific, 1974-84, 1986-90, 1992-1999"	Reference Library Book	FlawsSusp	Suspected flaws in data production	3
FAOSTAT	FAOSTAT is an on-line and multilingual database currently containing over 3 million time-series records covering international	http://faostat.fao.org/	FlawsSusp	Suspected flaws in data production	3
IncomeInequalityDa	The World Income Inequality Database collects and stores information on income inequality for developed, developing, and transition countries. Data includes the GINI Coefficient in percentage	United Nations Development Programme, Social Development & Poverty Elimination Division	SomeFlaws	A few flaws and some suspected	2.5
LatinAmerica75-84	"Statistical Yearbook for Latin America, Santiago, Chile, United Nations, Economic Commission for Latin America, 1975-84"	Reference Library Book	FlawsSusp	Suspected flaws in data production	3
LatinAmerica86-99	"Statistical Yearbook for Latin America and The Caribbean, Santiago, Chile, Economic Commission for Latin America and the	Reference Library Book	FlawsSusp	Suspected flaws in data production	3
LatinAmericaCEPA	"The Statistical Abstract of Latin America	Reference Library Book	FlawsSusp	Suspected flaws in data production	3
Trade&Development	This handbook is intended to provide a comprehensive collection of statistical data relevant to the analysis of world trade, investment and development. It was created by	United Nations Conference on Trade and Development Handbook of International Trade and	SomeFlaws	A few flaws and some suspected	2.5
UN Human	Human Development Reports 2005-2008 Basic needs and quality of life data (UNDP).	http://hdr.undp.org/en/statistics/	FlawsSusp	Suspected flaws in data production	3
UN Stat Databases	UN Statistical Data bases, Yearbooks & Reports	http://unstats.un.org/unsd/databases.h	FlawsSusp	Suspected flaws in data production	3
UNEnergyStatistics	The database contains comprehensive energy statistics on production, trade, and consumption (end-use) for primary and secondary conventional, non-conventional, new, and	Hermann Habermann, Director, United Nations Statistical Division,	FlawsKno	Known flaws in data production	2
UNPeriodical	UN periodical report		FlawsKno	Known flaws in data production	2
WorldData	access to many UN databases	http://data.un.org:80/	SomeFlaws	A few flaws and some suspected	2.5
WorldPopulationPro	World Population Prospects: The 2002 Revision contains demographic estimates for 1950-2000 and four variants of projections for 2000-2050 for countries, regions and major areas of the	Population Division of the Department of Economic and Social Affairs of the United Nations	SomeFlaws	A few flaws and some suspected	2.5
WorldUrbanization	The World Population Prospects: 2003 Revision (urban and rural areas 1950-2030, urban agglomerations 1950-2015) includes data for urban populations and urban agglomerations with	Population Division of the Department of Economic and Social Affairs of the United Nations	SomeFlaws	A few flaws and some suspected	2.5

Data Source Name / Data Set Name	Data Description	Data Citation	Producer Validity Type	Description	Value
UN WHO					
AIDSCasesDatabase	AIDS data reported to WHO by country/area. Although coverage may vary by country, the data include the number and rate of reported AIDS cases from 1979 though 2002, by year of	World Health Organization, Department of HIV/AIDS (as provided by Abiola Johnson on CD-	SomeFlaws	A few flaws and some suspected	2.5
Report on HIV/AIDS	From the July 2004 UNAIDS Report on the Global HIV/AIDS Epidemic, these data show the HIV/AIDS rate among adults aged 15-49 at the	UNAIDS 2004 Report on the Global AIDS Epidemic 2004 The data are from the section "Table of country-specific HIV/AIDS estimates and data, end 2003." Available at http://www.unaids.org/bangkok2004/	SomeFlaws	A few flaws and some suspected	2.5
WorldHealthOrgani	The WHO Statistical Information System is the guide to health and health-related epidemiological and statistical information available from the World Health Organization.	http://www3.who.int/whosis/menu.cfm	SomeFlaws	A few flaws and some suspected	2.5
UNC Asheville					
PolitSciTerrorScale	This is a graded scale for measuring human rights violation and was adapted from work originally published by Raymond Gastil of Freedom House in 1979. The raw information comes from the	Political Science Department, University of North Carolina Asheville, Mark Gibney Data available at http://www.unca.edu/politicalscience/	SomeFlaws	A few flaws and some suspected	2.5
UNESCO					
UNESCOStatistics	Global and internationally comparable statistics on education, science, technology, culture and	http://www.uis.unesco.org/ev_en.php ?ID=2867_201&ID2=DO_TOPIC	FlawsSusp	Suspected flaws in data production	3
UnivOfPennsylvania					
Democracy&Develop	Democracy and Development: Political Institutions and Material Well-Being in the World. This dataset covers more than 120 countries observed between 1950 or the year of	Adam Przeworski, Michael Alvarez, José Antonio Cheibub and Fernando Limongi. Democracy and Development: Political Institutions and Material Well- Being in the World, 1950-1990. Cambridge:	SomeFlaws	A few flaws and some suspected	2.5
PennWorldTables	Penn World Tables Provides purchasing power parity and national income accounts converted to international prices for 188 countries for	www.imf.org/external/pubs/ft/gfs/manual/gfs.htm; Data available at http://pwt.econ.upenn.edu/.	ModA&P	Moderate accuracy &	3.5
UOB DAT					
NGOStructures	Unclassified Non-Governmental Organizations	Unit Order of Battle Data Access Tool (UOB DAT), Computing Technologies Inc., Christian Farrell, cfarrell@dmso.mil, 1901 N Beauregard St Suite 500, Alexandria	SomeFlaws	A few flaws and some suspected	2.5
OrderofBattleCFDB	Classified US Units from OSD PA&E's Conventional Forces Data Base (CFDB)	Unit Order of Battle Data Access Tool (UOB DAT), Computing Technologies Inc., Christian Farrell, cfarrell@dmso.mil, 1901 N Beauregard St Suite 500, Alexandria	ModA&P	Moderate accuracy &	3.5
OrderofBattleCFE	Unclassified Conventional Forces Europe (CFE)	Unit Order of Battle Data Access Tool (UOB DAT), Computing Technologies Inc., Christian Farrell, cfarrell@dmso.mil, 1901 N Beauregard St Suite 500, Alexandria	FlawsSusp	Suspected flaws in data production	3
OrderofBattleFFDB	Classified units from the Future Forces Data Base	Unit Order of Battle Data Access Tool (UOB DAT), Computing Technologies Inc., Christian Farrell, cfarrell@dmso.mil, 1901 N Beauregard St Suite 500, Alexandria	FlawsSusp	Suspected flaws in data production	3
OrderofBattleJCOFA	Classified foreign units from JCOFA	Unit Order of Battle Data Access Tool (UOB DAT), Computing Technologies Inc., Christian Farrell, cfarrell@dmso.mil, 1901 N Beauregard St Suite 500, Alexandria	FlawsSusp	Suspected flaws in data production	3

Data Source Name / Data Set Name	Data Description	Data Citation	Producer Validity Type	Description	Value
OrderofBattleMIDB	Classified DIA Modernized Integrated Data Base	Unit Order of Battle Data Access Tool (UOB DAT), Computing Technologies Inc., Christian Farrell, cfarrell@dmso.mil, 1901 N Beauregard St Suite 500, Alexandria	ModA&P	Moderate accuracy &	3.5
OrderofBattleOpFor	Unclassified foreign units Opposing Forces	Unit Order of Battle Data Access Tool (UOB DAT), Computing Technologies Inc., Christian Farrell, cfarrell@dmso.mil, 1901 N Beauregard St Suite 500, Alexandria	FlawsSusp	Suspected flaws in data production	3
OrderofBattleTUCHA	Unclassified US forces from the Global Command and Control System (GCCS) Type Unit Characteristics file (TUCHA) and the Unit	Unit Order of Battle Data Access Tool (UOB DAT), Computing Technologies Inc., Christian Farrell, cfarrell@dmso.mil, 1901 N Beauregard St Suite 500, Alexandria	FlawsSusp	Suspected flaws in data production	3
US AID					
USAIDPeriodical	US AID periodical report		FlawsKno	Known flaws in data production	2
US Army					
FM 100.23-1	Multiservice Procedures for Humanitarian Assistance Operations		ModA&P	Moderate accuracy &	3.5
FM 100-20	Military Operations in Low Intensity Conflict		ModA&P	Moderate accuracy &	3.5
FM 100-23	Peace Operations		ModA&P	Moderate accuracy &	3.5
FM 3-0	Army Operations manual		ModA&P	Moderate accuracy &	3.5
FM 3-05.401	Civil Affairs Tactics Techniqus and Procedures		ModA&P	Moderate accuracy &	3.5
FM 3-07	Stability Operations and Support Operations		ModA&P	Moderate accuracy &	3.5
FM 3-07.31	Peace Operations: Multi-Service Tactics, Techniques, And Procedures For Conducting		ModA&P	Moderate accuracy &	3.5
FM 3-100.21	Contractors on the Battlefield		ModA&P	Moderate accuracy &	3.5
FM 3-13	Information Operations		ModA&P	Moderate accuracy &	3.5
FM 3-19.40	Military Police Internment/Resettlement		ModA&P	Moderate accuracy &	3.5
FM 3-24	Counterinsurgency		ModA&P	Moderate accuracy &	3.5
FM 3-61.1	Public Affairs Tactics, Techniques and Procedures		ModA&P	Moderate accuracy &	3.5
FM 4-0	Combat Service Support - logistics, supply,		ModA&P	Moderate accuracy &	3.5
FM 5-100	Engineer Operations		ModA&P	Moderate accuracy &	3.5
FM 90-29	Noncombatant Evacuation Operations		ModA&P	Moderate accuracy &	3.5
FM 90-8	Counterguerrilla Operations		ModA&P	Moderate accuracy &	3.5
US Army CAA					
ArdennesCampaign	Center for Army Analyses (CAA) data on Ardennes Campaign 1944-45	Ardennes Campaign Simulation (ARCAS), US Army CAA, 1995,	ModA&P	Moderate accuracy &	3.5

Data Source Name / Data Set Name	Data Description	Data Citation	Producer Validity Type	Description	Value
US Census Bureau					
HIV/AIDSSurveillan	HIV/AIDS Surveillance data base The HIV/AIDS Surveillance Data Base was developed and is maintained by the Health Studies Branch, International Programs Center (IPC),	http://www.census.gov/ipc/www/hivaidsd.html, U.S. Bureau of the Census, International Programs Center, Health Studies Branch (via CD-	FlawsSusp	Suspected flaws in data production	3
InfantMortalityRate	These data describe the infant mortality rate (IMR) as the number of deaths of infants under one year of age per 1,000 live births in a given year. The data can vary for many reasons. In the	U.S. Bureau of Census, International Programs Center, Population Division (via e-mail)	FlawsSusp	Suspected flaws in data production	3
InternationalDataBas	The International Data Base provides demographic and socio-economic statistics for 227 countries and areas of the world. Major types of data available in the IDB include	U.S. Bureau of Census, International Programs Center, Population	SomeFlaws	A few flaws and some suspected	2.5
PopulationPyramids	US Government Census Bureau: Poplation	http://www.census.gov/ipc/www/idbp	ModA&P	Moderate accuracy &	3.5
USCensusBureau	US Census Bureau Data Center, Access to US Census data and tools supporting research on	http://www.census.gov/main/www/access.html	SomeFlaws	A few flaws and some suspected	2.5
US Commerce Dept					
TradeStats	US Dept of Commerce annual and quarterly trade	http://tse.export.gov/ITAHome.aspx?UniqueURL=gbgwon55avf4xdmnlsojew45-2006-2-3-10-48-35	SomeFlaws	A few flaws and some suspected	2.5
US Dept HomelandSecurity					
ImmigrationStatisti	The Yearbook provides immigration data through 2002. Major areas include: immigrants admitted for legal permanent residence; refugees approved and admitted; nonimmigrant arrivals;	U.S. Bureau of Citizenship and Immigration Services (formerly Immigration and Naturalization Service Available at http://uscis.gov/graphics/shared/abou	ModA&P	Moderate accuracy &	3.5
US DoD					
Joint Pub 5-0	Joint Operational Planning		ModA&P	Moderate accuracy &	3.5
US DOE					
EnergyProdConsPric	This U.S. Energy Information Administration data contains information on energy production, consumption, and prices, with coverage for most variables from 1980 to 2002 or 2003.	U.S. Energy Information Administration, Main Products of the Office of Energy Markets and End Use	FlawsKno	Known flaws in data production	2
US Government					
CIA WFB	CIA World Fact Book, General reference on political, economic, social, cultural data by	https://www.cia.gov/cia/publications/factbook/index.html	SomeFlaws	A few flaws and some suspected	2.5
JTCG/ME	Munitions effectiveness		VGoodA&P	Accuracy & precision thought to meet	4.5
OPIC	Overseas Private Investment Corporation (OPIC) OPIC helps U.S. businesses invest overseas, fosters economic development in new and emerging markets, complements the private	http://www.opic.gov/	ModA&P	Moderate accuracy &	3.5
TerroristGrpProfiles	Index of Groups published in the Dudley Knox Library, Naval Post Graduate School. Material taken from Country Reports on Terrorism and Patterns of Global Terrorism, US Dept of State	http://library.nps.navy.mil/home/tgp/tgpndx.htm#2001	SomeFlaws	A few flaws and some suspected	2.5
US Institute for Peace					
USInstituteForPeace	An independent, nonpartisan, national institution established and funded by Congress. Its goals are to help prevent and resolve violent international conflicts, promote post-conflict	http://www.usip.org/	FlawsSusp	Suspected flaws in data production	3

Data Source Name / Data Set Name	Data Description	Data Citation	Producer Validity Type	Description	Value
US OFDA					
DisasterHistoryDatab	The disaster history database is maintained by the Office of U.S. Foreign Disaster assistance. It includes information on various natural and humaninduced disasters including drought,	U.S. Agency for International Development, Office of U.S.	FlawsKno	Known flaws in data production	2
US State Dept					
CoordReconStabiliz	Office of the Coordinator for Reconstruction and Stabilization This office will lead, coordinate, and institutionalize U.S. Government civilian capacity to prevent or prepare for post-	http://www.state.gov/s/crs/rls/43327.	SomeFlaws	A few flaws and some suspected	2.5
USStateDept	Country Background Notes; Facts about the land, people, history, government, political conditions, economy, and foreign relations of independent states, some dependencies, and areas	http://www.state.gov/r/pa/ei/bgn/	SomeFlaws	A few flaws and some suspected	2.5
US Treasury					
USTreasury	Terrorism and Financial intelligence	http://www.treasury.gov/offices/enfo	FlawsSusp	Suspected flaws in data production	3
USMC					
Small Wars Manual	how to operate in small wars	USMC 1940	ModA&P	Moderate accuracy &	3.5
Vanhanen					
Polyarchy Dataset	The Polyarchy dataset codes political competitiveness and participation in 187 countries over the period 1810 to 1998. This dataset is the result of a collaborative project	Tatu Vanhanen, University of	SomeFlaws	A few flaws and some suspected	2.5
Wharton					
PoliticalConstraint	This dataset was designed to derive an objective internationally comparable measure of the feasibility of policy change in a given country for a given year. This main measure, labeled the	Henisz, Witold Jerzy 2000. "The Institutional Environment for Economic Growth." Economics and Politics, 12(1): 1-31. Data available at http://www-	SomeFlaws	A few flaws and some suspected	2.5
World Bank					
EffectDevelopAssist	This database contains the conventional and the adjusted measures of official development assistance to a set of 133 countries between 1975 and 1995. The principal component of the	The World Bank Group Economic Growth Research http://www.worldbank.org/research/growth/ddaid.htm	SomeFlaws	A few flaws and some suspected	2.5
GlobalDevelopFinan	Global Development Finance 2004 is the World Bank's review of the external debt and finance flows of developing countries. It examines recent developments in flows from international	The World Bank	SomeFlaws	A few flaws and some suspected	2.5
GovernanceMattersI	This dataset contains updated composite governance research indicators for 199 countries, covering six dimensions of governance: Voice and accountability, political	Group and World Bank Institute http://www.worldbank.org/wbi/governan ce/govdata2002/index.html	SomeFlaws	A few flaws and some suspected	2.5
Mountains	The World Mountains dataset measures the percentage of mountain area in 161 countries. Mountain areas were identified using criteria including elevation, relative relief, and an	A.J. Gerrard and Paul Collier for The World Bank Conflict Group, with James Fearon and David Laitin	SomeFlaws	A few flaws and some suspected	2.5
PoliticalInstitution	A cross-country database of political institutions, this data covers 177 countries over 26 years (1975-2000). The variables provide details about elections, electoral rules, type of political	The World Bank Group Research http://www.worldbank.org/research/bios/ pkeefer.htm	SomeFlaws	A few flaws and some suspected	2.5
Urban Governance	The Urban Governance Initiative Report Cards World Bank – perception of institutional reliability, corruption, urban & rural	http://web.worldbank.org/WBSITE/EXTERNAL/WBI/EXTWBIGOVANTCOR/0,,contentMDK:20746471~pagePK:64168445~piPK:64168309~	FlawsSusp	Suspected flaws in data production	3
WorldBankGroupW	population with access to potable water	http://devdata.worldbank.org/data-	FlawsSusp	Suspected flaws in data production	3

Data Source Name / Data Set Name	Data Description	Data Citation	Data Producer Validity Type	Description	Value
WorldBankHistoric	Historical infant mortality rate data for countries no longer in existence (CZE, DRV, RVN, ETH, GDR, GFR, USS, YAR, YPR, YUG, PKS). Data was compiled using the World Bank	The World Bank Development Data	SomeFlaws	A few flaws and some suspected	2.5
WorldDevIndicators	World Development Indicators (WDI) provides an expanded view of the world economy for more than 200 countries with populations of over one million. It contains data on the people	www.worldbank.org/data/wdi2004/	FlawsSusp	Suspected flaws in data production	3
World Economic Forum					
WorldEconomicForum	Macroeconomic environment index	http://www.weforum.org/en/initiatives/gcp/GlobalCompetitivences	ModA&P	Moderate accuracy &	3.5
World Freedom Atlas					
World Freedom	World Freedom Atlas 1990-2006 The geo-world atlas is a geo-visualization tool for world	http://freedom.indiemaps.com/	FlawsSusp	Suspected flaws in data production	3
World Values Survey					
World Values	World Values Survey, 1981 – 2004 Surveys conducted in waves, individual perceptions of regime satisfaction, economic satisfaction, well	http://www.worldvaluessurvey.org/	FlawsSusp	Suspected flaws in data production	3