Socio-Cultural Analysis with the Reconnaissance, Surveillance, and Intelligence Paradigm

Topical Strategic Multi-Layer Assessment (SMA) and U.S. Army Engineer Research Development Center (ERDC) Multi-Agency/Multi-Disciplinary White Papers in Support of National Security Challenges

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Abstract:

Socio-Cultural Analysis (SCA) has evolved rapidly over the past decade as conflicts in Afghanistan and Iraq have forced the DOD to reappraise the techniques used to collect information about the populations in conflict zones. As these two major conflicts wind down, the DOD must recognize that SCA must evolve again due the changing responsibilities of phase zero operations while preparing for future conflicts. Given the challenges of declining DOD budgets while improving our SCA capabilities, the chapters in this white volume describe many of the issues facing the DOD for phase zero operations and collecting the socio-cultural information necessary should conflicts escalate. Most of the chapters' discussions were heavily influenced by LTG Flynn et al.'s "Left of bang: The value of socio-cultural analysis in today's environment" PRISM article.[1] "Left of bang…" was also revised and included in the SMA/ERDC organized White Volume "National Security Challenges: Insights from Social, Neurobiological, and Complexity Sciences," available at http://www.nsiteam.com/publications.html.

The target audiences are planners, operators, and policy makers. With them in mind, the articles are intentionally kept short and written to stand alone. All the contributors have done their best to make their articles easily accessible.

[1] Flynn, M., Sisco, J., Ellis, D. (2012). "Left of Bang: The Value of Sociocultural Analysis in Today's Environment,"*PRISM*, Vol 3(4), pgs 12-21.

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Preface

Lieutenant General Michael T. Flynn, DIA

In 2012, after more than 10 years of contingency operations in Iraq and Afghanistan, the Joint Staff released a report identifying 11 strategic lessons learned from the two defining campaigns of the 21st century. Titled the "Decade of War: Enduring Lessons from the Past Decade of Operations," the report listed "understanding the operational environment" as the first and possibly most important lesson learned over the last decade of warfighting.[1] Essentially, based on its extensive research and personal experience, the Joint Staff concluded that a failure to acknowledge and accurately define the operational environment had in many cases led to a mismatch of forces, capabilities, and goals, which directly diminished our forces' mission success.

In this context, the "operational environment" is not just the geographical terrain or the identity of warring parties; it is a multifaceted and layered picture of the various social, cultural, economic, and ethnic characteristics and elements that made up the unique identity of a given population. This richer, more contextual understanding of the environment, the report posits, is absolutely critical to modern warfighting and gets to the very root of grasping – and ultimately winning – any given conflict.

This lesson learned represents a groundbreaking insight for modern warfighting. Recognizing the importance of the broader operational environment, acknowledging its inherent complexity, and working to develop new methods and tools for understanding this complexity are not easy feats. These breakthroughs were also not pre-ordained. At the height of the Cold War, for the U.S. Department of Defense (DOD) and the Intelligence Community (IC), understanding the global security landscape meant assessing our adversaries' capabilities and intent. Simply put, we analyzed the state of our adversaries' tools for national influence: their military assets and formations, economic power, and diplomatic prowess. It was not as important to consider the populations within nation-states as it was to understand the capabilities of the state. People, culture, and ethnicity simply did not dramatically impact our way of waging war – and thus they did not matter to the IC supporting those fights. Yet today, non-state actors, especially terrorist groups, can cause damage and destruction on a scale normally associated with nation states

Times have clearly changed. The relative stability of the state-centric Cold War period is a thing of the past. Dramatic shifts that greatly affect the security environment occur at a rapid pace: leaders fall, governments dissolve, party loyalties change, and borders move at a startling rate. Today, the management of populations is no longer the sole purview of the state; increasingly, sub-national and non-state actors have a greater ability to influence events and organizations that have a direct impact on international security. In the modern era, the differences between states gives way to the differences within states – and these populace-driven dynamics hold far more sway over the world's geopolitical landscape than ever before.

[1] Joint and Coalition Operational Analysis, "Decade of War, Volume 1: Enduring Lessons from the Past Decade of Operations," June 15, 2012.

For the success of future missions (and in fact future wars and conflicts), a robust understanding of populations must be at the forefront of every military planner's mind and a key enabler of our operational toolkit.

To reach this level of understanding, we must update our analytic methods and tools. The new analytic model should be social and cultural at its core and exist in a different world than state-centric paradigms of the past. Analysis along these lines should begin with the individual as its point of departure and eventually transit to groups and other sub-national actors. This social cultural analysis (SCA) can provide warfighters with a decision advantage on the ground and policymakers with options informed by the wants and the needs of the affected population.

In order to effectively support warfighters and policymakers, the best SCA will draw on extensive legwork and a stepped process. The first step is to develop a baseline for the target population that draws its data from professionals and academics of all stripes: anthropologists, sociologists, demographers, economists, historians, political scientists, human geographers, census takers, pollsters, and international marketing firms. While the sources are many, the intent is the same: a population-centric documenting of the operating environment before the onset of conflict.

The second step is monitoring for change. Deviations from the baseline are strategic indicators – warnings that will ensure the IC prevents strategic surprise. The IC must increase the depth and granularity of cultural and social understanding of the world's populations and bring into focus to those sub-national events that increase instability or challenge the state.

We also must consider when and where SCA efforts can have the greatest impact. Since access to populations is more readily available and information flows more freely through an environment before the onset of conflict, SCA is best applied in so-called "Phase Zero" operations – or efforts to establish, maintain, and solidify relationships or dissuade, stem, and defeat potential adversaries without the use of force. In Phase Zero, relations between parties have not deteriorated to the degree where conflict is unavoidable. Focused SCA efforts in these pre-conflict environments offer the opportunity to unearth and analyze a wealth of information on societal underpinnings, spheres of influence, non-traditional power structures, and potential de-stabilizers. SCA findings can be fed directly into these Phase Zero operations, facilitating our forces' ability to have an impact "left of bang."

Over the past decade of contingency operations, we developed top-notch capabilities but often struggled to achieve strategic impact "left of bang." The IC and our military forces developed an impressive capacity for finding the target, fixing the target, and finishing the target. While effective, these efforts sometimes lacked strategic focus informed by a broader understanding of the social and cultural factors at the root of the conflict. This is where a more robust SCA capability – and this volume of white papers – will have an impact in changing the way we think about conflict and changing the way we operate in conflict environments.

Operations in Iraq and Afghanistan demonstrated the importance of understanding the human dimension of conflict. We experienced first-hand the difficulties our Nation will encounter when not fully prepared and postured for when operations go

beyond Phase Zero. Our challenge today is to increase our understanding of populations, to become population-centric, to influence the operational environment before the first shot is fired. If future success depends on our ability to understand the environment, then military planners and IC professionals must build their skills now. One cannot make a social cultural analyst overnight; only years of training, experience, and education can produce a true social scientist in this field. But building and molding these specialists are an important investment. Our ability to support contingency operations, forecast trends, and prevent strategic surprise depends on it.

Introduction and Executive Summary

Dr. Charles R. Ehlschlaeger, ERDC

Socio-Cultural Analysis (SCA) has evolved rapidly over the past decade as conflicts in Afghanistan and Iraq have forced the DOD to reappraise the techniques used to collect information about the populations in conflict zones. As these two major conflicts wind down, the DOD must recognize that SCA must evolve again due the changing nature of phase zero operations and prepare for future conflicts. Given the challenges of declining DOD budgets while improving our SCA capabilities, the chapters in this white volume describe many of the issues facing the DOD for phase zero operations and collecting the socio-cultural information necessary should conflicts escalate. Most of the chapters' discussions were heavily influenced by LTG Flynn et al.'s "Left of bang: The value of socio-cultural analysis in today's environment" PRISM article.[1] "Left of bang…" was also revised and included in the SMA/ERDC organized White Volume "National Security Challenges: Insights from Social, Neurobiological, and Complexity Sciences." SMA followed that effort with additional occasional white papers discussing the operational relevance of the social sciences[2] and social science validity,[3] available at http://www.nsiteam.com/publications.html. This White Volume builds on those efforts to provide a spectrum of views on the gaps on the operational use of SCA in a phase zero setting. If there is a valid criticism to be made regarding this white volume, it is that it favors researchers attempting to automate socio-cultural information processing over traditional qualitative techniques. The authors realize that the USG must understand socio-cultural situations across the entire planet to as high or higher level of fidelity than we did in Iraq and Afghanistan: without spending equivalent resources. Collecting magnitudes more useful information with a similar or smaller budget will require innovative techniques that don't require socio-cultural experts hand massaging ALL the data into actionable information.

The chapters are organized from the more theoretical and philosophical to the more technical. The following brief description of these papers provides an overview of each chapter, but doesn't express all the content contained within. The final chapter is an epilogue for both this White Volume and its sister tome: "Understanding Megacities with the Reconnaissance, Surveillance, and Intelligence Paradigm."

In the first chapter, "Toward a New Strategy of Peace," Christopher Holshek and Melanie Greenberg argue that the United States Government should refocus its phase zero strategic goals to more clearly emphasize "peace and security" over our "national security." They discuss how civil-military capabilities, partner nations, and non-government organizations can improve socio-cultural systems to make peace more resilient as part of a larger, national strategic approach.

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[1] Flynn, M., Sisco, J., Ellis, D. (2012). "Left of Bang: The Value of Sociocultural Analysis in Today's Environment,"*PRISM*, Vol 3(4), pgs 12-21.

[2] Canna, S. (ed.). (2013). Operational Relevance of Behavioral & Social Science to DoD Missions. Strategic Multilayer Assessment Program, Office of the Secretary of Defense.

[3] Cabayan, H., Ehlschlaeger, C., McGee, & A., Ackerman, G. (2013). Humans in the Loop: Validation and Validity Concepts in the Social Sciences in the Context of Applied and Operational Settings. Arlington, VA: Strategic Multilayer Assessment Program, Office of the Secretary of Defense.

The next chapter, "The Use of Shared Socio-cultural Information and Research Validation," discusses recent social media projects in the DoD as well as potential South Asian social media projects and the constraints likely to be seen in Bangladesh. Dr. Laura Steckman presents this view, both as a researcher and as a COCOM analyst. Chapters Eight and Eleven also focus on socio-cultural analysis using media data.

In Elizabeth Malone and Richard Moss's Chapter Three, "Measuring Vulnerability to Climate Change: An Indicators Approach," important natural indicators are modeled decades into the future. In a phase zero stability and security planning environment, forecasting indicators is critical to preparing plans that will take years to implement. While social indicator forecasting's accuracy will degrade much more quickly than natural indicators, the techniques discussed in this chapter apply to modeling social indicators.

Dr. Palmer-Moloney et al.'s "Urban-Rural Dynamics and Regional Water Security" chapter presents the complex relationship between natural (water) resources, social factors, state & sub-state stability, and security challenges. The chapter presents these relationships in an in-depth analysis of the Helmand River Basin.

In Chapter Five, "Through the Eyes of the Population: Establishing the SCA Baseline for RSI," Dr. David Ellis and James Sisco expand on their earlier writings about the Reconnaissance, Surveillance, and Intelligence (RSI) paradigm. The chapter introduces a methodology they call the "Five Foundations of SCA." It concludes with a case study on Syria illustrating how RSI with a rich SCA baseline using the "Five Foundations" methodology could have greatly enhanced the analysis of and policy responses to achieve US policy objectives in Syria.

Dr. Jonathan Pfautz & Mr. David Koelle, in Chapter Six "Approaches to Addressing Challenges in the Operational Use and Validation of Sociocultural Techniques, Tools, and Models" explore the challenges in creating computational models to support operational missions. They also present several approaches to ensuring operational validity of social science results.

Dr. Lynn Copeland, Lynndee Kemmet, Jeffrey Burkhalter, Marina Drigo, & Dr. Charles Ehlschlaeger discuss the potential contribution of tactical forces to strategic and operational planning in an RSI environment in Chapter Seven, "The Who, What, Where, and How of Regionally Aligned Forces: Supporting COCOM Mission Planning." While current DoD tactical phase 0 stability operations are spread throughout multiple organizations, information techniques are being standardized across these organizations. These teams are also increasingly operating within Combatant Commands (COCOMs) as envisioned in the Regionally Aligned Forces (RAF) concept. This chapter discusses challenges for improved data collection, the development of metrics, and phases zero information sharing.

In Chapter Eight, "Sentiment & Discourse Analysis: Theory, Extraction, and Application," Drs. Steve Shellman, Michael Covington, and Marcia Zangrilli discuss automated sentiment discourse from newly developed automated sentiment and discourse software engines. The chapter concludes with a study that uses automated information to explain and forecast the violent behavior of groups. Chapters Two and Eleven also discusses media analysis issues.

In Chapter Nine, "Integrating Social Science Knowledge into RSI," Hargrave et al. discuss a novel approach to making social science literature more easily accessible to analysts in the operational environment. The chapter includes a notional case study on the topic of insurgency in an African nation.

Chapter Ten, "Automating Early Warning of Food Security Crises," by Dr. Molly Brown explores how a food insecurity early warning system could be automated and assessed remotely. The chapter draws from her experience working with the Famine Early Warning Systems Network (FEWS).

In "Identifying and Understanding Trust Relationships in Social Media," Chapter Eleven, Corey Lofdahl, Jonathan Pfautz, Michael Farry, & Eli Stickgold discusses how Twitter data can be used represent four metrics that identify information-based trust relationships for potential use in phase zero planning and situation awareness. The chapter complements other media analysis research in Chapters Two & Eight.

Finally, Drs. Valerie Sitterle and Charles Ehlschlaeger will summarize the research presented in this white volume as well as the research in the Understanding Megacities with the RSI Paradigm white volume as they relate to phase 0 operational design and planning. This epilogue will draw heavily on "lessons learned" while performing research for the OSD sponsored Megacities-RSI project at ERDC.

Chapter One, Toward a New Strategy of Peace

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Abstract

The Decade of War has exposed the "strategy deficit" of the United States in terms of its national capability to take on the strategic imperatives of environment and resources that have rendered more traditional approaches less effective, including the "national security" paradigm itself. Inspired by John F. Kennedy's idea of a "strategy of peace" more than a half-century ago, the authors sketch out what that strategic pathway may look like by re-contextualizing national strategy as primarily about peace as both end state and process, looking at the relationship between peace and security, finding the right moral scale, and balancing capabilities to manage peace as well as conflict. A strategy of peace, as Kennedy pointed out a half-century ago and President Obama referred to at West Point recently, is neither idealism nor realism, but both. It is superior to a national security strategy because peace is innately more strategic than security. Security and stability, as explained, are components of peace – not the other way around. Peacebuilding, in turn, is applied national strategy, less ambitious and costly than nation-building. Seen this way, a peacebuilding approach to national strategy helps to contextualize the role of both civil and military power in foreign engagements as well as the relationship between the two borne out of the national ethos for applied power and the moral foundations of the country, which have even more relevance in the 21st century strategic environment. By doing so, it provides a conceptual "big tent" for these disparate communities to find a common pathway to the same end state.

Keywords

Peace, security, national strategy, peacebuilding, stability

Introduction

On the 10th of June 1963, John F. Kennedy delivered what some consider his most important speech. Beyond announcing pursuit of a nuclear test ban treaty following the Cuban Missile Crisis, the 35th president called not for an "absolute, infinite concept of universal peace and good will of which some fantasies and fanatics dream." Rather, he exhorted, "let us focus instead on a more practical, more attainable peace, based not on a sudden revolution in human nature but on a gradual evolution in human institutions... not toward a strategy of annihilation but toward a strategy of peace."[1] Over a half-century later, President Obama cited this gradual process in a major speech at West Point. (However, it appears the President still sees "national security" as the impetus of such a strategy.)

Kennedy, who was obviously well ahead of his time, never got to pursue this vision. Neither did the United States take the chance to put it to work, especially after the Cold War. With the end of the wars in Iraq and Afghanistan, however, the profound changes in the international landscape they evinced, and another deep postwar drawdown in defense, the opportunity may this time be irresist-

[1] "Towards a Strategy of Peace," John F. Kennedy, *The Department of State Bulletin,* XLIX, No. 1253, 1 July 1963, 2-6; internet: http://www.fordham.edu/halsall/mod/1963Kennedy-peacestrat.html; accessed 21 February 2013.

ible. Doing this requires re-contextualizing national strategy through a critical examination of American national strategy, looking at the relationship between peace and security and understanding what those terms now mean, finding the right moral scale, and balancing the ability to manage peace as well as conflict.

The Problem with American Strategy Isn't a Problem

American strategy, policy, and operations have been flawed as of late because they still run on 20th century operating software. The only serious upgrades to the National Security Act of 1947 have been the Foreign Service Act of 1961 and the Goldwater-Nichols Act of 1986. This strategic software suite no longer adequately processes two emergent systemic imperatives. First are the constraints of a complex and hyper-connected 21st century environment in which the power of persuasion is increasingly more relevant than that of coercion and where the security of individuals and communities underwrites the security of states. Then there are the restraints of diminishing strategic resources, especially financial, in the face of these broader and more complex challenges to a wider understanding of "security."

The issue is really not as much strategic ambitions as a strategic style still predicated on a "strategy of annihilation." As those writing about "network-centric" warfare have already critiqued:

> Accordingly, our American fixation has been the technical and industrial means of waging war. Our collective over-awe at the significance of our industrial achievements often leads us to expect strategic effects from systems and capabilities for tactical or operational impact. The result is a growing imbalance between our current capabilities and the range of security challenges for which our technology isn't the sole answer.[1]

In fiscal terms, U.S. taxpayers have been getting increasingly less bang for the buck. According to a Harvard University study, the wars in Iraq and Afghanistan have cost the nation somewhere between $4-6-trillion in total direct and associated costs, without commensurate strategic gain.[2] The "national security" paradigm for American interventions – more about the security of states than of communities – is no longer efficacious or affordable. This may be good news, for it may force the United States to be more serious about strategy on a whole-of-society scale as the defense drawdown ensues, if even to recognize that "defense and national security are not the same thing."[3]

Strategy is fundamentally about making choices about the future, and a strategic mindset is driven mostly by scarcity. (If you can do everything, you don't have to make choices.) The longstanding American penchant for "throwing money at the problem" or the overwhelming focus on operations and tactics such as stability operations, counterinsurgency, counterterrorism, or "winning hearts and minds" have all been substitutes for strategy rather than strategies themselves. Americans in

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[1] "Transformation and the Changing Character of War," Arthur K. Cebrowski, ROA National Security Report, *The Officer*, July/August 2004, 55.

[2] *The Financial Legacy of Iraq and Afghanistan: How Wartime Spending Decisions Will Constrain Future National Security Budgets*, Linda J. Bilmes, Harvard University Faculty Research Working Paper Series, March 2013, internet: https://research.hks.harvard.edu/publications/workingpapers/citation.aspx?PubId=8956&type=WPN; accessed 29 March 2013.

[3] "Where Defense Ends, Strategy Begins," Christopher Holshek, *The Huffington Post*, 10 August 2012, internet: http://www.huffingtonpost.com/christopher-holshek/national-security-reform_b_1760076.html; accessed 27 March 2013.

general have been averse to thinking and acting very strategically because, up to now, they could get away with it – or, as said in sports, they have been more "lucky than good."

Then there is the obsession with threats and the intrinsic assumption that national security drives everything, exacerbated by what David Rothkopf of *Foreign Policy* has called a "Decade of Fear." Threat-basing does call for more actionable, measurable, and readily available "hard" power and its resource-intensive and risk-laden solution sets. But it limits the strategic aperture of the world to being reactive and averse to innovation as well as risk, preferring more static than adaptive planning. While businesses have shifted from "corporate planning" to "strategic management," the Pentagon remains mired in a planning process grounded in outdated premises of a rational design model (e.g., DoD's Planning, Programming and Budgeting System and the Quadrennial Defense Review) that leads it to prepare to fight the wars it prefers but not often finds itself in.

You can be reactive if you can afford to react to everything, and you dominate the scene. But when you don't, your approaches have to be more comprehensive, collaborative, connective, and coordinated. The strategic process must shift from formal plans for "known unknowns" to an emergent learning process to deal with "unknown unknowns." Deliberate planning should look to manage the process of strategic learning. What John Nagl said about the winner in counterinsurgency being the better learning organization[1] is just as true with regard to businesses, sports teams, governments, and nations.

The problem with American strategy, therefore, really isn't a problem at all:

> Strategy is not problem-solving. Problem solving as a mode of action is appropriate when goals or objectives are simple and clear. Complex situations that strategists should be thinking about are anything but simple and clear, so strategists are making multiple errors when they reduce ontological complexity and then apply an inappropriate epistemological model (i.e., means/ends reasoning) via problem-solving.[2]

No wonder the calls for a "grand strategy" that "weaves together the many threads of foreign and domestic policy with the aim of pursuing American interests and values more effectively. Although intellectually appealing, this way of thinking is difficult to translate into practice."[3]

Peace > Security

War and peace remains the central dichotomy of national strategy. Colin S. Gray simply states that "war is about peace, and sometimes vice-versa."[4] Politicians and strategists, of course, have argued for peace, implicitly or explicitly, for centuries. Ringing eerily prescient, Sun Tzu noted that "there

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[1] *Learning to Eat Soup with a Knife – Counterinsurgency Lessons from Malaya and Vietnam*, John A Nagl, Chicago: University of Chicago Press, 2002. See especially Ch. 1.

[2] "Tipping Sacred Cows – Moral Potential Through Operational Art", Lt. Col. (ret.) Tim Challans, *Military Review*, September-October 2009, 21.

[3] *America's Path: Grand Strategy for the Next Administration*, Richard Fontaine and Kristin M. Lord (eds.), Center for a New American Security, May 2012, 10.

[4] "Concept Failure? COIN, Counterinsurgency, and Strategic Theory," Colin S. Gray, *Prism* 3, No. 3, 22.

has never been a protracted war from which a country has benefited."[1] Clausewitz, in his famous dictum about war as an extension of policy "by other means" also seemed to imply warfare as an exceptional state. Former DoD General Counsel Jeh Johnson goes further. The War on Terror, like any war, is a "finite, extraordinary and unnatural state of affairs." Peace, on the other hand, "must be regarded as the norm toward which the human race continually strives."[2] B.H. Liddell Hart, observed that strategy, in its grandest sense, "looks beyond the war to the subsequent peace."[3]

We all want peace – but it seems more difficult and remote than conflict. DoD doctrine is full of operational explanations for conditions like "stability," but it deigns to define the end states of national strategy – peace and security. Everyone from Spinoza to Martin Luther King Jr., Ronald Reagan, and the Dalai Lama have pointed out that peace is not merely the absence of war and conflict, adding other qualifiers, among them justice and social harmony. Peace, however, is not merely an end state. In his own vision of "a strategy of peace," Kennedy describes peace as a process: "Genuine peace must be the product of many nations, the sum of many acts. It must be dynamic, not static, changing to meet the challenge of each new generation."[4]

Seeing peace as a process as much as a determinant goal helps identify a workable theory of change for peace to form a realistic national strategy. For one, peace and conflict are part of a cycle of change, as Kennedy implied, to which nations and other international, transnational, and subnational actors constantly try to adapt. When enough actors or systems have appropriately adapted to these changes, caused as much by the actors themselves as the environment, and bought into that adaptive system, then there is relative peace and stability. When they have not, then there is unacceptable conflict (e.g., the outbreak of mass violence).

Another way of looking at peace as a transformative process is in the most nettlesome of quandaries: "The adventures in Iraq and Afghanistan are only the latest reminders of a pathological American problem – the United States knows well how to get into wars, and fight them, but not how to end them… It takes a strategic decision-making process to get into wars. There should be a comparable national capability to help figure out how to end – or better yet – prevent them..."[5] War termination (the DoD term) and conflict transformation (as peacebuilders put it) require a strategic pathway to peace, the main components of which are fairly consistent.

As Eric Patterson constructs in *Ending Wars Well*, successful *jus post bellum* features three co-determinants in expanding magnitude, complexity, difficulty, required time, etc: order; justice; and (re)conciliation.[6] These roughly relate to the more familiar elements of peace and stability operations, as shown in Figure 1. Order and security in current situations comes mainly through the protection of civilians. Justice is facilitated through transparent and accountable governance and the

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[1] The Art of War, Sun Tzu, trans. By Samuel B. Griffith, Oxford University Press, London, 1963, 73; also quoted in the preface by B.H. Liddell Hart, vi.

2 "The Conflict Against Al Qaeda and its Affiliates: How Will It End?" Jeh Charles Johnson, Oxford University, 30 November 2012, speech transcript available at internet: http://www.lawfareblog.com/2012/11/jeh-johnson-speech-at-the-oxford-union/; accessed 25 March 2013.

[3] *Strategy*, B.H. Liddell Hart, second revised edition, Meridian, London, 1991, 322.

[4] Kennedy, op. cit.

[5] "Ending Wars", Christopher Holshek, *Diplomatic Courier*, 2 August 2012, internet: http://www.diplomaticourier.com/news/opinion/1068-ending-wars; accessed 26 March 2013.

[6] See *Ending Wars Well: Order, Justice, and Conciliation in Contemporary Post-Conflict*, Eric D. Patterson, Yale University Press, New Haven, 2012.

rule of law. Development, in a broader sense, is the way to encourage (re)conciliation or a civil society characterized by a fair distribution of socioeconomic advantages and inclusiveness.

If the object of war is indeed a better peace, it comes through this emergent path – a process leading to stable, just, and concordant civil society; conversely, what often results in conflict is the disintegration of these three elements, usually (but not always) in reverse order. While the three are hierarchical, their relationships are not necessarily linear, depending on the circumstances of culture and geography as well as the influence and impact of internal (local) and external (transnational) actors. What's clear here, however, is that peace is greater than security, in operative and not just moral terms.

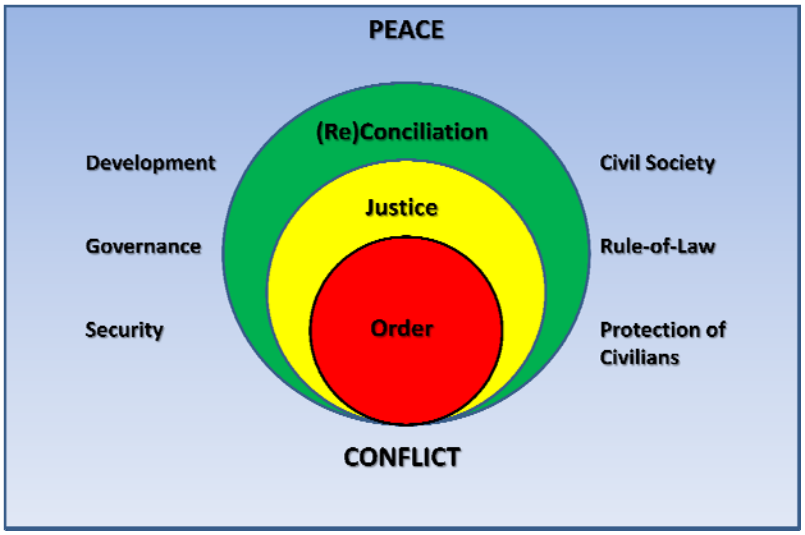

Figure 1, Peace and Security Operations

What this model also implies is that, moving from conflict to peace, the enterprise at hand becomes more essentially civilian in nature. Although inter-state wars and violent conflicts have essentially been the realm of the military, the emergence of "human security" as the predominant challenge calls for more collaborative approaches. Hybrid operations such as security sector reform are growing in criticality, requiring a blend of both civilian and military involvement and generally taking place in the realms of governance and justice. Two more truths, then: one is the overriding significance of the primacy of civil authority at all levels of policy and engagement (and thus the demonstrated democratic civil-military relationship, especially in those hybrid areas); the other is thus the greater importance of civil-military coordination and transition management.

This also helps explain the relationship between peacebuilding and stability operations. Stability operations focus mainly on the lower tasks of order (or security) and, to a certain extent, governance related to the rule of law and other essential public services. Peacebuilding goes beyond that, looking to help create more sustainable, local solutions in developing civil society. In a multilateral (i.e., UN) context, the nexus is between peacekeeping and peacebuilding.

Peacebuilding, however, does not begin where stability operations end. The recent UN Security Council Resolution (2086) on "Multidimensional Peacekeeping" emphasizes the criticality of "early

peacebuilding" in peacekeeping and conflict prevention.[1] This reflects one of the salient lessons of the last decade in conflict management: namely, that stability and peace operations must start as early and as robustly as possible in conflict transformation (i.e., prior to Phase 4 Stability and Phase 5 Transition to Civil Authority) – so early, in fact, as to mitigate the costs and risks of conflict in the first place. Hence the emergence of conflict prevention as pre-emptive peacebuilding (as well as the renewed emphasis on Phase 0 Shape and Influence).

Nevertheless, the relationship between security and development holds constant – while there is no development without security, there is also no sustainable security without development.

More important than even what this model explains is the understanding that security is a component of peace – not the other way around. This is why simply expanding national security to include development and civil society issues is problematic. Security issues, in fact, are problems of peace. Moreover, peace is the outcome of superior strategy – an inherently comprehensive, collaborative, and coordinated process inclusive of all aspects of civil society and its components, among them security (which is why the military should be seen as a civil society organization).

But no national strategy can work without a moral scale to balance priorities and efforts.

The Moral and the Physical

Strategy is an innately moral exercise – if you can't do everything and thus have to make choices, you have to make those choices based on what you value most. National values largely shape national interests, whereas national interests, in turn, inform policy, operations, and tactics. Such is the hierarchy of national strategy. Peace, as both outcome and process, inculcates a values-based approach to national strategy as well as shapes its operating principles.

Values, of course, come from the psychological and not the physical domain. In the 21st century, Napoleon's famous observation that "the moral is to the physical as three to one" in war has a new relevance in the power, reach, and velocity of ideas as a primary agent of change in peace and security – i.e., how ideas are communicated and made to work in people's lives. Morality, in this sense, "can be usefully described along the lines of what people intend, what people do, and what consequences people bring about."[2] In looking at the "enduring lessons from the past decade of operations," the Joint Staff identified among them "the battle for the narrative." [3]

The key to re-shaping American strategy is thus in the relationship between intimidation and inspiration. George F. Kennan's advice to "first use moral authority," embodied in the last successful grand strategy of the United States laid out in NSC-68 still resonates. In it, diplomacy (not defense) was in the lead, and military power was a holding or enabling action until moral suasion could facilitate the collapse of the Soviet system under the weight of its self-contradictions through the connective and "corrosive power of freedom." What brought down the Berlin Wall, prompted Islamic fundamentalists to launch the 9/11 attacks, and is stirring many to rise up and overthrow the old

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[1] S/RES/2086 (2013), United Nations Security Council, 21 January 2013, internet: http://www.un.org/ga/search/view_doc.asp?symbol=S/RES/2086%282013%29; accessed 26 March 2013.

[2] Challans, op. cit.

[3] *Decade of War, Volume I – Enduring Lessons from the Past Decade of Operations, Joint and Coalition Operational Analysis*, Joint Staff J7, Department of Defense, Washington, D.C., 15 June 2012, 2.

order in the Middle East remains the same dynamic – the rising aspiration of people living under those systems for a better life, as exemplified elsewhere (such as in the United States).

The core challenge for the United States in the 21st century thus remains "to construct a peaceful and prosperous world based on the universality of basic American values of the worth of the individual and the primacy of personal freedom."[1] In both the moral's psychological and ethical connotations: "For strategy to work in our age, it must possess solid moral and political legitimacy… We must realize that the use of military 'hard power' to pursue a political goal is no longer feasible unless that goal also possesses moral legitimacy, at home and amongst our coalition allies."

Further, we must understand that, if a lasting and desirable peace is to come from any war, the means and ends must possess moral symmetry…"[2] Or more concretely:

> We need a coherent, multinational civil-military approach with a corresponding set of multinational civil-military coordination mechanisms. Furthermore, this broad, multinational civil-military approach must reflect the best that democracies have to offer. Our political goals cannot merely be negative ones based on fighting and fear. Rather, they must be positive, must inspire practical action and unite allies in a common cause… In sum our policy must place us on the moral high ground – and keep us there.[3]

The impetus for this comes more than from the strategic imperatives of constraints and restraints explained above: It comes from the American people. In a remarkable study conducted by the Fund for Peace, a major conclusion was that the U.S. leads most effectively when it "walks the talk…"

> America's ideals impel it to lead in the world… But how America leads is as important as whether it leads… there was significant discussion about the differences between "American power" and "national strengths". Many associated the former with an emphasis on coercive behavior in the world, while they viewed the latter as concerning principles and values, such as democracy, liberty, and tolerance. While coercive means might be necessary in some cases, an over-reliance on them was seen as counter-productive and even disastrous; whereas pursuing policies on the basis of the nation's strengths was seen as the most effective way to produce lasting influence in the world. In addition, people viewed a predominantly coercive approach as out of touch with new global realities.[4]

A more recent Chicago Council on Global Affairs survey concluded especially among Millennials about diminished perceptions of threat, more selective uses of force, and, greater favor to non-military approaches.[5] Yet, while Americans embrace a more morally-based global leadership role,

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[1] *Threats & Challenges – Strategies in a New Century*, Edward A. Corcoran, Lakewood, CO: Edward A. Corcoran, 2012, 113.

[2] "War Is a Moral Force – Designing a More Viable Strategy for the Information Age," Peter D. Fromm, Douglas A. Pryer, and Kevin R. Cutright, *Joint Forces Quarterly*, Issue 64, 1st Quarter 2012, 40 and 46.

[3] Lt. Gen. (ret.) James M. Dubik, "Lessons from Lincoln: On Being a War President," Landpower Essay No. 08-4, Association of the United States Army, December 2008.

[4] *The Use & Purpose of American Power in the 21st Century – Perspectives of Americans from the 2008-2009 National Dialogue Forums*, Will Ferroggiaro, Washington, DC: The Fund for Peace, June 2010, 15-16 and 32.

[5] *Foreign Policy in the New Millennium – Results of the 2012 Chicago Council Survey of American Public Opinion and U.S. Foreign Policy*, Dina Smeltz, Chicago: The Chicago Council on Global Affairs, Chicago, 2012.

the better idea "doesn't have to win just because it is a better idea. It requires great powers to champion it."[1] And championing those ideas is not an amateur sport.

Peace is for Professionals

One of the most poignant lessons of the Iraq War is that winning the peace is much harder than winning a war, but that you also can't really win the war without winning the peace because winning the peace *is* winning the war. This is nothing new: "History tells us that it can be hard, if not harder, to make peace than it is to make war successfully."[2] The other, of course, is that you can't win the peace merely at gunpoint. Another is that peace is found more in communities than states – more sustainable peace comes as much from the bottom up than the top down.

Winning at least conventional wars has been fairly straightforward. It involves defeating an enemy force. Although security operations have expanded to involve sub-national actors, "asymmetric" methods, and "irregular" challenges, they remain at least for the U.S. centered on the application of hard power for "decisive action." Building peace, however, is not about "decisive action." It involves a much more complex, non-linear, indefinite, and less easily measurable process of convincing people to embark on a course of political, social, and economic change they may or may not want to take at that time. This is also nothing new, as the World Bank realized in 1949:

> Money alone is no solution… Perhaps the most striking single lesson the World Bank has learned in the course of its operations is how limited is the capacity of the underdeveloped countries to absorb capital quickly for really productive purposes. There are many reasons why development is necessarily a gradual process… Certainly no amount of external aid, technical or financial, can replace the essential will and determination on the part of the government of the country concerned to adopt the difficult and often politically unpopular economic and financial measures necessary to create a favorable environment for development.[3]

Peacebuilding is, in short, applied national strategy. It goes beyond maximizing stakeholders and minimizing spoilers to create more space for civil society. Although it involves a wide range of efforts by diverse government and civil society actors – including the military – to address the root causes of violence and protect civilians before, during, and after violent conflict, peacebuilding is neither nation-building, state-building, nor national security driven development. "Nations cannot be built. Most especially they cannot be built by well-meaning but culturally arrogant foreign social scientists, no matter how well intentioned and methodologically sophisticated. A nation (or community) is best defined as a people who think of themselves as one."[4]

Peacebuilding is somewhat less ambitious than nation-building, because of its more managed expectations, appreciation of time, and core emphasis on local ownership. It applies, in military terms,

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[1] Robert Kagan, "Why the World Needs America", *The Wall Street Journal*, 11 February 2012, internet: http://online.wsj.com/article/SB10001424052970203646004577213262856669448.html?mod=WSJ_hp_LEFTTopStories; accessed 15 February 2012.

[2] Gray, op cit., 27.

[3] *Fourth Annual Report to the Board of Governors, 1948-1949*, International Bank for Reconstruction and Development, Washington, D.C., 13 September 1949, 8, internet: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2000/02/28/000178830_98101911112815/Rendered/PDF/multi_page.pdf; accessed 27 March 2013.

[4] Gray, op. cit., 29.

a "shaping operation." Indeed, it is an essential element of U.S. foreign assistance – or at least should be – and requires "recalibrating civil-military roles and relationship and developing a clearly articulated shared mission of building global human security consistent with national interests."[1]

Fortunately, a civil-military convergence seems to be at hand, in part because both "communities" are conceptually moving towards each other – especially the military to the civilian. For one, "the U.S. military has been changing over the last 20 years from a force of confrontation to one of cooperation. The military has learned that partnership is better than clientism and is adapting its command structure once optimized for waging major combat to one that is focused on conflict prevention."[2] The Army's new mission bumper sticker of "prevent, shape, win" and Regionally Aligned Forces also suggest a new ordering of priorities. It is tacit recognition that the military's comparative advantage lies less with "providing good governance, and inculcating democratic values in foreign, undeveloped societies driven by internal conflicts," which is "simply too hard a task, and one for which military forces are not particularly well-suited."[3]

In other words, peacebuilding is better led by the growing number of civilian professionals, most of whom are now outside government. This has serious implications for government organizations, including the military, to look to be service coordinators as much as, if not more, than service providers. This is why some suggest future military engagements adopt a "light-footprint construct" that favors prevention over decisive action and is civilian-led, mainly through the country team, where "military activities are planned and approved in the context of more sustainable, civilian-led efforts to address the underlying socioeconomic and political drivers of the conflict through reconciliation, governance reform or other programs designed to address local grievances."[4]

Peacebuilding is the whole-of-society strategic approach to essentially whole-of-society challenges, where appropriate capabilities lie often outside government agencies, which nonetheless must still leverage the comparative advantages of players as diverse as society itself (including the military):

> The most effective strategy for addressing transnational or global problems involves mixed networks of public, private and civic actors created under the rubric of public-private partnerships, global alliances, global campaigns or collaborative networks. Although not a panacea, such arrangements can stretch scarce government resources and ensure that they leverage other contributions of money, expertise and other in-kind resources.[5]

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[1] "Peacebuilding in US Foreign Assistance – Recommendations and Proposed Language for the Foreign Assistance Act," 3D Security and Alliance for Peacebuilding Policy Brief, 2010, internet: http://3phumansecurity.org/site/images/stories/PolicyBriefs/peacebuilding_in_us_foreign_assistance%202010.pdf; accessed 28 March 2012.

[2] "When Foreign Policy Goals Exceed Military Capacity, Call the Pentagon," Derek S. Reveron, *Foreign Policy Research Institute E-Note*, 12 February 2013, internet: https://www.fpri.org/articles/2013/02/when-foreign-policy-goals-exceed-military-capacity-call-pentagon; accessed 8 Mar 13.

[3] *A New US Defense Strategy for a New Era: Military Superiority, Agility, and Efficiency*, Stimson, Washington, D.C., November 2012, 25.

[4] *Light Footprints – The Future of American Military Intervention*, Maj. Fernando M. Lujan, Center for a New American Security, Washington, D.C., March 2013, 9.

In other words: If you want peace, then you have to plan, organize, educate and train, and most of all resource for peace. Unfortunately, the United States is not currently configured for this, given the huge imbalance between capacities for peace and capacities for conflict – the United States "just doesn't take the profession of peace seriously."[1]. But this requires more than "a comprehensive re-thinking of U.S. foreign assistance and security interests."[2] What it really requires is a new mindset.

The National Strategy of the United States of America

A strategy of peace is superior to a national security strategy because peace is innately more strategic than security. It lends to more appropriate comprehensive, collaborative, connective, and coordinated approaches to the whole-of-society challenges and opportunities of our times. It works from a positive rather than a negative – being more about inspiration than intimidation. It is a maximizing, inclusive strategy, leading foremost with the full moral suasion of the United States. Values-based, it leverages and revitalizes renewable strengths rather than tries to cover or compensate for weaknesses through costly, risk-laden, and more perishable power mechanisms. It is thus more economical. As such, like all good strategies, it "doesn't just draw on existing strength; it creates strength through the coherence of its design."[3]

A strategy of peace, as Kennedy pointed out a half-century ago, is neither idealism nor realism, but both. It is a practical idealism, focused on helping to bring order, justice, and civil society to a world America needs as much as it needs America. In the 21st century, American national strategy must be less about "peace through strength" and more about realizing that peace *is* strength.

This is not as hard as we may think. "Transformation is first and foremost about changing culture. Culture is about behavior, about people: their attitudes, their values, their behaviors, and their beliefs. What we believe, what we value, and our attitudes about the future are ultimately reflected in our actions: in our strategies and processes, and in the opportunities they create."[4]

Despite the incongruities of its national security psychology, the United States, whose foundation of moral strength, codified in its national motto of *e pluribus unum*, is still very well qualified to be a lead nation in the 21st century. Its dynamic, multicultural civil society and its democratic national values harbor tremendous social and strategic capital. The ethos of its engagement with the world and the civil-military relationship that connects peace with security is most clearly depicted in a symbol more than two centuries old – namely, the obverse of the Great Seal of the United States (Figure 2). The state, symbolized by the eagle, aspires for peace and civil society, looking in the di-

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[5] "A Grand Strategy of Network Centrality," Anne-Marie Slaughter, in *America's Path: Grand Strategy for the Next Administration*, Richard Fontaine and Kristin M. Lord (eds.), Washington, D.C., Center for a New American Security, May 2012, 54.

[1] "America's Peace Crisis," Christopher Holshek, *Foreign Policy*, 1 May 2014, internet: http://www.foreignpolicy.com/articles/2014/05/01/america_peace_crisis_profession; accessed 16 June 2014.

[2] "Peacebuilding in US Foreign Assistance…"

[3] *Good Strategy, Bad Strategy*, Richard Rumelt, New Delhi: Viva Books Private Limited, 2011, 9.

[4] Cebrowski, op. cit., 55.

rection of the olive branches in one talon while holding the arrows of war in reserve (or support) in the other – hard power, after all, is most effective when implied and not applied. The Great Seal elegantly illustrates the alignment and application of national strength and power.[1] This ethos must permeate not just policy, but its practice, in every aspect.

Figure 2, Great Seal of the United States

Some have called for a "national strategic narrative" that transitions from "control in a closed system to credible influence in an open system," from "containment to sustainment," and so on.[2] One way of doing this is for the White House to issue a *National Strategy of the United States of America* – simply dropping a single, distorting word. Wherever and whenever possible, it should contextualize American interests in terms of "peace and security" as national strategic choices rather than "national security" as some kind of singular *über alles*. More specifically, it could outline a national strategy for peacebuilding that explains how the U.S. government not only brings its own civil-military capabilities to bear, but more importantly, how those capabilities leverage and enable non-government capacities for building peace and prosperity.

More than ever, you cannot have viable peace without a strategy that both aspires to and applies the process of peace. In the 20th century, peace was a by-product of security; in the 21st century, security must be the by-product of peace. Putting peace and security the right way around will not be easy, and will take some time. But we need to get going. We're already a half-century behind.

Melanie Greenbeg is the President and CEO of the Alliance for Peacebuilding. Christopher Holshek, Col. (ret.) U.S. Army Civil Affairs, is Senior Fellow there.

[1] For a detailed explanation of the Great Seal of the United States, see *The Power of Myth*, Joseph Campbell (with Bill Moyers), New York: Anchor Books, 1991, 31-34.

[2] *A National Strategic Narrative*, Mr. Y, Woodrow Wilson Center of International Scholars, Washington, D.C., 2011, internet: http://www.wilsoncenter.org/sites/default/files/A%20National%20Strategic%20Narrative.pdf, accessed 29 March 2013.

Chapter Two, The Use of Shared Socio-cultural Information and Research Validation

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Abstract

This chapter discusses factors to consider when working with shared socio-cultural data, particularly as it pertains to social media analysis. Using Bangladesh, and Dhaka more specifically as the primary examples, this article discusses the challenges posed by the imposition of political boundaries onto an online, unbounded world; regional and linguistic differences in netiquette and cyber culture that are often unaddressed in social media research; and the cultural and national identity of analysts that plays into research and reporting that can introduce underlying biases and assumptions into the research process and resulting data. In considering these challenges, the chapter concludes with the caveat that all data, particularly shared data, regardless of its origin, should be carefully vetted to ensure that it can be validated to meet the standards of rigor prior to incorporation in social science research.

Keywords

Socio-cultural data, social media

Introduction

Social media has become an important means of communication. Information conveyed through social media provides rich data on populations, making it an important socio-cultural contribution to the operating environment. This contribution provides a broad overview of social media projects, what they produce, and why their results must be examined critically when offered as shared socio-cultural data. The discussion begins with a generalized description of social media projects. Many social media projects, as well as those producing shared socio-cultural data, are not social science research. Used for their intended purposes, any existing project's lack of social science precision is not problematic. The project already performs to specifications. The challenge is to understand what these projects report, and to know that while the data is valid for the intended recipient, the same information can impact validity when used in a social science research effort. The discussion concludes with selected topics to consider when choosing to utilize shared socio-cultural data in another project.

Social media programming as shared socio-cultural information

Social media provides a wealth of information about how people in different societies think and what they think about. Because of its ready availability and low cost to access and monitor, social media information is a valuable resource to assess parts of a society and its populations, as evidenced by the fact that DoD, its associated contracting organizations, and non-governmental corporations are frequently advertising positions for skilled social media analysts.

[1] This work is performed for the Marine Corps Information Operations Center.

Existing programs have specific requirements to provide targeted analyses, often broken down into geographical regions and/or language(s) to assess specific Information Environments. In many cases, they are further broken down into specific topics of interest. These programs produce reports designed to inform about key events, topics, and trends in the online Information Environments. The nature of these programs is to follow mission-specific or other requirements placed upon them, a feat that is accomplished using the methodologies and techniques that will produce results the fastest; many projects are neither designed nor scoped by social scientists. For example, a project that examines conversational tone and volume – a task that can be performed with the rigors of social science – can produce results that should not be confused with work completed by trained social scientists.

Data gathered in many social media projects is intended to inform the decision-making process in a way that does not require the precision of social science studies. In addition to assessing volume and tone, many of these projects are attitudinal, meaning that they seek to identify attitudes in a defined place about a specific topic.[1] For example, recall the 2012 conflicts in Burma between the Rohingya and Buddhists. Opinions and tensions ran high within Burma and abroad, and gained the attention of the Organization of Islamic Cooperation (OIC). While the OIC and other groups outwardly offered aid and assistance, the media spun the situation by using politically-charged vocabulary, labeling the Rohingya's plight an overt genocide, and attributed this language to the OIC.[2] This incident could have been an interesting moment to trace in terms of attitudes, as Bangladesh refused admittance of refugees and aid to those already in-country, Burma waivered over the decision to allow the OIC's and other observers' admittance to the province, and many domestic protests flared against foreign interference in Rakhine state.[3] Information on attitudes pertaining to these events could reveal more in-depth insights into the region's history, relations between people of various religions, and confirm how various groups perceive the Rohingya. Attitudes could also enhance a larger project on a people, region, or country by providing additional socio-cultural insight. Attitudes by themselves, however, are not sufficient for understanding or predicting behaviors. A more rigorous social science study would be required to examine how these online attitudes affect offline behaviors. Though the example presented is perhaps oversimplified, it should suffice to show how social media projects can be tailored to meet given requirements, such as learning how people express their opinions online about certain events. While this data is collected and processed to meet predetermined needs, it does not necessarily translate into data for a social science assessment, but falls more along the lines of supplemental socio-cultural data for more structured, rigorous behavioral studies.

The significance in highlighting the differences between social media reporting and social science research is to show that they are not necessarily the same, and require evaluation prior to being incorporated into a social science project. Because of these distinctions, shared socio-cultural information that is not collected and analyzed under social science protocols should be carefully con-

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[1] It is important to recognize that the term "attitude" has multiple definitions, many of which are disciplinary-specific in the social sciences. The usage here refers to feelings, intentions, and thoughts expressed online within the language environment under examination.

[2] Muslims face genocide in Rakhine: OIC. (2012, November 18). *Saudi Gazette*. Retrieved from http://www.saudigazette.com.sa/index.cfm?method=home.regcon&contentid=20121118143212

[3] For additional information, see: Bangladesh: Assist, Protect Rohingya Refugees. (2012, August 12). *Human Rights Watch*. Retrieved from http://www.hrw.org/news/2012/08/22/bangladesh-assist-protect-rohingya-refugees; *Govt invites OIC to probe violence in Rakhine* (Vol. 32, No. 639). (2012, August). Retrieved from Myanmar Times website: http://www.mmtimes.com/2012/news/639/news63904.html; Weng, L. (2012, October 10). Rakhine Women, Monks Protest OIC. *Irrawaddy*. Retrieved from http://www.irrawaddy.org/archives/16182.

sidered before being accepted as inputs for behavioral studies. The data can provide valuable insight when properly assessed and incorporated, yet the challenge of using these inputs is how to assess the extent to which they are validated, or at a minimum understand their construction and selection biases, in order to avoid invalidating a project that does adhere to social science protocols.

The next section will mention some key areas to consider before adopting shared socio-cultural data into another study. The discussion will cover generalities common to many social media programs, and include examples as illustrations. When possible, examples will use Dhaka, Bangladesh, or Bengali socio-cultural norms to conform to the Megacities project and its proof-of-concept effort based on Dhaka and the Reconnaissance, Surveillance, and Intelligence (RSI) Paradigm.

Topics to Consider for Shared Socio-Cultural Information

All research projects require data to be collected, analyzed, and then utilized based on how the information is evaluated. Ideally, each project would select, gather, and assess its own data for the highest degree of reliability. However, this method is neither cost nor time efficient, particularly when data already exists that may be relevant to the study. This area is one of the benefits of shared socio-cultural data – it saves time, money, and effort, allowing research to be conducted with greater efficiency and expediency. The challenge is to determine whether shared socio-cultural information can be used as part of a validated social science project. One way to make this assessment is to understand how the shared data was collected, assessed, and reported, essentially acknowledging what might be considered the equivalent to assumptions or biases inherent in the shared data. The following subsections are intended to provide a general overview about how many social media projects are organized and point out some general socio-cultural features of online environments. Social scientists need to think about how this data is constrained, collected, and reported, in addition to thinking about other socio-cultural complexities that are sometimes overlooked in online research. Thinking about and addressing these points will challenge and enhance research based on shared socio-cultural inputs, leading to stronger, more accurate results at the study's conclusion.

Geographic and/or linguistic boundaries

Projects are often defined by geographical region (country or COCOM AOR) and/or language, and frequently defined by both. Bounding socio-cultural projects for geographical locations and language generally limits the scope of many projects into manageable units and conforms to COCOM delineations. These limitations ensure that the projects focus on the area, language, and topic required for the decision makers. In addition to scoping, there are still technical issues to examining dynamic online Information Environments, and these challenges are faced to produce the most accurate results to meet project requirements. In more specific terms, a Bengali language project would commonly examine Bengali speakers in Bangladesh. Usually it would not look beyond Bangladesh, despite the fact that Bengali is the 7th most commonly spoken language in the world.[1] Examining Bengali speakers in other locations is possible, though the approach has some potential operational disadvantages such as the possibility of high volume or irrelevant information. At the same time, a geographically- and linguistically-bounded project could obscure important dialogue between the area of interest and its diaspora.

[1] Lewis, P. M., Simons, G. F., & Fennig, C. D. (2013). *Summary by language size*. Retrieved September 17, 2013, from Ethnologue: Languages of the World, Seventeenth edition website: http://www.ethnologue.com/statistics/size

The traditional geographical breakdown in the social media project model complicates the study of a Megacity. Challenges already exist in examining online Information Environments at a country level. For a city level, the traditional model will need to be recalculated. Scoping a project to a sub-national level is not a simple process.

Using Dhaka as an example, the first question is how to limit data collection to Bangladesh's capital city. Geo-location tools are one answer, though not every online platform will contain this data. Some platforms will locate a user in Dhaka, but will not be able to specify which administrative unit. Dhaka can be viewed as a division, one of Bangladesh's largest regional administrative blocks, or as a zila (district). Dhaka also has an administrative unit termed Dhaka City Corporation, and can be further broken down into upazilas or thanes (sub-districts), then unions, villages, and wards. To put these differences in numeric terms, Dhaka Division's population was 47,424,418 in 2011, whereas Dhaka Zila had 12,043,977 people.[1] The zila level is the most comparable to the Megacities effort, though the specific subnational unit chosen for examination may be the larger division or a smaller unit as required. At the zila level, collecting data on over 12 million people will be a tremendous undertaking, and will require significant server storage capacity and the appropriate computer tools to sort and analyze collected data on an on-going basis. A Dhaka-specific project will also need to break the zila data down into the smaller administrative units for the purposes of geo-location. The way each online platform distributes locational data, if at all, will be critical in determining how to collect and manage shared socio-cultural information for Dhaka.

Challenges also exist when using the language breakdown to examine Dhaka. In 2013, there were 40 living languages spoken in Bangladesh, excluding immigrant languages such as Punjabi, English, Gujarati, and Hindi.[2] On the positive side, not all of these 40 languages will have a web presence, though it will need to be determined which do and which do not. It is also possible that not all 40 are spoken in Dhaka, though with the city hosting the densest population, having the country's most robust economy, and drawing people from rural areas, it is likely Dhaka contains this rich linguistic diversity. It will take careful study to determine which languages are relevant to a Megacities study and the best method to include them. At minimum, a study should be conducted to determine where in the city, if at all, these languages are spoken, and uncover the socio-cultural context in which they are used to include intra-linguistic and inter-linguistic communications. Such a study could inform an examination of the online Information Environment; the resulting information will help scale the project into smaller, more manageable units.

Shared socio-cultural data must be assessed to determine how it fits into the Megacities project, and must also be evaluated for its accuracy. A solid social science study must take any geographic, linguistic, and technical parameters into consideration when incorporating shared information to ensure that the end product is valid. It is likely that the study will need to establish a new method based on the geographical constraints of Dhaka and the languages with online presences to maintain reliability and validity.

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[1] *Community Report, Dhaka Zila* (Population and Housing Census 2011). (2012, June). Retrieved from Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning website: http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/Census2011/Dhaka/Dhaka/Dhaka at a glance General.pdf

[2] Lewis, P. M., Simons, G. F., & Fennig, C. D. (2013). *Bangladesh*. Retrieved September 17, 2013, from Ethnologue: Languages of the World, Seventeenth edition website: http://www.ethnologue.com/country/BD

Netiquette/Cyber Culture

Despite being an obvious statement, it must be reiterated that people from other cultures tend to have distinct ways of thinking. Diverse ways of thinking lead to differing ways of tackling a problem, or using specific tools to accomplish a task. The Internet is a communications tool, and it is not exempt. People in other countries often think about and therefore use the Internet in different ways. This phenomenon is related to netiquette, or what is considered the correct, acceptable way to communicate on the Internet, and is intertwined with how online cyber culture is locally understood. Foreign netiquette can be substantially distinct from American netiquette, though this point is often overlooked in social media research design. In fact, it is an under-researched topic within communications studies.

Native perceptions of the Internet are very real. In a study conducted on Internet usage in Bangladesh and Dhaka, one researcher reported there existed a popular opinion that the "Internet is a form of American temptation or a means to disseminate the American ways of life and that will lead other people thinking and doing as the same as the American. And the result is other cultures will disappear sooner or later."[1] People sharing this opinion may be hesitant to use the Internet, or may use it to disseminate anti-American or anti-imperial information. How people perceive the Internet will correlate to how they use it, if at all, and should be a point of additional study.

Discussing netiquette with a Bengali language researcher, the analyst revealed that in general Bangladesh's Internet users adhere to Bangladeshi social norms. Within Bangladeshi society, a person's actions can be held against them personally, as well as against their family's reputation. Online actions are sometimes held in the same regard as offline actions. Therefore, expression online may appear more reserved than intended, so as not to shame the family or threaten its social status, regardless of the perceived anonymity of online communications. Having face and losing face are concepts imbedded into South, Southeast, and East Asian cultures. Preservation of face, a term referring to dignity and/or prestige, is an important cultural concept. Causing a family to lose face could ruin its social status, and lead to the offender being removed from the family. Because Bangladesh is primarily a collective culture, meaning priority is given to the group over the individual, causing the group or family to lose face is a serious cultural infraction. Therefore, online interaction and communications may be sensitive about certain topics, and what they omit may be just as valuable as what they include. This topic would make for an interesting social science-based study.

This section can only hint at some of differences in perceptions and uses that nuance Bengali netiquette from American online behavior. Identifying the differences allows for greater research accuracy, and aids in deciding which shared socio-cultural information is applicable to a given behavioral research study.

Analysts

The previous subsections provided an overview of how many social media projects are constructed and how different cultures use the Internet in general. Another issue to address is who is involved in creating and analyzing projects that produce shared socio-cultural information. This question is particularly tricky, because a report does not often give clues as to who determined and verified the

[1] Miah, Md. J. I. (2008) The Impact of Internet Culture on Youth Group of Bangladesh: A Socio-Cultural Study (Thesis). KDI School of Public Policy and Management, Dongdaemun-gu, South Korea. p. 8.

information on the document. In fact, this information is rarely available, though it can directly affect the data's validity and usability in another project.

Some employers will only hire native speakers to work on in-language project analysis. Native speakers will have strengths that non-native speakers do not, though the most accurate projects will use a combination of trained native and non-native speakers who score highly on the available language battery tests. Together, native and highly scoring non-native speakers provide a balance for linguistic issues, as well as are able to identify differences in netiquette/cyber culture and produce more relevant analysis. For example, a native speaker discussing his social media project was asked about how he incorporated dialects and local language variations. The analyst replied that the language in question had neither dialects nor variations, and were therefore not applicable to the project. However, the language under analysis has four recognized dialects in one country where it is spoken, two dialects in another country where it is spoken, and several major regional variations in the second country. With a little research it was determined that some of these dialects and variations had morphological (spelling), lexical (word), and syntactical (grammar) differences. Additionally, some dialects and variations were distinguishable online. The end result was that the project had less than 25% accuracy. While this accuracy was considered sufficient to meet project requirements, any shared data from this project could skew attempts to validate another project when incorporating these results. In conversing with other native speakers on a similar project, no one appeared aware that linguistic differences were not being addressed in their work. This issue may have been addressed if non-native speakers with intensive language training had been involved in the project.

Conversely, non-native speakers can also accidentally contribute to causing data errors. In pitching a new social media-based project to two COCOMs, a non-native speaker discussed how the online information was data mined and displayed. However, authors often upload image files of their writings because people in the particular language's Information Environment utilize a script that is difficult to manage online. At this point in time, there is no program that can accurately decipher these images. The presenter, not being a native speaker and not having spent time in this language environment, did not realize that the product being pitched was approximately 60% reliable.[1] While the program sounded very solid and could theoretically perform to mission standards, data from this project would need to be evaluated before being carried over into a social science behavioral study. In another example, it is common knowledge that many languages, including English, have developed shorthand writing system to send text messages. For some languages, abbreviated language is also in common usage as standard social media and online communications language. An analyst working with one of these languages decided that the shorthand form looked like "gibberish," and was therefore irrelevant to the project. It was removed because the analyst, a non-native speaker who did not try to understand the significance of the shorthand writing, decided it was irrelevant. The outcome was reduction of project accuracy, and likely a significant loss in relevant project volume. In both of these instances, the non-native speaker would have produced better data if paired with a native speaker.

One very promising proof-of-concept effort looked at an online insurgent publication in the English language. The authors wrote in an English dialect that is specific to the group, a version of English that contains some minor, but significant differences to American English.[2] Working with a native

[1] This number is estimated based on knowledge of the language environment. The product pitch was not clear on which platforms it included in its assessment, and overall accuracy could be higher or lower depending on this information.

[2] For example, Singlish, or Singaporean English, or Manglish, Malaysian English, contain words that have developed slightly different meanings from those used in the US, and often adopt words from other languages into their English.

English speaker from that country, the project took these variations into account. Using other techniques to complete the analysis, the resulting information was both internally and externally validated for the English-language version of the magazine. Shared data from this project would be immediately usable in other forms of social science research. This example is only one of many where native and non-native speakers collaborated to improve a project focused on online media.

Who the data collectors or analysts are may be difficult to ascertain. Who they are does add additional assumptions and biases into any outputs released from their projects. It is likely that projects using both native and non-native speakers may be more accurate because the two can work as an internal system of linguistic and cultural checks and balances. The accuracy of social media research based on the analysts' language ability would be an interesting study, and would help determine in which data higher confidence should be placed.

Conclusion

There are many factors to consider when using shared socio-cultural data in a behavioral study. Since many of the projects producing such data are neither intended nor constructed to meet social science research protocols, each set requires evaluation prior to implementation. This essay is not intended to critique the existing programs, as they perform the vital functions that are required of them. It does, however, highlight the fact that, just as with any data set encountered, shared information from these projects are not automatically validated to social science standards. Data evaluation is critical to prevent the introduction of inaccuracies into socio-cultural analysis, particularly when the outputs will inform strategy, planning, and decision-making; less careful assessment can lead to mismatches of forces, capabilities, and goals.

The points made in this essay are intended to stimulate thinking on how best to use what is ultimately a dynamic, cost-effective, and rich resource. Social media and other shared socio-cultural data have the ability to enrich a larger study, but just as all other data considered for such a project, require careful consideration.

Chapter Three, Measuring Vulnerability to Climate Change: An Indicators Approach

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Abstract

Research in vulnerability related to climate change can contribute to national security studies in at least three ways: (1) The inclusion of environmental factors provides an important context and significant elements that can add stresses and triggers to potential conflict situations. (2) Climate change research takes the long view, often a century or more into the future, thus complementing shorter-term security analyses. (3) The ability to analyze change by analyzing disparate factors together allows feedbacks and second- and third-order effects to be projected, thus improving the ability to intervene early in potential conflict situations, when non-military strategies can be used to defuse or mitigate issues. Although just beginning to be applied to urban settings, an indicators approach to measuring vulnerability provides valuable first-order analysis, transparency and ease of use, and the ability to project future vulnerability using structure scenarios. The potential to use remotely sensed data and map both environmental and social indicators is also beginning to be explored.

Keywords

indicators modeling, climate change vulnerability, security and climate change

Introduction

In climate change research, the concept of vulnerability has played a key role in analyses of climate change impacts on human and ecological systems and in extended research on coping and adaptation responses to long-term stresses and short-term climate-related disasters. In this paper, we identify and describe an indicators approach in climate change vulnerability analysis that would be useful both in national security studies and in joint climate and security studies, especially with reference to urban environments.

The application of these methods to urban environments is particularly important as they are a locus of concentrated societies and places where human-ecological systems have been created that are likely vulnerable to climate change and conflict (Schneider et al., 2009). One might think that because urban areas include infrastructure built to withstand current climate variability, only marginal adaptations would be required to accommodate the seemingly slow pace of changes in average conditions. But a growing set of assessments and reports prepared by city governments, nongovernmental organizations, utility providers, and others indicate that vulnerability to climate variability and change is high. This is partly because current infrastructure is not, in fact, well adapted to current conditions – storms, heat waves, and other extreme events often exceed design capacity. Interdependencies among systems (e.g., interruption in one infrastructure network such as electric power, water supply, or public transit has impacts on many other sectors and activities) create the potential for cascading failures and increase vulnerability. Finally, because of relatively high population densities and wide disparities in the living conditions and access to services in some cities, they are potential hot spots of social unrest and mobilization. Rural-to-urban migration is creating

"peri-urban areas" (Webster, 2002) and compounding the potential for protracted social conflict. In recognition of the vulnerability of urban areas, the Intergovernmental Panel on Climate Change's Fifth Assessment Report (IPCC AR5), due to be completed in March 2014, will include a chapter that assesses current knowledge of potential climate change impacts and adaptation options for urban areas (see http://www.ipcc-wg2.gov for updates on the IPCC AR5).

Characteristics of urban areas make them challenging – but fascinating – locations for research that seeks to understand how changes in socioeconomic, climate, and environmental conditions may interact with strategies to encourage growth and improve resilience. This article will take initial steps in exploring the potential application and integration of several different research methods to assess vulnerability and security issues in urban environments.

Definitions

We adopt a definition of vulnerability that includes both ecological systems that humans rely on (importantly, food production, water quantity/quality/timing, and forest and marine services) and human social systems that influence use of climate-interfering resources and enhance or impede well-being. Moreover, the definition of vulnerability can lead to a definition of resilience that in many ways is complementary.

In the context of climate change, we define vulnerability as the potential for harm from the effects of climate change (Moss et al., 2001); vulnerability resides in not only the physical changes in climate-related conditions but more importantly in the social systems that rely on known climatic conditions. In the context of national security, the potential for harm includes instability and conflict in human societies.

In the context of climate change, resilience is the potential for systems (physical and social) to resist and recover ("bounce back") or reorganize their functioning ("bounce forward" or "transform") in response to climate change impacts so as to support socio-ecological systems. There has been a shift in resilience research from an assumed goal of returning to the original state to an exploration of potential multiple stable states (Turner et al., 2003; Gallopin, 2006; Nelson et al., 2007) In the context of national security, resilience includes the potential for social systems to cope or adapt to climate change without harmful instability.

Adaptation – adjustments in infrastructure, human activities, and even "natural" systems – is one of two broad approaches (along with reductions of greenhouse gas emissions) for managing the risks of climate change. Adaptive capacity – the ability of a society or social system to change to accommodate changes in climate – is distinct from the technological options that are often the focus of adaptation. Both technologies and capacity to implement them over time are crucial to manage changes in climate that can no longer be avoided.

Vulnerability and resilience are abstract concepts that cannot be measured directly and that have most relevance within specific contexts. Important questions are, "Who is vulnerable?" "Vulnerable to what?" "Vulnerable how?" These can be applied to a range of stresses, including conflict and climate change. In urban environments, answers to these questions will differ based upon the "who" (new migrants? middle-class citizens? industrial firms? etc.), the "what" (heat island effects? floods? extreme weather events? etc.) and the "how" (location in low-lying or densely populated areas? dwelling or working in substandard buildings? unable to evacuate? underserved by government services such as potable water? etc.).

Methods to Assess Vulnerability and Resilience

Vulnerability and resilience researchers take several approaches to assessing vulnerability; these have been reviewed in Malone and Engle (2011) and Füssell (2009), among others; Ford et al. (2010) have reviewed the extensive case study literature. The principal approaches include describing and analyzing case studies, particularly for small island states, coastal areas, and poor developing countries (i.e., known areas of vulnerability); developing and evaluating indicators for vulnerability and resilience; using scenarios to probe alternative future conditions; evaluating impacts on livelihoods; and sectoral studies, such as those with a focus on food or water security). In conjunction with each method, researchers have used top-down data (often at the national or regional scale), stakeholder-driven methods (frequently at a community level), and visualization techniques such as mapping.

Here we discuss in more depth the use of indicators for vulnerability and resilience assessment in comparative analyses with projections, and the use of scenarios to probe alternative plausible futures. Each of these approaches can be structured to provide comparability (often lacking in case studies) and integration of wide-ranging factors, including both environmental and social factors (often lacking in sectoral studies). We describe the ways in which these methods can be used to enhance and extend security studies.

Quantitative approaches to vulnerability assessments typically feature indicators that are composed of proxy variables for a range of factors that in theory contribute to vulnerability (or, more recently, resilience). A prominent system of indicators, the Environmental Performance Index (EPI) has been developed by researchers at Columbia and Yale Universities (CIESIN & YCELP, 2013); it includes climate change impacts, water and air pollution effects on ecosystems, agriculture, forestry, biodiversity, fisheries, and human health. The EPI provides a basis for analysis at the global and country levels. A smaller set of indicators comprises the Vulnerability-Resilience Indicators Model (VRIM) (Moss et al., 2001; Malone & Brenkert, 2006), as shown in Table 1. Many other indicator sets have been developed, frequently for specific analyses in specific places (e.g., Allison et al., 2009, for vulnerability of 132 economies; Brooks et al., 2005, for social vulnerability in Africa; Berry et al., 2006, for agricultural land use and biodiversity; Luers et al., 2003, for vulnerability of Mexican farmers; O'Brien et al., 2004, for adaptive capacity, climate sensitivity, and exposure to globalization in India's districts; Perch-Nielsen, 2010, for vulnerability of beach tourism). Eriksen and Kelly (2007) provide a review of development of credible vulnerability indicators for climate adaptation policy assessment. Lamhauge and colleagues focus on the use of indicators to monitor and evaluate adaptation (Lamuage et al., 2013).

VRIM results have been used in national security studies to provide a comparative framework for analyses of climate change projections, projected impacts, and projected adaptive capacity to 2030 for six regions of the world (NIC 2009a,b,c,d,e,f). Political and social analysts then used these regional analyses as a basis for identifying potential circumstances that could lead to conflict where climate changes, impacts, and lack of adaptive capacity could lead to conflict. Thus, a longer-term frame can be the basis for near-term analyses.

Although they do not, in general, account for system interactions and feedbacks, indicators and their proxy variables are flexible and transparent, easily altered to answer specific questions and explore alternative futures. For an investigation of the effects of providing adequate family planning services for expressed needs, Malone et al. (2012) added variables on the status of women. Governance variables have been recognized as important for assessing vulnerability and resilience, and demographic characteristics and economic status have also been foci of recent studies (e.g.,

Astorino-Courtois & Bragg, 2013; Malone et al., 2012), as shown in Table 2. In addition, researchers at the Peace Research Institute of Oslo (e.g., Buhaug et al., 2010) have analyzed climate and weather factors and the theoretical basis for associating climate change impacts with increased conflict, but have discovered few statistical correlations. These are also included in Table 2.

A principal difficulty is identifying representative proxy variables for concepts such as food security, water security, social stability, and good governance. The systems of indicators in Prescott-Allen (2001) and Astorino-Courtois and Bragg (2013) are theoretically complete and representative but lack proxy variables for important factors.

There are additional challenges specific to use of indicators for vulnerability analysis in urban areas. One issue relates to interdependent spatial scales. The physical space occupied by buildings, transportation, and other infrastructure that service a city's population is relatively small when compared to its much larger footprint in terms of food, water, and other climate-sensitive natural resources. In assessing the vulnerability of urban areas, it is challenging to determine how wide a net to cast in terms of analysis of interdependencies with resources or systems that may be geographically distant but that provide crucial resources which, if interrupted, would create serious impacts for the population.

A second challenge is tailoring the proxy variables to the particular attributes of an urban area that are most important to consider in assessing its vulnerability. Table 2 provides examples of potential attributes or systems and measurable "proxy" variables that serve to represent these attributes in ways that permit us to examine their interactions with changes in climate and socioeconomic/environmental conditions. A key challenge is to develop a defensible basis for selecting a manageable yet comprehensive set from among the options. For example, we have proposed a community-oriented assessment process that establishes a stakeholder-driven process to identify proxy variables that are meaningful to the users in evaluating the vulnerability and resilience of their city. What is the basis for external analysts to select proxy variables that will serve as good indicators for the potential for a particular area to be harmed, and for instability to result, from a particular climate event? There are some obvious choices related, for example, to the availability of reasonable quality housing, the presence of basic service deficits, or the existence of disaster management plans. But there are other factors related to social systems, culture, norms, and governance that will be key in understanding whether existing capacity for adaptation will be adequate to cope with the impacts of a particular climate event, or whether existing social stresses and conflict will be exacerbated.

Most indicators approaches present snapshots of the present; the VRIM is an exception, using modified scenarios based on those used in a well-known integrated assessment model, the Global Change Assessment Model (Brenkert et al., 2003; Pitcher, 1999). These scenarios provide a global context in which countries are developing economically, demographically, and technologically, at different rates over time. Figure 3 displays example results from the VRIM (Malone & Brenkert, 2009) that show pathways of ten countries from the baseline 2005 resilience status to 2065 under two scenarios, high/fast economic growth and delayed economic growth.

SECTORAL INDICATORS	PROXY VARIABLES	PROXY FOR
Food security	Cereals production/ crop land area	Degree of modernization in the agriculture sector; access of farmers to inputs to buffer against climate variability and change
	Protein consumption/ capita	Access of a population to agricultural markets and other mechanisms (e.g., consumption shift) for compensating for shortfalls in production
Water resource sensitivity	Renewable supply and inflow of water	Supply of water from internal renewable resources and inflow from rivers divided by withdrawals to meet current or projected needs
Settlement/ infrastructure sensitivity	Population at flood risk from sea level rise	Potential extent of disruptions from sea level rise
	Population without access to clean water	Access of population to basic services to buffer against climate variability and change
	Population without access to sanitation	
Human health sensitivity	Completed fertility	Composite of conditions that affect human health including nutrition, exposure to disease risks, and access to health services
	Life expectancy	
Ecosystem sensitivity	% Land managed	Degree of human intrusion into the natural landscape and land fragmentation
	Fertilizer use/ cropland area	Nitrogen/phosphorus loading of ecosystems and stresses from pollution
Human and civic resources	Dependency ratio	Social and economic resources available for adaptation after meeting other present needs
	Literacy	Human capital and adaptability of labor force
Economic capacity	GDP(market)/ capita	Distribution of access to markets, technology, and other resources useful for adaptation
	An income equity measure	Realization of the potential contribution of all people
Environmental capacity	% Land unmanaged	Landscape fragmentation and ease of ecosystem migration
	SO_2/area	Air quality and other stresses on ecosystems
	Population density	Population pressure and stresses on ecosystems

Table 1, variables used in VRIM for country and state studies

PROXY VARIABLE	REPRESENTS	SOURCES	COMMENTS/NOTES
Literacy and political status of women	Good governance, relative equality of voice and participation	Malone et al. 2012	Resilience ↑ as status of women ↑
Governance: level of corruption, effectiveness, policy priorities	Good governance	Astorino-Courtois and Bragg 2013; Malone et al. 2012	Resilience ↑ as corruption ↓, effectiveness ↑, and climate change priorities ↑
Network density, other variables	Social accord and quality of life	Astorino-Courtois and Bragg 2013	Resilience ↑ as network density ↑
Incidence of armed conflict	Stability	Buhaug et al.2010	Resilience ↑ as conflict ↓
Migration	Social stability	Buhaug et al.2010	Resilience ↓ as migration ↑
Climate-related disaster	Uncertainty/ instability	Buhaug et al.2010	Resilience ↓ as disasters ↑
Rising sea level	Potential disruption in infrastructure	Buhaug et al.2010	Resilience ↓ as sea level ↑
Resource scarcity	Potential threat to well-being	Buhaug et al.2010	Resilience ↓ as scarcity ↑
1. Income/Wealth 2. Jobs & Earnings 3. Housing Conditions 4. Health Status 5. Work/ Life Balance 6. Education & Skills 7. Social Connections 8. Civic Engagement and Governance 9. Environmental Quality 10. Personal Security 11. Subjective Well Being	Urban well-being	OECD	Resilience ↑ as well-being ↑

Road density and commuting practices	Availability of transportation	Authors' compilation	Resilience ↓ as available transport ↓
Age of housing units	Adequate shelter, living conditions	Authors' compilation	Resilience ↓ as age of housing units ↑
Urban-ecosystem classifications	Pressure to modify the natural environment	Authors' compilation	Resilience ↓ as urban land ↑
Value of floodplain property improvements	Vulnerability of infrastructure to flooding	Authors' compilation	Resilience ↓ as improvements ↑
Energy use	Pressure on energy resources	Authors' compilation	Resilience ↓ as energy use ↑
Electricity consumption	Pressure on natural resources	Authors' compilation	Resilience ↓ as consumption ↑
Low birth weights	Adequate nutrition	Authors' compilation	Resilience ↓ as birth weights ↓
Doctors, nurses, hospital beds per 1000	Availability of health care	Authors' compilation	Resilience ↓ as availability of health care ↓
Asthma hospitalizations for children	Threats to health	Authors' compilation	Resilience ↓ as occurrence ↑
Wastewater returns and treatment capacity	Capability to provide adequate amounts of clean water	Authors' compilation	Resilience ↓ as returns/capacity ↑
Quality – phosphorus and nitrogen loadings	Availability of clean water	Authors' compilation	Resilience ↓ as quality ↓
Capacity to handle stormwater	Ability to cope with intense storms, flooding	Authors' compilation	Resilience ↓ as capacity ↓
Per capita income and gender inequality	Access to markets, technology and other resources	Authors' compilation	Resilience ↑ as wages or income ↑ and as inequality ↓
Total employment & average weekly wage	Prosperity	Authors' compilation	Resilience ↑ as employment/wages ↑
Climate-sensitive industries (% of sector)	Capability to offset climate-related losses	Authors' compilation	Resilience ↑ as % ↓
Poverty – families in poverty (%)	Realization of the potential contribution of all people	Authors' compilation	Resilience ↑ as poverty ↓
Food insecurity and food stamps	Ability to obtain an adequate diet	Authors' compilation	Resilience ↑ as % population ↓
Percent of employed population that are government employees	Ability of government to support economic well-being	Authors' compilation	Resilience ↑ as % ↑ *
Education – % with high school, college degrees	Human capital and adaptability of labor	Authors' compilation	Resilience ↑ as education ↑
Crime rate	Ability to society to act collectively	Authors' compilation	Resilience ↑ as crime rate ↓
Availability of parkland	Availability of recreational opportunity	Authors' compilation	Resilience ↑ as availability ↑
% of population in incorporated towns	Increased governance at multiple levels (local control)	Authors' compilation	Coping-adaptive capacity ↑ as % ↑
Climate-related hazards	Ability of government to respond to a natural disaster	Authors' compilation	Coping-adaptive capacity ↑ as hazards ↓

Table 2, Examples of Potential Variables To Be Modeled in Vulnerability and Resilience Assessments

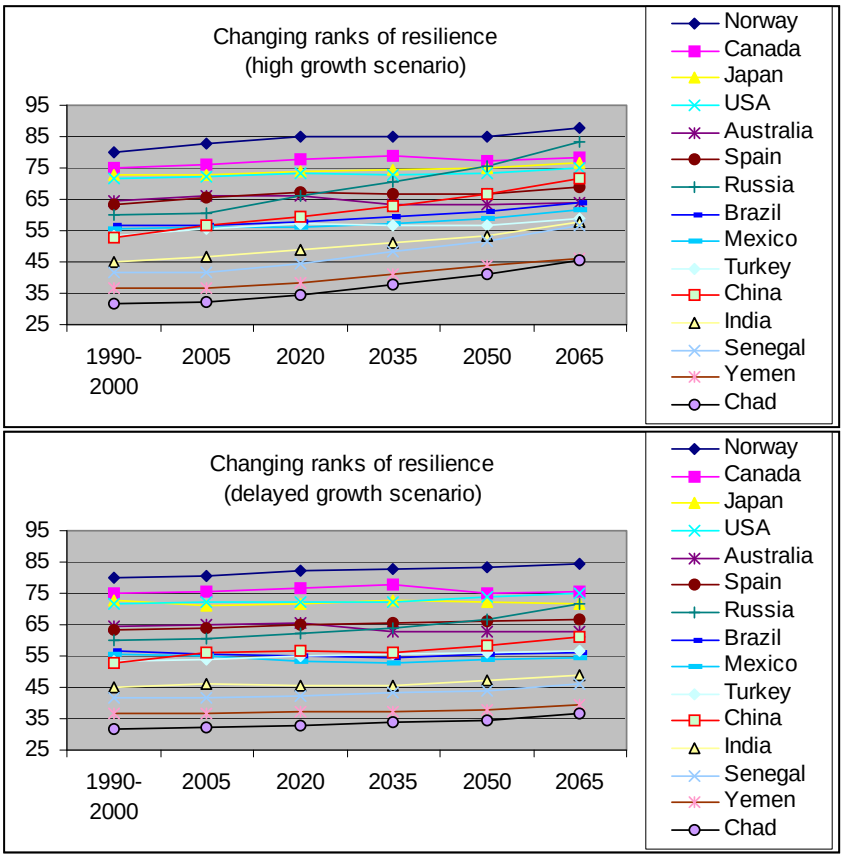

Figure 3, Projections of resilience for 10 countries from a 160 country study (Malone and Brenkert 2009)

The current mainstream scenarios process specifies emissions pathways of the future without specifying social and environmental conditions that result in the pathways. These scenarios are now being developed by the research community that focuses on impacts, adaptation, and vulnerability (Moss et al., 2010).

An indicators approach, with the advantages of transparency and flexibility, can be a useful complement to the national security tools such as the Failed States Index, to consider the range of stresses that interact and can produce insecurity. No one factor is likely to result in conflict and state insecurity, and several studies have shown links among climate-related factors such as drought and conflict (Reuveny 2007), including studies of Rwanda, Pakistan, and Syria. It is important to be able to assess current situations as well as project various what-if scenarios both quickly and comprehensively; indicators models, with appropriate sets of proxy variables, can assist analysis in real time and provide pointers to factors that need more in-depth assessment.

Although remote sensing and other satellite data have not been used in indicators models, the potential is great for tracking changing land use (rural to urban spaces, drought impacts, etc.) and automating updates of indicator models. Combined with data on demographic variables in GIS systems (see Shensul et al. 2013, Martine and Ojima 2013, and Graisbord 2013 for examples of urban

areas in Malawi, Brazil, and Mexico City, respectively), data can be easily updated and analyzed. The same models may also be used to map and analyze what Preston et al. (2013) have called "adaptation frontiers," i.e., forward indicators that a country, region, or city may soon not be able to cope with climate change impacts and is thus headed for likely instability.

Conclusion

The use of indicators to assess vulnerability allows analysts to evaluate factors of different kinds (social and environmental), to perform rapid and transparent scenario analyses, and to explore a range of issues (security, development, climate change, etc.) and their interactions. Indicator models can be rapidly modified, and their results can complement those of more detailed, specialized models. There is good potential to use remotely sensed data that will broaden both the temporal and spatial scope of geographical studies.

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Chapter Four, Relating Urban-Rural Dynamics to Regional Water Security

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Abstract

Water security is critical to sovereign state stability. It is needed to stabilize population movement, to support agriculture, to generate energy, and to sustain public health. It underpins the essential services that a country's citizens expect their established government to provide. Yet countries around the world face profound water security challenges tied to food, energy, climate variability, and population dynamics, which can exacerbate ethnic and political tension, negatively affect economic and social wellbeing, and increase the likelihood of a sovereign state's instability. Though these challenges present themselves in discrete locations, they must be understood at the regional scale and in the context of the watershed. The Reconnaissance, Surveillance, and Intelligence (RSI) Paradigm requires a long-term research perspective for learning about populations and associated challenges so that Commands with complex operational imperatives requiring multi-agency, multi-disciplinary solutions can understand, analyze, and engage populations properly. To do so effectively will entail understanding and incorporating regional water security implications and urban-rural population dynamics that extend beyond the city limits and beyond the purview of governance and rule of law. As currently conceptualized, the military PMESII/ASCOPE models for gaining situational awareness fail to capture the dynamic human-environment interaction necessary in the RSI paradigm.

Keywords

water security, water/food/energy/climate nexus, PMESII/ASCOPE

Introduction

Water is a basic human need, and water security is a fundamental key to sovereign state stability. Water security is directly or indirectly present in all aspects of strategic and operational planning—political, military/security, economic, infrastructure, physical-environment, and time—but with the exception of its place in infrastructure, its importance is understated, dismissed, or overlooked.

Water insecurity can destabilize a population, and the likelihood of this increases when climate variability, geopolitical tension, and economic disparities at the subnational, national, regional, and local levels are part of the equation. Hence, water resource management requires understanding water demands and considerations: competition for water use (agricultural, industrial, and household); competing water needs (rural, low density vs. urban, high density populations); over-exploitation of commonly held surface water supplies; control of groundwater resources (private vs. public; vulnerability to unregulated withdrawal); transboundary watershed management (upstream vs. downstream expectations and agreements); inequitable (gender, ethnic, socio-economic) water access; and impact (social, ecological, and economic) of large-scale water projects (Vivekanandan and Nair 2009). While systemic, effective water resource management at the water-

shed scale can mitigate water insecurity (Palmer-Moloney and Duckenfield 2013), it requires awareness of water's complex nature[1] and an integrated approach that:

- reduces competition over scarce water resources through more efficient irrigation systems, drought resistant crops, and public awareness campaigns
- increases supply of water through water harvesting and infrastructure initiatives
- improves water governance by addressing inequitable access to water for marginalized groups, reducing corruption in the sector, supporting the community management of water, and building capacity for dispute resolution
- understands and prepares for the impact of climate and human-driven change that will impact water security
- improves trans-boundary water management

(UNAMA 2013)

Proactive, adaptive watershed-scale resource management, supported by military stability operation initiatives, could increase opportunities for socio-economic development leading to the reduction of vulnerability and maintained or increased stability across the combatant commands. However, this requires integration of the complex interrelationships between people (socio-cultural and economic dimensions) and the physical places that they occupy, which are missing from the military decision-makers' toolkit (Palmer-Moloney 2012).

Defining water security

Security is a term most often tied to protection and freedom from danger. When broadened to include water, *water security* means the guarantee of having an adequate supply of water and having it accessible so that everyone who needs clean water can obtain enough of it when – and where – they need it (Palmer-Moloney and Duckenfield 2013). Water security is driven by both environmental and human factors and related to numerous water demands. In regions of the world where water stress is the norm, everyone struggles to live in the face of profound, long-term water insecurity, and many strategies, both cooperative and competitive, are pursued to address the conditions that water insecurity presents. People can make a living, and live amicably with their neighbors, in the absence of an acute water crisis. Likewise, when the perception that others are threatening water security arises, conflict follows.

Water is critical to sovereign state stability. It is needed to stabilize population movement, to support agriculture and ensure food security, to generate power, and to sustain public health. And it often underpins the essential services that a country's citizens expect to have provided by the established government (Palmer-Moloney 2011). This links water to U.S. national security interests because countries around the world face profound water resource challenges, such as those caused by flooding or drought, which can exacerbate ethnic and political tension, negatively effect econom-

[1] Four provisions of water must be integrated to understand the complexities of water for a given area of interest: water quantity, water quality, water availability, and water accessibility. These characteristics are interrelated; changes in any one often affect the others. All must be taken into account to understand water's role in regional human-environment interaction (Palmer-Moloney 2010, Veeravalli 2012).

ic and social wellbeing, and increase the likelihood of a sovereign state's instability (Krakowka 2011, Parthemore and Rogers 2010).

According to the Quadrennial Defense Review (QDR), "America's national security and defense strategies depend on strong foreign ties, including a vibrant network of defense alliances and partnerships adapted to this challenging era" (U.S. DOD 2010). Climate change and water extremes (flooding and drought) affect the security and the stability of U.S. Partner States when they cause these countries to incur the cost of insurmountable human needs. It follows that proactive engagement with Partner States is needed to build their capability to respond to environmental stress and associated water insecurity.

Water/Food/Energy/Climate Nexus

Water security is the keystone of the water/energy/food/climate nexus, and to grasp the complexity of water security issues, the issues must be put into the nexus context. Food production requires water and energy; water extraction and distribution require energy; and energy production requires water (World Economic Forum 2011, 2013a, 2013b). Agriculture is the single largest consumer of water worldwide, and rapidly growing urban populations require safe, clean drinking water and adequate sanitation, as well as more food. Expected impacts of climate change on water resources increase the urgency of finding new ways to balance urban and rural needs in a sustainable way that also ensures the continued health of freshwater ecosystems (NEXUS 2013).

Rapid growth anticipated over the next twenty years will intensify global demands for water, food, and energy. Demand drivers include population growth (from 6.83 billion to 8 billion, largely in the developing world), economic growth (particularly emerging markets with estimated 6 percent growth, compared to 2.7 percent of higher-income countries), and urbanization (especially in megacities located in developing countries), while climate change, and the potential for poorly constructed policy responses to it, will add pressure to these challenges (World Economic Forum 2013b).

As noted by Boano, et al. (2008) there is increasing evidence that serious and relatively rapid alterations to ecosystems induced by climatic change and anthropogenic factors will have direct and indirect impacts on societies which, when other coping mechanisms are overcome, will have no other option but to migrate as a permanent or temporary coping strategy. While numerous multi-causal (social, economic, and political) factors are associated with environmentally forced migration, the migration of populations from the rural countryside to urban centers is directly tied to the water/food/energy nexus.

Water Security, Climate Stress, and Conflict

An understanding of the inextricable links between the systems of water, food, energy and climate is critical to make informed decisions regarding trade-offs between these systems, rather than suffer unintended consequences. While the tenants of water security have long held that floods drive conflict and droughts drive cooperation (Delli Priscolli and Wolf 2010) , in recent years, there has been a dramatic increase of reporting that relates armed political conflict to climate stress. Recent research on civil unrest in Africa shows that unrest escalates during extreme water stress events, both high and low (Hendrix and Salehyan 2012). In primarily agrarian societies, food price increase is a major driver of migration (Page et al. 2013). Migration of rural communities to urban areas can be a destabilizing factor in cities--micro to mega—particularly when an influx of people taxes already strained resources.

Migration potential is highest in conflicted countries with high percent agricultural-based GDPs. And migration potential is inversely proportional to cereal yield per hectare and low per capita hectares of cereal production—when cereal production declines in densely populated areas with agricultural livelihoods, rural populations move (Page et al. 2013). Cereal production decline is associated with a number of water-related problems, including poor water quality, water scarcity or inundation, shifts in seasonal rains, and moisture and temperature changes supporting crop disease. Thus, much of migration can be linked back to water security issues and land allocation policies, particularly as environmentally displaced people (EDP) are forced to relocate because of environmental change and resulting loss of livelihood.

When EDPs move into urban environments, the population increase in destination communities presents challenges to water security, food security, and energy security. Whether to build adaptive management strategies or to cope with unexpected growth demands, reconnaissance, surveillance, and intelligence analyses are needed, because generating, collating, and disseminating reliable data on EDPs is essential.

Urban-Rural Dynamics Case Study – Helmand River Basin, Afghanistan

The stability and economic development of Afghanistan hinge on improved management of its water resources, given the dominance of agriculture in the Afghan economy, the relatively low fraction of arable land available, the poor condition of the country's water infrastructure, and the inadequate coordination and planning of water-related civil projects (Wegerich 2009). Although Afghanistan's **five major drainage** basins extend beyond its borders (Favre and Kamal 2004) and are a source of tension with its neighbors, the country lacks transboundary water agreements[1] that would improve not only the outlook for Afghanistan's long-term water security but also regional stability (Dehgan and Palmer-Moloney 2010, King and Sturtewagen 2010).

The most recent climate projections from the Intergovernmental Panel on Climate Change (IPCC), coupled with downscaled modeling of the IPCC global predictions for region that includes the Helmand watershed, suggest that water stress will continue to increase in southeast Iran and southwest Afghanistan (Alcamo et al. 2007). As regional precipitation decreases and temperatures and rate of evaporation increase, the population in the **Helmand watershed** seeks to meet its water needs from a river system that is producing less.

Globally, people compensate for rainfall deficits by placing demands on surface water and groundwater supplies for domestic consumption, business, and food production. In arid regions where surface water is not guaranteed, groundwater resources are critical, and they are at risk. As seen in examples from arid regions where groundwater recharge is minimal, i.e. Iraq (Lightfoot 2009) and Pakistan (Mustafa 2007), as new groundwater wells are drilled and water is pumped from deep aquifers, the water table falls rapidly and does not recover, at best disrupting water availability and at worst causing entire villages to be abandoned (Lightfoot 2009, Warner et al. 2009).

[1] The only trans-boundary agreement in place is the disputed Helmand River Treaty with Iran. The Helmand River accord, signed in 1973, determined the specific amount of water that should flow into Iran: 22 cubic meters per second—with an option for Iran to purchase an additional 4 cubic meters per second in "normal" water years. However, this agreement was never fully implemented due to the Afghan coup d'état, the soviet invasion of Afghanistan, the Islamic revolution in Iran, and the tensions between the Wabhhabist Taliban and the Shia Tehran governments. Although Iran and Afghanistan have held discussions with the Karzai government under the framework of the 1973 agreement, they have been inconclusive to date.

Decreased water flow in the region not only affects the water table, but also increases desertification. Sand and dust storms that scoured southwestern Afghanistan in early June-Sept 2003--called the worst in living memory by residents of the area--buried villages, filled waterways, destroyed crops, and killed livestock. Wind-generated sandstorms persisted longer than expected in the recent years of drought, creating a huge environmental problem for the residents of this region. Most of the windblown dust originated in the Sistan Basin wetlands in the beds of the dried out hamuns (lakes) (Weir 2002, NASA 2003). Persistent drought conditions, coupled with increased water capture and diversion from upstream on the Helmand River, have quickly turned these wetlands into arid salt pans (NASA 2003, IRIN 2007, United Nations Environmental Programme 2003, 2006).

From 2003-2013, civilian and military efforts to stabilize Afghanistan generally failed to balance near-term gains in agricultural production with (a) the potential of increased transboundary conflicts over water and (b) the potential to exhaust Afghanistan's water resources. The situation called for resource policy/water resource management capacity and effectiveness, with special focus on increasing efficiency of water quantity and quality monitoring and assessment that were beyond the scope of the International Security Assistance Force (ISAF) mission[1]. Nevertheless, development projects to improve economic livelihood—typically through agriculture—continued, requiring increased water use and investment and improvement in water infrastructure. There was neither coordinated, cross-ministry nor ongoing watershed-scale water-quality data collection, dissemination, and analysis (Palmer-Moloney, Dehgan, and Chirico 2009; Palmer-Moloney 2012; Palmer-Moloney personal observations (field observations[2]) 2011-2012).

From 2009-2012, stability operations in Regional Command Southwest were concerned with putting in wells, refurbishing canals, and expanding agricultural opportunities in Helmand Province. Water assistance projects, particularly wells, were in high demand across Afghanistan, and civilian and military stability operations strove to comply with the wishes of the local nationals (Palmer-Moloney 2010, 2011a, 2011b). However, only sparse, uncoordinated data existed both on groundwater withdrawal/recharge and on water quality. In unconfined and confined aquifers, the water level was dropping as a result of drought and groundwater overdraft. Augmenting reduced surface-water flow by putting in wells that tapped the unconfined water-table aquifer and withdrawing from the deeper, confined fossil groundwater sources was not a sustainable alternative because the withdrawal rate was greater than the rate of groundwater recharge. Data on water quality were more difficult to find than data on surface-water and groundwater supply. Little information was found in the literature or government documents; most reporting was anecdotal (Palmer-Moloney 2011). Findings from well water tests in 2012 revealed that numerous wells dug by Coalition Forces yielded non-potable water (Palmer-Moloney (fieldwork) 2012).

The **Helmand River**[3] Basin flows from Afghanistan's Central Highlands south, then west and north where it diverges into landlocked deltas at the mouths of several other Afghan river systems at the Iran-Afghanistan border. The political boundary in this border region known the Sistan Basin was drawn to divide the delta in half, thus sharing the water resources. However, the water is rarely allocated according to the terms of the relevant governing treaty (Palmer-Moloney and Duckenfield

[1] Water resource policy and management capacity building with the Government of the Islamic Republic of Afghanistan (GIRoA) was and continues to be part of the U.S. Agency for International Development (USAID) role in Afghanistan. It is important to note that USAID's metrics for success in Afghanistan revolve around the number of jobs created and amount of money obligated rather than the outcome and sustainability of water-relevant development projects (Palmer-Moloney personal observations (fieldwork) 2011-2012).

[2] Palmer-Moloney deployed to Afghanistan from July 2011-May 2012 and, as an AFPAK Hand, served as Senior Advisor on Water to the Commanding General, Regional Command Southwest.

[3] http://www.lib.utexas.edu/maps/middle_east_and_asia/afghanistan_physio-2009.jpg

2013). Zaranj, Afghanistan, provincial capital of southwestern Nimruz Province, is north and downstream of where the Helmand River divergence into Iran begins. Water resources in the most downstream portion of the Helmand River supporting Zaranj have dwindled due to withholdings at the Kajaki dam and various irrigation canals. (Figure 4) The urban population in Zaranj has grown in the past 10 years due an influx of EDPs migrating from rural Mimruz because of loss of livelihood (death of livestock, inability to grow crops) and loss of water for human consumption. Subsequent investment in the city has led to increased infrastructure. However, the city has limited water supply and cannot develop at its current pace due to water limits. The city has no water treatment facility, and water that is available from the limited supply is non-potable. In circular fashion, Zaranj's citizens currently buy their treated drinking water from Iran, while the water feeding Iran's reservoirs, which support Zaranj's citizens, originates within Afghanistan (Palmer-Moloney 2012, Palmer-Moloney personal observations (fieldwork) 2011-2012), Palmer-Moloney and Duckenfield forthcoming).

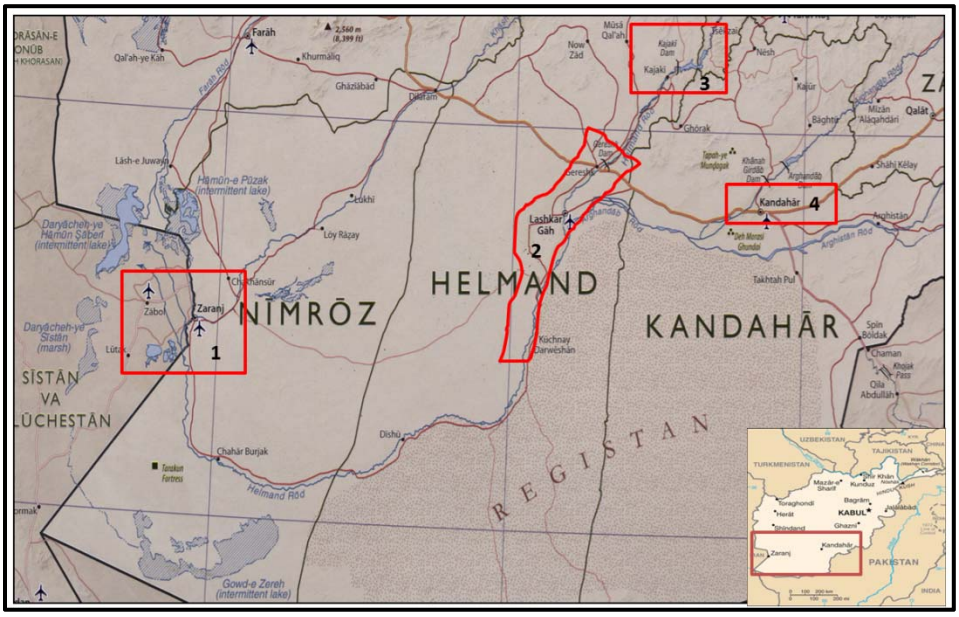

Figure 4, Key water-food-energy demands in Afghanistan's Helmand River watershed: (1) Zaranj, Nimruz Province and Sistan Basin (at Afghan-Iranian border); (2) Central Helmand Agricultural Zone, Helmand Province; (3) Kajaki Reservoir & Hydropower Plant, Helmand Province; and (4) Kandahar City.

During the past decade, Iran and India have funded infrastructure projects in the Sistan Basin that have expanded their trade opportunities with Afghanistan and Central Asia. The Iranian port of Chabahar is now linked to the Sistan Basin via Indian-financed paved roads[1] extending from the port city to Zabol, Sistan va Baluchestan Province, crossing the Helmand[2] River at Zaranj, and then continuing to Delaram, Afghanistan. This road network has effectively opened Iran and South Asia to trade with Afghanistan and Central Asia (Malhotra 2013, Palmer-Moloney (fieldwork) 2012, Jaffrelot 2011). Chabahar has long-standing geostrategic significance. As early as 1613, British and Portuguese jockeyed there for maritime superiority of the Arabian Sea (Jaffrelot 2011). As the international forces prepare to withdraw from Afghanistan, the port could become a lynchpin of Iran's Afghanistan-Central Asia strategy (Padukone 2012).

[1] http://www.lib.utexas.edu/maps/middle_east_and_asia/iran_country_profile_2009.jpg

[2] http://www.lib.utexas.edu/maps/middle_east_and_asia/afghanistan_trans-2009.jpg

Improved infrastructure and expanded regional trade opportunities are leading to increased economic opportunities, population growth, and new needs for water across the watershed. Projected population growth, increased agricultural expansion, and climate change conditions are likely to exacerbate existing tension with Iran over dams and other water control features on the Helmand River. Population in the middle Helmand watershed has increased as security improves and people, who had fled the fighting, return. This phenomenon has been linked to counterinsurgency stability operation success, particularly in the central Helmand agricultural zone (Palmer-Moloney 2010, 2011, 2012).

During times of water scarcity, the Sistan Basin, culturally linked and historically water insecure has been the site of tensions ranging from diplomatic exchanges to violent skirmishes for at least the last century and a half (Pajhwok Afghan News 2011, Pashtun Forums 2011). The perennial scarcity of water in the region is now aggravated by extensive and increasing consumption upstream and increasing demand downstream (Palmer-Moloney 2012, Palmer-Moloney and Duckenfield 2013 and forthcoming). Water of the Helmand River is used for hydropower generation, irrigation, and human consumption in Kandahar and Helmand provinces before it ever reaches the Sistan, where water is needed to support economic development and population growth along a new trade corridor. Though surface water availability can be detected by analyzing land use/land cover change (Figure 5), imagery analysis has not been regularly used for the ground-based, transboundary water decision-making. [In figure five dark blue=persistent water; red= areas that went from having water to having no water lighter blue=increase in water; darker green=persistent vegetation; lighter green=increase in vegetation; orange=decrease in vegetation (associated with harvest) (Griffin 2013).] As international forces prepare to transition security and stability operations to the Afghan government, recent developments suggest that *Helmand River water sharing is the most likely driver of a significant water dispute between Afghanistan and any of its neighbors, potentially destabilizing the region* (Palmer-Moloney and Duckenfield forthcoming, Vick 2013).

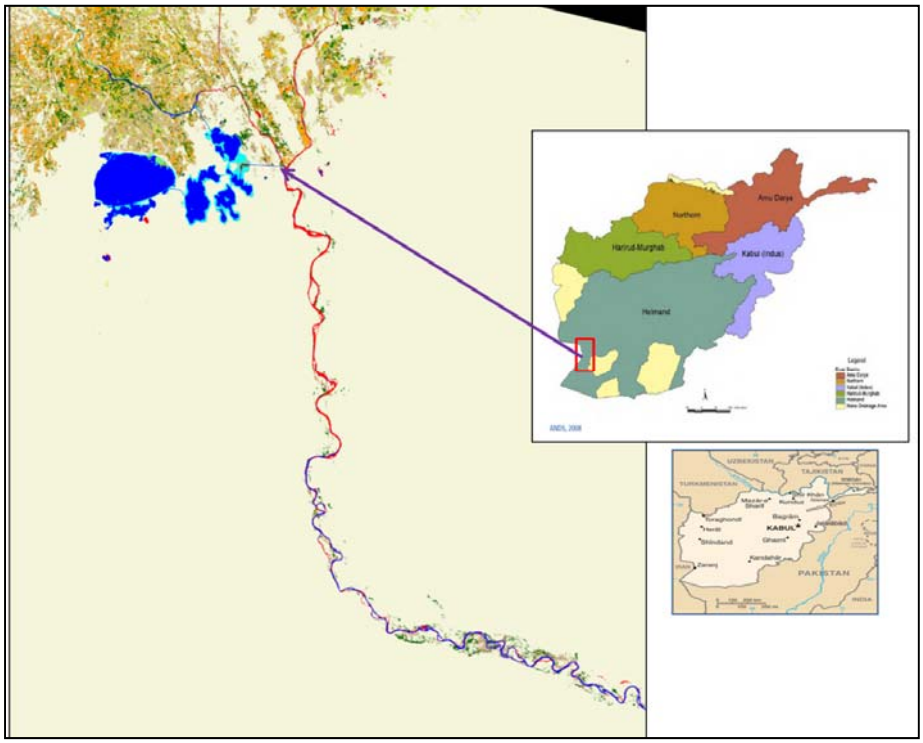

Figure 5, Land Use/Land Cover Change, Lower Helmand Watershed, April – August 2013

Discussion

Relevance to Migration

In the Helmand River basin, a rural migration trend was observed when Helmand River flow dwindled and large dust storms drove many EDPs in the region to seek refuge in Zaranj where the population has dramatically increased over the past 10 years. The very climate forcings that drove these populations to the regional capital are the very same trends that reduce the city's capacity to support the increased population.

At the watershed scale, in most of the world, the largest use of surface water is irrigation. Half of the water used in irrigation is lost due to inefficient infrastructure. The remaining portion of water that is not consumed by agriculture is largely consumed by industrial purposes, such as cooling of hydropower plants, extractive activities (i.e., mining), construction needs, and even pumping and treatment of water. The smallest fraction remains for drinking water.

Urban livelihoods are frequently reliant on the industrial purposes of water while rural livelihoods require irrigation water. Thus, without proper planning and in light of increased consumption patterns and population, food and energy become increasingly competitive sectors reliant on an entire water system. Closer attention must be paid to these potential positive feedback systems when analyzing potential security threats.

Thus climate shocks and variability intensify water need competition due to decreased water resources or natural disaster devastation, and trigger further EDP migration, also causing more strain on urban industrial resource capacity and greater competition. Effective systemic water resource management at the watershed scale can mitigate water insecurity and be the foundation for improving rural livelihoods to prevent fast-pace urban population growth and reduce food and energy competition within the water system.

Relevance to COCOMs

From the National Environmental Protection Act (NEPA) mandates of the 1970s to the Strategic Environmental Research and Development Program (SERDP) and Defense Coastal and Estuarine Research Program (DCERP) goals of 2012, the Department of Defense's interest in the environment has been focused on *environmental management* tied to *U.S. military assets* (SERDP n.d.). However, the significance of strategic nature of the natural environment, the impacts of climate change on people as well as the environment, and the relevance of how water security impacts regional stability in areas of operation have been missed.

During Operation Iraqi Freedom and Operation Enduring Freedom, counterinsurgency doctrine addressed both the need for physical security and essential services, but neglected to address water's role in regional security:

> During any period of instability**, people's primary interest is physical security for themselves and their families**. When Host Nation forces fail to provide security or threaten the security of civilians, the population is likely to seek security guarantees from insurgents, militias, or other armed groups. This situation can feed support for an insurgency. However, when Host Nation forces provide physical security, people are more likely to support the government. (U.S. Army 2006, 3-67.)

> Essential services provide those things needed to sustain life. Examples of these essential needs are food, water, clothing, shelter, and medical treatment. Stabilizing a population requires meeting these needs. **People pursue essential needs until they are met, at any cost and from any source. People support the source that meets their needs.** If it is an insurgent source, the population is likely to support the insurgency. If the HN government provides reliable essential services, the population is more likely to support it. Commanders therefore identify who provides essential services to each group within the population. (U.S. Army 2006, 3-69.)

And though stability operations doctrine, which is designed to incorporate coordinated civilian and military efforts, is suitable for water security's inclusion, the doctrine's governance, sector-driven approach misses water security's holistic role:

> By nature, stability operations are typically lengthy endeavors. All tasks must be performed with a focus toward maintaining the delicate balance between long-term success and short-term gains…To [this] end, military forces have to operate with other instruments of national power to forge unity of effort through a whole of government approach…that accounts for broader national policy goals and interests. (U.S. Army 2008, vii.)

The ASCOPE-PMESII-PT[1], model used for gaining situational awareness needed for stability operations does not consider regions as systems and fails to show how regional factors, such as water, food, energy, and climate variability relate to one another. ASCOPE stands for an aspect of the operational environment: Areas, Structures, Capabilities, Organizations, People, and Events. The six ASCOPE areas of civil considerations are used to inform the eight PMESII-PT operational variables: Political/governance, Military/security, Economic, Social, Infrastructure, Information, Physical Terrain, and Time. ASCOPE-PMESII-PT is population-focused rather than enemy-focused, and in contrast to a traditional area assessment, ASCOPE-PMESII-PT organizes and examines strategic and operational factors for their relevance to local stability (U.S. Army 2011). Designed to give leaders a comprehensive understanding of stability conditions and the factors influencing them, ASCOPE focuses on civil considerations while PMESII-PT identifies operational variables.

Despite the unifying role of water in all phases (0-V) of military operations, in ASCOPE/PMESII, water is addressed in "A" (area), "E" (economic), and "I" (infrastructure) as it includes the physical terrain, geography, trade, development, finance, institutional capabilities, regulation and infrastructure to support basic services (USA 2011). But a synthesis of how these systems can be evaluated to understand the operational environment to support water security is missing.

Recommendations

1. **Incorporate water security and urban-rural dynamics into socio-economic and cultural assessments.** The Reconnaissance, Surveillance, and Intelligence (RSI) Paradigm suggests that a long-term research perspective is necessary for learning about populations and their associated challenges so that Commands with complex operational imperatives requiring multi-agency, multidisciplinary solutions can understand, analyze, and engage populations properly. Regional water security (in terms of water quantity, quality, accessibility, and availability) and urban-rural population dynamics extend beyond the city limits and

[1] ASCOPE-PMESII replaced METT-TC (Mission, Enemy Terrain, Troops, Time, Civil Considerations) in counterinsurgency operations.

beyond the purview of local governance and rule of law, and are critically important to stability when considering the water/food/energy nexus.

2. **Integrate the water/food/energy/climate nexus into all phases of operation analysis and decision-making.** Commanders use a "system of systems" approach to the operational environment that addresses Military, Social, Political, Economic, Information, and Infrastructure systems, with "centers of gravity" at the strategic and operational scales that does not address regional water security or urban-rural population dynamics. Integration of the water/food/energy/climate nexus will add cross-cutting variables and conditions and will improve comprehensive understanding of the operational environment.

3. **Tie water security issues to Theater Critical "Environmental Security" operations.** Water security ties to Theater Critical "Environmental Security" Operations across the Combatant Commands because it relates directly to environmental issues in any area of operation. Adding this dimension will deepen the complexity of analytic products and provide a more comprehensive picture for decision-makers.

4. **Expand water beyond an "essential service."** If stability operation plans are to succeed, water security from a regional, watershed scale perspective must be included to overcome deficiencies in understanding of issues and in ability to make projections and implement response mechanisms. This expansion should be required for civilian as well as military stability operations programs.

5. **Feature water security in professional military education.** Develop a series of informational blocks of instruction—focused on awareness and procedures for understanding, planning, and conducting analysis of water security—for inclusion in key professional development education at various officer training institutions.

6. **Include regional water security and its associated urban-rural dynamics as part of the "whole of government" approach used in Contingency Program Management.** This will require inter-agency dialogue, collaborative data collection and sharing, and a new approach to analysis and decision-making.

Conclusions

Though water security challenges present themselves in discrete locations, they must be understood at the regional scale and in the context of the watershed. The Reconnaissance, Surveillance, and Intelligence (RSI) Paradigm requires a long-term research perspective for learning about populations and associated challenges so that Commands with complex operational imperatives requiring multi-agency, multidisciplinary solutions can understand, analyze, and engage populations properly. To do so effectively will entail understanding and incorporating regional water security implications and urban-rural population dynamics that extend beyond the city limits and beyond the purview of governance and rule of law.

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Chapter Five, Through the Eyes of the Population: Establishing the SCA Baseline for RSI

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Abstract

Reconnaissance, Surveillance, and Intelligence (RSI) is a collection technique designed to enable analysts to detect emerging social and political tensions before they reach crisis and drastically increase the costs of investigation. For RSI to be effective, analysts require socio-cultural baselines to determine culturally relevant Indications & Warning (I&W). This chapter explains why "big data" and technology solutions predominate tradecraft, but fail to deliver contextually rich population analysis. It then introduces a methodology for effectively operationalizing SCA, called the "Five Foundations of SCA." The chapter concludes with a case study on Syria that illustrates how RSI with a rich SCA baseline using the "Five Foundations" methodology could have greatly enhanced the analysis of and policy responses to achieve US policy objectives in Syria.

Keywords

Ontology, socio-cultural analysis, Human Terrain, RSI, SCA

Introduction

Reconnaissance, Surveillance, and Intelligence (RSI) is an information collection concept designed to operationalize Socio-cultural analysis (SCA) which in turn:

- Creates accurate baseline assessments of populations and cultures;
- Provides progressive population-centric early Indications and Warning (I&W);
- Avoids the high costs of conflict by mitigating it "left of bang";
- Enables the US Government to deliberately, systematically understand and leverage decades of academic and business expertise; and
- Rebalances the time and expertise equation currently vexing the Intelligence Community.1

The Intelligence Community (IC) and Department of Defense (DoD) are investigating the emerging RSI concept and realize the need to operationalize SCA at the strategic, operational, and tactical levels. In the US military, it is almost axiomatic that leveraging technology is the key to victory. Therefore, tremendous investment has been directed toward technological solutions for operationalizing SCA, including "big data" and social media monitoring efforts. Unfortunately, these capabilities lack

[1] Flynn, LTG Michael, James Sisco, and Dr. David C. Ellis. "Left of Bang: The Value of Sociocultural Analysis in Today's Environment." *PRISM*. Vol. 3, #4 (2012), pp.19-20; Puls, Matthew and Dr. David C. Ellis. "Socio-Cultural ISR for COIN and Stability Operations." *Presented at DISCCC Exemplars of SCA Tradecraft Conference August 2011* (July 2011), pp.7-10.

the rich, population-centric understanding required to develop baseline assessments, conduct qualitative and quantitative analysis, and produce strategic I&W. They are also typically employed after a crisis has occurred, and at best provide context for the reasons underlying it.

For RSI to succeed, the IC must develop a framework for developing baseline understandings of populations in order to see the world through their eyes and reveal the true drivers of instability. Recognizing the technology bias so prevalent in US military culture – and its limitations – is key to placing the effort on the right track. This article explains why a technical solution was applied and remains prevalent in the SCA field, but fails to identify the true drivers of instability or conflict. It then describes the framework for conducting baseline socio-cultural analysis. It next introduces a methodology for establishing accurate population-centric, baseline assessments and provides a case study on Syria that describes how RSI could have markedly enhanced the government's response to the ongoing conflict. It concludes with recommendations on how to incorporate the SCA research process into RSI activities to support future SMA projects and initiatives.

Response to an Urgent Operational Need

During Operation Enduring Freedom and Operation Iraqi Freedom, it became clear that the "human terrain" was as important to warfighters as the physical terrain. The solution was to create and employ Human Terrain Teams (HTTs) to gather population-centric information and enable intelligence analysts through technical means and "big data" to understand, make sense of, and produce operationally relevant assessments. It was thought that through this combination, deep, societal understanding and measurable and quantifiable analysis of complex societies would be revealed. While the IC and DoD experienced tremendous achievements in human terrain mapping and network analysis tradecraft, it did not develop an agreed upon SCA methodology or deliver operationally and strategically relevant SCA assessments. A number of factors contribute to this outcome:

- Technical, "big data" approaches fail to make foreign, complex societies comprehensible;
- Analysts typically rely on COIN doctrine, DIME actions, and PMESII effects as the basis of their assessments; and
- The IC and DoD do not have socio-cultural baselines against which it can assess information collected on subject populations.

Although technology is a tremendous enabler, it is an insufficient foundation for RSI. Most of the IC operates on the assumption that sophisticated queries and Internet searches can reveal what needs to be known about populations. The trick, according to this belief, is to make the right computer interface and link in the best data. This "big data" approach has utility, but not for making foreign, complex societies understandable. By 2012 it became clear that reliance on search engines and social media is insufficient for developing I&W because they are at best contemporary with – if not retrospective to – crisis events.

Similarly, human terrain analysis suffers in part because analysts are encouraged to build their products around Diplomatic, Information, Military, and Economic (DIME) actions and Political, Military, Economic, Social, Information, and Infrastructure (PMESII) effects. DIME and PMESII contribute best to national capabilities and order of battle research, not sub-national, identity based politics. PMESII and DIME, while having the benefit of doctrinal support, elevate the importance of states and national governments, which has the adverse effect of overlooking the subnational indicators that contribute to most modern conflicts.

Socio-cultural fault lines and drivers of instability are knowable and measureable, but assessments must focus on populations vice governments and require historical, sociological, and political analyses to explicate them. The fact is that big data, technology solutions cannot reveal these baseline socio-cultural factors. Social media, news reports, and other indicators can provide I&W once these factors are known and tensions already understood. They cannot, however, reveal these critical SCA fundamentals on their own. Indeed, having all the data in the world is as paralyzing and irrelevant to decision makers as having insufficient data if it is unclear which bit is useful.

Applying SCA to RSI

RSI provides a solution to the challenges faced by the IC by identifying the socio-cultural dynamics that drive instability and conflict. RSI takes a long-term perspective and builds upon the data and knowledge resident with subject matter experts (SMEs) to generate deliberate, systematic understanding of populations. In RSI, information collection occurs pre-conflict where a wider range of information providers is available, freedom of movement is easier, and the costs associated with collection lower.

SCA is the foundation of the RSI effort because it enables analysts to see the world through the eyes of the population. It is an immutable fact that humans automatically apply their own worldview to the people they observe. In the absence of understanding the world as experienced by the local population, humans inevitably misinterpret behavior and its underlying social rationality. The combination of RSI and SCA allows analysts to see the world through the eyes of the population and identify what matters to populations, not what matters to states.

Today, SCA is both a research approach and an umbrella term for the variety of population-centric investigatory and depiction activities now undertaken in the IC/DoD. The more popularly recognized tradecraft activities are Human Terrain Analysis, human geography, polling, and media monitoring. It is possible to teach young, newly minted analysts the tradecraft skills of human terrain and human geography. It is altogether a different thing to expect them to quickly learn the skills, concepts, and research methods of graduate level anthropology, sociology, and political science. Viewing the world through the eyes of the subject population is simply impossible without first a systematic social science methodology.

The Methodology for Conducting Baseline SCA for RSI

Combining SCA and RSI requires analysts with the ability to distill academic material into digestible baseline assessments. It then requires analysts to engage academia and business to answer gaps and provide deeper contextual analysis on social trends. Clearly, the emphasis on qualitative expertise and systematic investigation seeks to prevent crises from surprising policymakers and avoid the subsequent dash for technology solutions to make sense of why events transpired as they did. By combining SCA and RSI the IC/DoD can identify the I&W that matter to each population – and only then for the states they inhabit.

For SCA to be effective, analysis must be able to create and produce a baseline or model of reality that enables commanders to understand the complex social dynamics that exist within populations, communities, groups, and individuals. By having this baseline or model of reality the IC can identify the drivers of instability and develop accurate population-centric advanced I&W. These indicators provide decision makers with the ability to develop activities that can shape and influence the population – the center of gravity in contemporary conflict - toward different outcomes. However, ef-

fective shaping activities are dependent upon understanding a population's ontology, identity layers, logics of appropriateness, narratives, and social structures.

Our suggested socio-cultural analysis methodology is predicated upon the "Five Foundations of SCA" and can be used as a framework for the IC/DoD in the M-RSI initiative. The methodology relies on five inter-related socio-psychological concepts that form a hierarchical relationship. The "Five Foundations" can be applied across populations and levels of abstraction to reveal ever greater detail about how a given population. The "Five Foundations of SCA" include,

- **Ontology:** Ontology asks, "What does one know to be *real*?" Ontology is the fundamental building block of both individual and social reality. While some confuse it with worldview, ontology relates to a deeper set of constructs and assumptions about the nature of existence, the fiber of social relationships, the basis of cause and effect, and the foundations of morality and appropriate behavior. The power of ontology lies with the fact that it is so intrinsic to a population that it is assumed, generally not discussed and is often incomprehensible to foreigners or outsiders without dedicated study. While ontology is enduring due to its fundamental role in forming culture, elements of it are mutable over time, especially as new social structures gain power and manipulate or modify it for their own ends.

- **Identity:** Identity asks, "Who am I and how do I relate to others given a particular ontology?" Individuals and groups within a given ontology hold multiple identities. Relevant identities include primary socializations – family, religion, ethnicity, social status, kinship, nationality, etc. – and secondary socializations – education, occupation, recreational associations, political associations, etc. Formal and informal group identities, particularly those supported by active social structures, perpetuate ontology and culture and seek to privilege certain identities over others to induce behavioral outcomes. However, individuals have the capacity and do choose among their identity palettes – whether consciously or unconsciously – depending on how they view themselves in a given situation. This methodology enables analysts to determine the identities that are animated for conflict, but also the identities that can be leveraged to facilitate inter-group negotiation and compromise.

- **Logics of Appropriateness:** The logic of appropriateness is the behavioral manifestation of norms, values, and ethics embedded in identity. It asks, "What is rational behavior given who I am in this situation?" Different identities or roles within a culture elicit different standards of right and wrong, morally appropriate action, and perspectives on events. The power of the logic of appropriateness rests with the fact that behaviors associated with identities are often prompted unconsciously and individuals do not recognize the "inevitability" or chain reaction of "rational" behavior sparked once an identity is adopted. Understanding a population's norms, values, and ethics – and how these relate to different identities and group ontology – is the key to determining how a population views action that affects it and appropriate cultural responses.

- **Narrative:** Narratives are the subtle, often "symbolic" understandings hidden within verbal discourse. A population's discourse is by nature public and is typically available for analysis since people must communicate with one another to make sense of events in order to achieve coherent social interaction. The hidden meanings contained within public speech are crucial for determining trends in a population's attitudes, needs, sense of security, and views of potential opportunity.

- **Social Structures:** While the above elements provide a baseline understanding of a population's culture, it is the networks of social structures that animate culture to achieve social outcomes. Governments, tribes, businesses, religious and educational institutions, ideological movements, markets, and civil society organizations are but a few broad categories of social structures that are manifestations of culture. However, they also constitute cultural and ontological innovators because they manipulate, interpret (or reinterpret), and modernize culture for their own purposes. In this way, social structures must make use of existing ontology, identities, logics of appropriateness, and social narratives to resonate with a population, and they must also act as agents to mobilize society to achieve their organizational objectives. This cycle slowly mutates a population's ontology, but their activities and impacts are knowable, measureable, and comprehensible.

By applying the "Five Foundations of SCA" methodology to the RSI design, analysts can develop accurate baseline assessments through the eyes of the population. It is through accurate baseline assessments that SCA, big data, and media monitoring can be operationalized. If the purpose of RSI is in part to prevent commanders from operating from "Western" realities or perspectives that share little consistency with others they are seeking to influence, then SCA is the key to the enterprise.

Operationalizing SCA for RSI

The Five Foundations of SCA provide a digestible methodology for distilling often difficult and obscure academic research into operationalized SCA. For example, contemporary politics are rooted in a population's ontology, prey or play upon individuals' identities, reveal rational behavior in response to adopted identities, establish frames of discourse to achieve mobilized attitudes, and rely on social structures to animate individuals to collective behavior. However, the hardest analytical undertaking is identifying the types of social structures that do not exist, whether due to oppression, conflict, or lack of capacity, but that could form with the right assistance. To the extent that RSI supports a Whole of Nation effort for keeping potential conflicts "left of bang," it is essential for imagining the social structures that could evolve and providing resources to positive social actors whose interests align with the government's. Understanding those elements allows analysts to operationalize the familiar or latent socio-cultural dynamics.

SCA for RSI also leads to two other important conclusions. First, RSI necessitates on-the-ground investigation. SCA research can reveal much about socio-cultural dynamics in the research phase, but it will always have gaps or stale information that needs to be updated. Second, operationalizing SCA for RSI demands geospatial depiction of social reality. Field research intrinsically avails itself of the opportunity to record geo-coordinates and research dates. This type of information is crucial for establishing baselines or updating prior research. With accurate assessments of population dynamics acting as a baseline, big data, technologically intensive research can be employed to monitor changes that could compel more traditional intelligence activity.

Operationalizing SCA through RSI: A Syria Case Study

Syria's civil war has been a difficult foreign policy issue for policymakers because of a lack of deep, pre-conflict socio-cultural analysis. Had an RSI effort preceded the conflict by even two years, the crisis may have been foreseen "left of bang" and much clearer policy alternatives would have been available.

On the surface, Syria's ethno-sectarian composition resembles that of Iraq – an unwelcome coincidence for IC/DoD analysts. Sunnis, Shi'ites (Alawites, Druze), Kurds, and some Christians comprise

the society, and a minority group rules the Baathist government. It is an unfortunate reality that most ethno-sectarian maps used by the US government have difficulty depicting social reality below these broad primary identity layers. As a result, many analysts assumed the ethno-sectarian conflicts they experienced in Iraq to be representative of Syrian society as well – a key ontological error. Socio-cultural analysis of the Syrian population reveals a rich variety of identity layers and, when combined with RSI, generates detailed maps contributing a wider variety of policy options.

For example, knowing that Syria's Sunni population is comprised of a majority that practices the religion from a Sufi tradition or with a civil/secular political disposition is key to recognizing the options for generating or reinforcing multi-sectarian and multi-ethnic organizations. Additionally, the pattern of Sunni military defections back to rural villages and towns would have been a baseline expectation had the historical pattern of military service, in which urban males were discouraged by their parents from joining, been widely disseminated. The effects of three years of drought on Syria's vast agricultural population (2006-2009), especially the male youth, should have been a key factor in assessments of the reform movement in 2011 given its composition. Instead, these elements were widely unaccounted for as the crisis unfolded and big data approaches could not have elucidated their contribution to the evolution of the conflict or its politics.

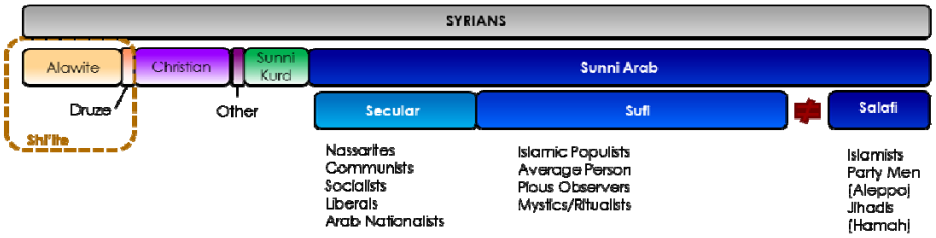

Figure 6, Syrian Primary and Secondary Identities

A baseline assessment of Syria's population reveals important secondary identities that offer a broader range of political responses to the crisis. Figure 6[1] illustrates that breaking the Sunni population out according to type of Islamic practice, political party, and interest reveals a potential coalition of minorities and secular Sunnis that equal approximately 50% of the population. Alawites, Druze, Christians, and Sunnis are all represented in the Arab Nationalist and socialist parties and

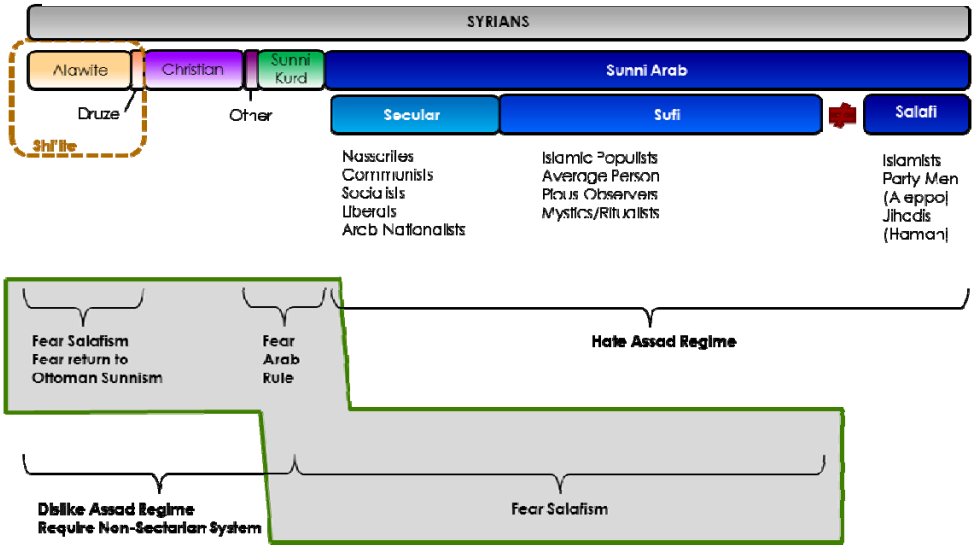

Figure 7, Potential Multi-Sectarian & Ethnic Syrian Alliance

[1] *Understanding the Syrian Opposition: Prospects for Conflict or Consensus*. USSOCOM JICSOC SCA Section. (January 2013), p. 11.

are counted among the liberals pressing for reforms for over three decades. Capturing any portion of the Sunni community that practices Islam within the Sufi tradition presents a political coalition that easily dwarfs concerns over Syrian Muslim Brotherhood Islamism and overwhelms jihadi Islamism, a phenomenon that only exists in Syria today due to the disproportionate flow of weapons and military support to Salafis.

Figure 7[1] similarly illustrates the political coalition that could be animated if the civil society networks were more fully known. While conducting analysis on these networks is still possible, the cost of identifying them and building the maps that depict their influence is now radically higher than it would have been had this undertaking begun prior to active conflict in 2011. In other words, a dedicated RSI effort on Syria starting in 2009 could have revealed much about the underlying socio-cultural dynamics, allowed the IC/DoD to engage academics and businesses based on specific questions, and provided greater insight into the narratives and requests for support coming from moderate Syrians at the beginning of the conflict.

RSI would also have allowed for better operationalized humanitarian assistance and diplomatic activity. In particular, it is possible even in the current context of the Syrian civil war to determine local needs, plot them on the map, and date stamp the data for time series analysis (Figure 8[2]). Imagine the policy options that would have been evident had RSI efforts been able to geospatially depict civil society networks; trans-ethnic and trans-sectarian secondary identity layers, such as farmers or youth or professionals; and the narratives emanating from these different populations.

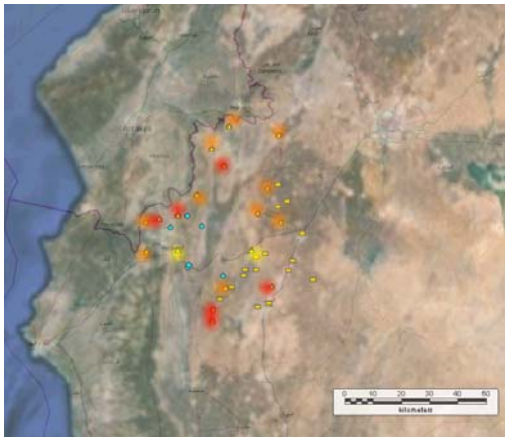

Figure 8, Idlib Civil Administrative Council Relationships with the Syrian Opposition Council

Conclusion

Technology-based approaches to RSI can enhance and augment SCA efforts, but the rich contextual understanding derived from SCA must guide the big data solutions for them to have operational relevance. For the US Government to make the most of its limited resources in a world with seemingly endless crisis points, it will need to align its policies and resources with the needs of the populations that comprise states, not just the governments that rule them. The best way to understand the politics of a country is to apply resources to it when it is not in crisis, to not wait for it to suddenly matter and rely on technology to retrospectively explain why events evolved and who has influence.

SCA for RSI provides a framework for identifying conflict before it occurs because it focuses on populations. However, this requires a fundamental shift in research and production perspective of the IC/DoD. SCA for RSI explains both why events have evolved – and how they might be shaped – from the worldview of the population. With SCA and technology solutions working together, policymakers can use Whole of Nation resources to more effectively shape existing social structures or stimulate ones that might mobilize populations toward more harmonious outcomes.

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[1] *Understanding the Syrian Opposition: Prospects for Conflict or Consensus*. USSOCOM JICSOC SCA Section. (January 2013), p. 14.

[2] *Empowering the Syrian Civil and Armed Opposition: Influencing the Outcome without Armed Intervention, Idlib Governorate*. GoldBelt Hawk, LLC. (2013), p. 25.

Chapter Six, Approaches to Addressing Challenges in the Operational Use and Validation of Sociocultural Techniques, Tools, and Models

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Abstract

A primary challenge impeding the operational use of research and development in social and behavioral disciplines is ensuring the operational validity of social science techniques, tools, and models. For a result to be operationally valid, it must contribute positively to decision-making and analysis in an operational setting. In this paper, we discuss the challenges in creating computational models and in applying these models to operational environments and missions. We then present several approaches to ensuring operational validity of social science results.

Keywords

Operational validity, application validity, sociocultural modeling, computational social science

Introduction

The social and behavioral sciences should inform warfighter decision-making across a wide variety of operational situations. However, a number of challenges impede the operational use of research and development in social and behavioral disciplines. Chief among these is a disconnect between the outcomes of R&D and the requirements for military operations. While R&D has pursued the operational transition of social science results, including specific techniques (e.g., surveys), tools (e.g., for demographic analysis), and models (e.g., for anticipating regional instability), these techniques, tools, and models may not be adopted by warfighters, despite being well-established and rigorously validated from a scientific perspective. The reasons for this disconnect are many: models may require specific forms of data; techniques may require considerable education to apply properly; tools may be too complex (Zacharias, MacMillan, & Van Hemel, 2008; Pfautz, Koelle, & Roth, 2008), or apply to a level of analysis that is different than is needed; or warfighters may simply not trust the outputs. Understanding these challenges is essential to ensuring *operational validity*—that is, techniques, tools, and models must contribute positively to decision-making and analysis in an operational setting before we can consider them *operationally valid*. This is quite a different standard for validity than is traditionally used by the social science community and borrows from the definition of "application validity" (Campbell & Bolton, 2005; U.S. Department of Defense, 2001) or "fitness for a purpose" (Fenstermacher et al, 2013). We assert that new approaches that contrast from those currently used (e.g., identify a well-established theory, construct and verify a computational model representing that theory, interpret historical data to perform a sort of "validation" of the model, deliver model to warfighter) are required to achieve operational validity. We believe that the application of the behavioral and social sciences should span not only models, but also data, techniques, instruments, and tools, and that models themselves need not inform decision-making only through their outputs, but also via an explanation of their construction, underlying theories, and assumptions. The end goal of applied R&D in the behavioral and social sciences should be not

only improved performance by warfighters but also an appropriate level of trust in effective techniques, tools, and models (Farry et al., 2010).

In this paper, we discuss the challenges in achieving operational validity from multiple perspectives. First, we describe the challenges of creating computational models (i.e., as a social scientist), then explore the challenges of how those models can be applied to operational environments and missions (i.e., as an applied scientist or engineer). We also cover the challenges faced by when using models for specific tasks within a mission (i.e., as a warfighter). We then present approaches for addressing these challenges that we have identified, designed, and/or developed in our own research and via our own discussions with warfighters.

Challenges of creating models in the social science domain

The development of computational social science models should begin with an analysis of the requirements in the operational domain. However, we recognize that the process of creating models itself has requirements and challenges that necessarily affect operational validity. The verification and validation (V&V) of models determines the credibility of these models (Goerger, 2003), and therefore influences the likelihood of their adoption by operational communities (i.e., the stated confidence of the R&D community in a model should influence the confidence of the operational community in a model). Verification is the "process of determining that a model implementation accurately represents the developer's conceptual description of the specification" (i.e., "Did I build the right thing?"), while validation is the "process of determining the degree to which a model is an accurate representation of the real world from the perspective of the intended users of the model" (i.e., "Did I build it right?") (ITT Research Institute, 2001). Whereas V&V is well-understood for physics-based models, validating social science models remains an open challenge (Zacharias et al., 2008). For example, scientific validation may be hindered by a lack of data, a lack of the right kind of data, a lack of planning for future data (and therefore the use of historical data where outcomes are already known), a lack of common problem sets to enable comparison of models, or a failure to adequately define the scope and assumptions of a model. Best practices for model validation are only beginning to be adopted by the R&D community, despite ongoing attempts to establish standards (U.S. Department of Defense, 2001).

Challenges in applying models

Dr. John Sterman, an expert in the field of system dynamics, claims that "validation and verification [of sociocultural models] are impossible; the emphasis should be more on model testing" (Sterman, 2000); that is, the ability for the model to produce realistic results may be more appropriate than formal V&V efforts. DMSO has defined "application validity" as the degree to which a model represents the real world from the perspective of its intended use (Campbell et al., 2005). In a recent SMA whitepaper on validation and validity concepts in the social sciences, there is a discussion of the notion of "fitness for a purpose," in which fitness depends on the overall confidence in reliability (i.e., consistency and repeatability) and validity (i.e., appropriateness, accuracy, and utility) of the model (Fenstermacher et al, 2013). Clearly, the notion that the application of models is important is beginning to gain traction within the applied R&D community.

However, although these concepts of applied validity indicate growing interest, a number of challenges remain. Validation with respect to an application might need to extend to the theories that provide the foundation for the models, the data and how it is used within the models, and the means with which the model results are presented for interpretation. Similarly, the required degree and form of validity may vary dramatically across different agencies (e.g., Department of Defense,

Department of State), different communities (e.g., planning versus operations), and different layers within an organization (e.g., strategic, operational, or tactical). The actual problem space itself also confounds attempts to establish operational validity. Rittel and Webber coined the term "wicked problems" to describe a class of sociocultural situations that have properties that make it difficult to apply models: in addition to the concerns just mentioned, such problems have no definitive formulation and do not have an enumerable set of potential solutions (Rittel & Webber, 1973). Clearly, no single, universal definition of application validity can be defined—fundamentally*, validity must be defined for each application.* This leads to the need to adequately describe the operational problem space and what would constitute "success" in that space (e.g., from successful completion of a mission to achievement of a specific objective, such as "decrease incidence of violence at demonstrations").

From the perspective of the modeler, achieving operational validity is a challenge. Lack of access to operational data and data types, lack of access to potential users of a model, and lack of information describing typical and current mission parameters can impede the ability of the modeler to ensure a resulting model meets operational needs. Existing theories can refer to data that simply is not available in an operational setting. Similarly, theories can be overly general or overly specific, and therefore their relevance to multiple levels of analysis (i.e., individual, group, society, culture) is inherently suspect. Most critically, the modeler may simply lack an adequate understanding of the specific tasks that a model might support (e.g., "What is the likely impact of increased flooding on crop production, and therefore socio-economic status indicators that are known to forecast instability?"). So, while documenting the assumptions of a particular model should be the job of the modeler (Pfautz et al., 2009c), the burden on achieving operational validity does not lie solely with the computational social science community, but also with the operational community interested in applying the model. As the National Research Council (NRC) study in the application of models in operational environments states, "Basing model validation on the usefulness of the model for specific problems requires that model purposes be clearly stated by model users and clearly understood by model developers" (Zacharias et al., 2008). Given a lack of well-defined problems and tasks from the operational community (including operating environment conditions, such as data availability, as well as example data sets), the development of models that focus on scientific over operational validity should come as no surprise.

Challenges in the operational use of models

Understanding the operational domain is essential to establishing a meaningful definition of operational validity. This understanding should not only capture the details of specific tasks or desired outcomes, but also the environment and context of operations, as these also influence operational validity as we have defined it. A model may perform correctly, but if the warfighter is unable to make use of the results, it is not operationally valid. One such challenge concerns the skills and knowledge of the warfighter. Models that are constructed to be evaluated and studied in an academic context may presume a level of expertise in the social sciences not typically found in a warfighter. Warfighters instead bring to bear a very different set of skills and knowledge, one that should be understood to support the presentation of model results (as well as some degree of description of the assumptions of a model, the model's internal processes, the data used by the model, when to "run" a model, etc.). Typical models often require warfighters to have a degree of technical and/or software skills to use a model; this may be due in part to the challenge that developers face in designing usable software models. If a developer is not successful in providing a tool free from technical hurdles, the warfighter may find the model unusable.

Warfighters may also have biases about trusting science and technology for certain applications (e.g., they may trust airplane guidance systems and remain highly skeptical of adversary behavior models). As a function of this sense of trust, warfighters may become over- or under-reliant on tools (e.g., a model that performs adequately 70% of the time may rapidly become unused due to issues of trust). In some of our observations during training exercises and in theater, warfighters tend to be skeptical of models, seeking specific examples of a model being used in the real world and ideally a colleague who has had a positive experience using the model (A direct quote from a warfighter: "It makes logical sense, but where has it been used?"). We have heard several warfighters convey outright distrust in models, with the rationale that no one better understands critical local conditions than the warfighter on the ground. Another factor impacting trust in a model is the relevance of the model to a particular situation. When lack of trust is an issue, operators may employ several approaches to working tentatively with the model: using the model only to check the operator's own work, politely ignoring the model, not using the model at all, and actively disparaging the model (Farry et al., 2010; Pfautz et al., 2009b; Pfautz et al., 2008). These challenges also result in an increased reliance on opportunistic, *ad hoc* methods of determining answers to questions, such as relying on the experience of fellow team members or on other resources who are directly or obliquely involved in the situation. Clearly, the operational validity of a computational social science model is constrained by the degree to which users consider it trustworthy (Pfautz et al., 2009c).

Finally, the practical realities of the operational environment can create burdens on a warfighter that will dictate the operational validity of a model. During times of high operational tempo, warfighters may be encumbered by a significant degree of stress and the need to attend to multiple critical tasks. In such high workload situations, the ability to learn or apply an unfamiliar and/or complex model (or supporting technologies) may quickly erode. Similarly, determining the relevance of a particular model or finding an appropriate set of input data may simply be too time-consuming. And, the risk of making a poor decision or analysis may be too high to work with less trusted technologies. Therefore, operational constraints, such as explicit deadlines by which information must be determined, further impact operational validity.

Approaches to Achieving Operational Validity of Social Science Models

First and foremost, an approach is needed to establish an adequate understanding of operational tasks and the operational environment and context. Ideally, models are developed from a problem-first perspective rather than a model-first perspective, and therefore are tailored to meet specific operational needs. However, even models that have already been constructed could benefit in that their applicability can be more accurately and precisely defined for different operational domains. Fortunately, the human factors engineering community has established methods for developing an understanding of a work domain with the sole purpose of informing the design, development, and evaluation of tools. Such methods (e.g., cognitive systems engineering) have been successfully applied to the design of critical systems for nuclear power plants, airplane cockpits, and air traffic control. The success of these methods come from the formal analysis of the work domain, including perceptual and cognitive tasks, environmental constraints, and socio-organizational dimensions (Scott et al., 2004; Potter et al., 2000; Vicente, 1999; Pfautz & Pfautz, 2008). We have successfully applied these methods for a small operational community (Pfautz, 2010) in an effort that informed the description of the above challenges. As a result, we espouse their use, as they formalize the process of describing the needs of the operational community in a form that can be digested by modelers. However, we also recognize other approaches are also likely to be useful, such as formal requirements analysis and definition methods used in systems engineering, or user-driven software requirements analysis (Abran & Moore, 2004; U.S. Department of Defense, 2005).

A second critical concept in designing approaches that achieve operational validity is to consider not solely models in complete form that are "run" and provide results, but a broad spectrum of capabilities that arise from the process of modeling. That is, operational validity, as we have defined it, may not be achieved with a complex, computational model, but with a simple tool that helps correctly apply an established theory during a well-defined decision-task. This is not to imply that a reductionist approach is a panacea for the challenges mentioned above, but rather to exhort the computational social science community to broaden the types of "applications" that might be considered. For example, a model may serve as a concise "reference volume":rather than forcing a warfighter to read books on a particular subject, models may enable the rapid exploration of critical factors and their interrelationships. Similarly, a model can represent a particular interpretation of a problem of situation, and therefore help the warfighter consider additional factors and relationships. A model may be operationally valid if it simply helps identify previously unknown data sources, and therefore improves a decision or analysis.

Part of this concept revolves around the need to address, over time, more general issues of warfighter skepticism in computational social science (which are not universally held by warfighters across operational domains). We recommend establishing an appropriate level of trust in a stepwise fashion by first providing either simple tools or highly constrained/reduced models, where a high degree of operational validity can be achieved. The success of these tools should enable the development of more complex tools by establishing both a degree of trust and, the requisite skills and knowledge to understand when and how to apply that trust. One approach involves the development of "sub-models" that, while highly constrained, achieve high degrees of operational validity—and then can later be composed by a modeler into more complex models. We have termed another approach *user-adaptable modeling*, in which end-users interact with models that are inherently designed to be readily adaptable to a set of operational situations (Pfautz et al., 2008). A different approach is *user-composable* modeling (Pfautz et al., 2010), in which the user is guided through the process of combining self-contained models in terms of their relevance and interdependence. A further extension of both of these approaches is *user-created modeling*, in which users are guided to create a model, leveraging the guidance provided by theory, and then validate and refine that model themselves (to the standard required by their mission, organization, commander, etc.) (Pfautz et al., 2008). This latter approach involves creating an entire modeling (and analysis) process for the warfighter. While this is potentially intimidating in terms of R&D scope, it also is likely to be required for the most skeptical users or situation-specific applications.

When models have already been created and they have achieved some level of scientific validity (or garnered the interest of a particular operational community), other approaches are needed to achieve operational validity. One potential approach is to standardize a set of *meta-information* that associates models with descriptions of their capabilities and assumptions made in the models that relate to operational decisions (Carlson, Pfautz, & Koelle, 2010). The NRC study similarly suggests that clear guidelines be developed for specifying model purpose (Zacharias et al., 2008). This meta-information can guide the application of models (not only in the field, but in R&D programs focused on creating tools). Such meta-information will clearly map model capabilities and assumptions to operational decisions (Pfautz et al., 2009a). Another approach is to perform a meta-analysis of an existing model to provide a simplified representation. This approach, sometimes called *meta-modeling*, involves describing the assumptions of a model in a model-independent manner (i.e., independently of any particular theory or implementation (Neal Reilly, Pfeffer, & Barnett, 2010; Neal Reilly et al., 2011). A meta-model could help provide meta-information to a warfighter attempting to determine the relevance of a particular model, and could also inform R&D into the auto-selection of the best possible model for a given situation or data (Bentley, Shellman, & Levey, 2012). A similar concept is used in the system dynamics modeling community, where *reference models* provide an

abstraction of a deeper, more complex model to aid in its understanding (Randers, 1980). Such meta-modeling techniques also have the potential to inform, more broadly, the R&D community, in that when they are used across many models, they can establish gaps in capabilities and areas requiring further research.

Finally, operational validity can be achieved by approaches that focus on the visual representation of the model. Presenting model outcomes in an effective manner (i.e., relevant to the specific operational decision or analysis) may be sufficient to achieve operational validity, but such presentation may be lacking for many models. However, simply representing model outputs is likely to be insufficient if these outputs cannot be explored. The notion of interactive exploration of data is not new, yet application to computational social science models remains an open research topic (especially due to the high degree of uncertainty, vagueness, ambiguity, etc. that spans both the model and its data). Approaches to representing model results that focus on making the qualities of the data and the model explicit require balancing the need for *observability* (i.e., knowledge about the quality) and *conciseness* (i.e., the ability to reach a conclusion about the data). In addition, visual representation of the model itself may be required to achieve trust and therefore operational utility. This could be a visual representation of model factors and their interrelationships, a display of an extracted meta-model, or a graphical model of a specific sub-set of the model. Such visual representation approaches have particular benefits for circumstances requiring collaboration (e.g., to formulate a model, to adapt a model, or to present decisions/analytic conclusions to others).

Conclusion

Our assertion in this paper is that operational validity can be achieved with appropriate focus and effort by the R&D community, and concomitant commitment from the operational community to provide information about their challenges. Operational validity can only be achieved through a deep and systematic understanding of operational analyses and decisions, as well as the operational environment. The computational social science community must broaden its perspective on modeling, considering not only "standalone" models, but also approaches that bring techniques, theories, and tools to bear in a form that improves their applicability and engenders appropriate levels of user trust. Both the operational and R&D communities should avoid one-size-fits-all solutions; the very nature of operations requires a degree of customization and therefore constructing methods and tools that can help create custom solutions should be a priority. Finally, we acknowledge that the approaches mentioned above (and described in many of the referenced papers) are but a subset of what is possible given an increased R&D focus on operational validity.

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Chapter Seven, the Who, What, Where, and How of Regionally Aligned Forces: Supporting COCOM Mission Planning

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Abstract

DoD tactical phase 0 stability operations are currently fragmented in that such operations are conducted not only by active and reserve Civil Affairs (CA) Teams, but also by National Guard units and by teams drawn from conventional forces for temporary security and stability missions. These teams are increasingly operating within Combatant Commands (COCOMs) as envisioned in the Regionally Aligned Forces (RAF) concept. While such units may have their own training regime, all share a need for civil information to support their training and mission planning. This chapter addresses these civil information needs identified by trainers and commanders of such RAF units. Based on this need identification, this chapter then discusses approaches for addressing these needs through improved data collection and the development of metrics that can help inform operational needs related to urban environments. Finally, the chapter will discuss implications for tactical and strategic phase 0 information sharing.

Keywords

Regionally Aligned Forces, Civil Affairs, phase 0 data collection

Background: Regionally Aligned Forces (RAF) and their mission

The Regionally Aligned Forces (RAF) concept was initiated in 2013 with the goal of providing Combatant Commands (COCOMs) with access to U.S. military forces that can respond quickly and that are versatile enough to support missions related to partner capacity building, such as in bilateral and multilateral military exercises, and in missions related to stability and theater security cooperation efforts.[1] Units deployed on RAF missions generally partner with security forces in a host country and work to build the capacity of that host nation to provide security and stability for its population. Missions of U.S. teams working within the RAF realm are varied and can include such things as assisting host nations to develop rule of law, providing host nations with training in emergency management and disaster response, in law enforcement and related security training, providing economic development assistance and even assistance in improving public service provision.

Civil Affairs (CA) teams and National Guard units involved in the Guard State Partnership Program (SPP) are also directly involved in missions related to building host nation capacity under the Regionally Aligned Forces concept. CA teams, both reserve and active units are generally small teams of about four military personnel working directly on the ground to support stability and security efforts in host nations. Both SPP and SFAT missions focus most on working with host nation security forces to build their ability to provide security to the population and in doing so, to build government capacity by linking people to their governments through improved governance. CA teams,

[1] Army Times (2013). *First regionally aligned BCT shares lessons learned*. Sept. 16, 2013.

on the other hand, can have broader missions that also cover such areas as assisting in economic development and in improving education, healthcare, agriculture and infrastructure but all with the goal of reducing instability.

Regionally Aligned Forces (RAF) Training

Civil Affairs units heavily support COCOMs in the realm of security and stability as part of the implementation of the Regionally Aligned Forces concept. However, they are not the only units supporting RAF missions. Soldiers from more conventional combat units also receive training to support missions within RAF. Initially, training for RAF-related missions was conducted at Ft. Riley, Kansas. That included not only training in combat skills but also training in socio-cultural awareness to assist units in better understanding the dynamics within host nations. This initial RAF training was targeted at providing support to the African Command. Although supporting COCOMs, units deployed under RAF are also under the direction of the U.S. State Department, which makes the RAF concept truly an interagency effort.

More recently, training for RAF-related missions has become the responsibility of the 162nd Infantry Brigade at Ft. Polk, Louisiana, which operates a training program for Security Force Advisor Training (SFAT) with a focus on building security and governance capacity of host nations. As with the Ft. Riley training program, this eight-week program incorporates traditional military training with socio-cultural training. Below is a typical eight-week course training schedule.

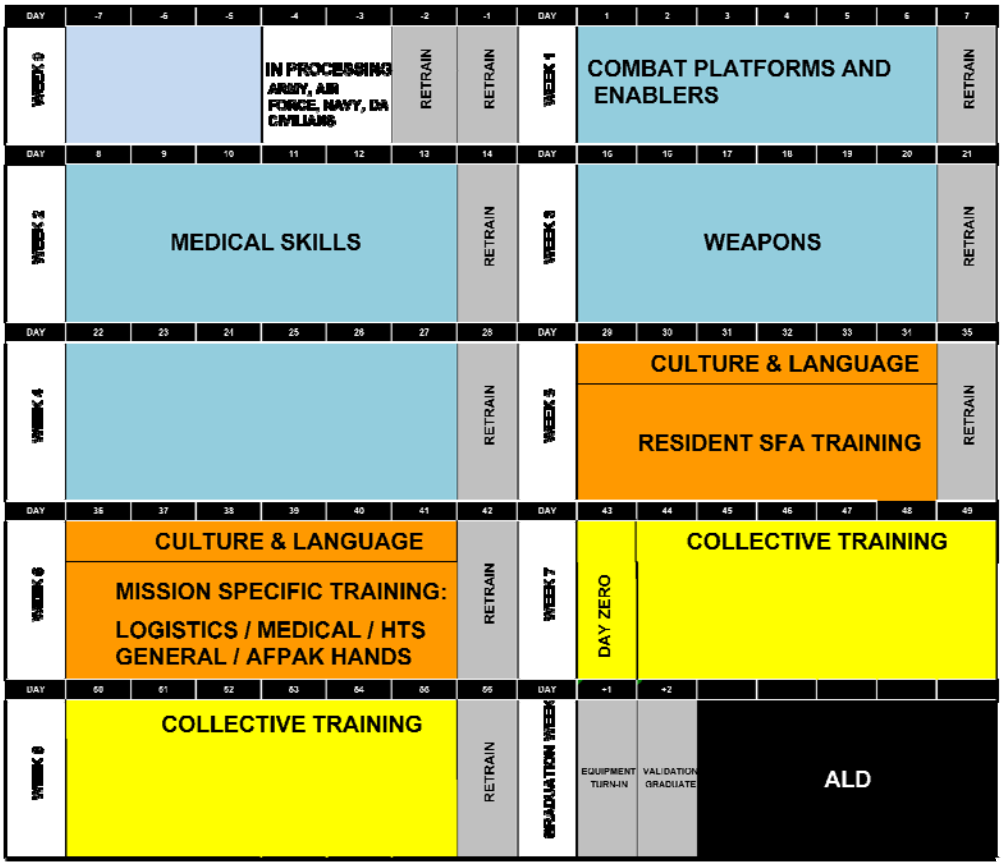

Figure 9, Training Schedule for Security Force Advisor Teams (SFAT)

Through the SFAT program, military personnel are prepared for missions within the Regionally Aligned Forces concept. SFAT is a joint program involving personnel from several branches of the U.S. military, including the National Guard. There is also a short eight-day course designed for more rapid deployments. This short course provides an overview with guidance for where team members can access additional information in order to fill in the gaps. In 2014, responsibility for RAF training will move from the 162nd to another military organization as yet unnamed. Current options include placing responsibility for RAF training with each individual COCOM or assigning training to a military organization other than the 162nd.

Current SFAT training is agile in that training is tailored to the specific mission of a team and training programs are constantly adjusted as the situation on the ground changes. Training must also be adjusted to match the size a deploying unit, which could be as small as a team of two or as large as an entire company or battalion but generally training is geared toward small teams. A core view of SFATs is that small teams operating on the ground can have big impacts. However, this approach requires team members who are trained to think outside the box so that they can be agile and adaptive as the situation on the ground changes. Hence, much SFAT training is focused on teaching critical thinking skills. Since military personnel on RAF missions are working closely with host nation military and government personnel, relationship building is critical to mission success.

In addition to SFATs, some CA teams do pass through the SFAT training program. However, most training for CA teams is conducted by their commands. This is also true of training of SPP units. National Guard personnel do undergo SFAT training but much more training for SPP missions is under the control of individual state National Guard commands.

SFAT has also adopted a Community of Purpose training approach by which training is adapted based on a team's deployment location. In order to develop location-specific training, the Ft. Polk training program taps Foreign Area Officers (FAOs) with geographic specialties for region-specific information and also makes use of a network of area specialists who provide socio-cultural data for specific countries. That socio-cultural data is then incorporated into the training program for the team heading into a specific geographic location.

Current RAF Information Collection Techniques

Clearly, one need for both trainers and commanders of units deployed on RAF missions is easy access to socio-cultural data that can provide them with relevant and timely situational awareness. While national-level data is relatively accessible, community and neighborhood-level data is currently less accessible. In addition, there is the challenge of data overload. There is much open source socio-cultural data but this data is scattered and much is unvalidated. The open source socio-cultural data is also not easily accessible or searchable. Because of the challenge in making sense of these disparate data sources, trainers for RAF missions often build their own communities of Subject Matter Experts (SMEs). As an example, SFAT trainers report that they most often rely on their own group of regional experts who can either point them to usable data sources or work directly with deploying units during training events. Previous SFAT team members with knowledge of a particular geographic region from a prior deployment also are often assigned to a follow-on team for knowledge continuity or become part of the SME community for training future teams.

Hence, within the SFAT training program itself, direct contact is still the main form of transferring information and knowledge from one team to the next. A team in training at Ft. Polk will usually have direct communication with a current team working in a partner nation in order to acquire information from the current team that is used for training the follow-on advisor team. In addition,

the SFAT program will often seek to get previous advisors to join a follow-on team in order to have some continuity of experience and knowledge.

In terms of technology, the SFAT trainers have set up a chat board called SAFnet2.0 to encourage information sharing among advisor team members. The SFAT training program also draws information from the Army Knowledge Online system and the Joint Center for Security Force Assistance at Ft. Leavenworth, KS. SFATs on the ground also conduct assessments and use any tools available to capture human geography data that can provide situational awareness and guidance not only to the current team but incoming teams.

SPP units also tap a variety of sources for data, often relying on relationships built within their states. For example, state Guards share data with the private sector for homeland security purposes and through these relationships gain access to private sector sources. As an example, Guard SPP units have gained access to power grid and other infrastructure data from private sector businesses working in host nations. However, these are data sources not widely available to military units outside of a particular state Guard unless that state Guard serves as liaison between the military unit needing the data and the private sector data holder.

CA teams, like the Guard SPP units and SFATs, also tap both military and open source data to assist with training and mission planning. The US Special Operations Command (SOCOM) has developed a program of record for civil information known as the Civil Information Management Data Processing System (CIMDPS) that will eventually become the joint program of record for civil information. At the moment, it seems that neither the SFATs nor SPP units are making wide use of this system either to pull data or input data. However, as CIMDPS becomes the joint database for civil information it will assist in addressing the information needs of RAF units.

In September 2010, CIMDPS was approved as a SOCOM Program of Record. In November 2013, CIMDPS became operational on the Special Operations Forces Information Enterprise as an automation system that assists Civil Affairs and others engaged in civil-military operations (CMO) to collect, process, analyze, maintain, data mine and deliver civil information and analysis products in support of military operations. CIMDPS effectively links those in the field who collect civil information, with those responsible for exploiting and disseminating that information. CIMDPS provides a structure and a common framework for CIM analysis of both classified and unclassified data. CIMDPS has the capability to operate from garrison or deployed facilities and under the full continuum of military operations (wartime to peacetime). The Capabilities and Production Document for Increment 2 of CIMDPS is currently being staffed at SOCOM. This future Program of Record will allow for the Joint CA community to be supported by the original CIMDPS. Beyond Increment Two, SOCOM will combine multiple information systems within Special Operations to achieve a greater integration of human terrain data.

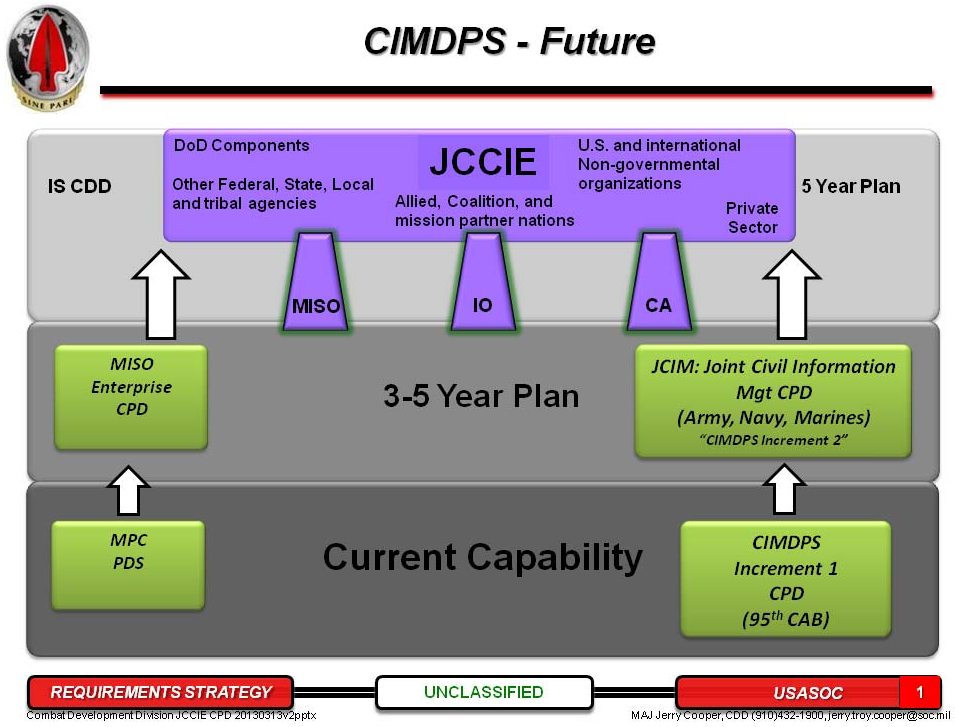

Figure 10, CIMPDS Future

One of the bigger information challenges for RAF units is the transfer of knowledge and lessons learned from one unit to the next. The Guard SPP program has sought to address this by assigned host nations to particular state Guards. As a result, some state Guards have had missions rotating in and out of the same host nation for as long as 20 years. Very often, Guard personnel who serve on one mission in the host nation return several times over the years for follow-on missions. It is not uncommon for Guard officers to have developed long-term relationships with military commanders and government officials in host nations who have also advanced their positions over a course of years.

Although the transfer of information from one Guard SPP unit to the next can occur rather smoothly within a state Guard command, the data collected and lessons learned by SPP units is not easily accessible by units outside of that command. SFAT trainers have learned to tap Guard SPP units for regional expertise when developing training programs for specific countries but this requires directly contacting a Guard SPP and building relationships to gain access to their information.

Discussion of Gaps

Trainers for missions related to the Regionally Aligned Forces (RAF) concept and commanders who lead such teams both have a need for socio-cultural data in order to improve their situational awareness prior to deployment. Commanders need relevant threat indicators to improve their ability to monitor security in dynamic populations in order to forecast likely future situations. The ability to forecast security threats could greatly improve both training and mission planning, ultimately reducing the likelihood that a local problem would trigger instability in a broader region. Beyond these immediate socio-cultural information needs, the remainder of this chapter will discuss ongoing challenges.

Most CA teams and National Guard units currently have a "do-it-yourself" approach to data collection and storage. COCOMs are also realizing that sub-national, socio-cultural information must be collected to satisfy operational requirements. While current research efforts are beginning to standardize sub-national information collection and dissemination for tactical and operational gaps, those who conduct research from the tactical end have identified these issues:

- Both COCOMs realize that more raw socio-cultural data does not necessarily improve situational awareness. COCOMs typically do not have the resources to easily consume large amounts of raw socio-cultural data. See the chapter "Piercing the Noise Floor"[1] (Flynn et al., 2012) for a detailed discussion on this issue. An analysis of currently available data is necessary in order to develop indicators of insecurity and instability, both for tactical and strategic understanding. Development of indicators is not a trivial undertaking, requiring collaborative research as well as interaction with trainers and commanders of units deployed on RAF missions. Commanders have learned through experiences from previous deployments what they need to prepare for upcoming deployments.

- RAF's "do-it-yourself" data collection techniques have limitations from both a top-down (Internet and satellite) and bottom-up (tactical data collection by troops) approaches. Boots on the ground typically do not have enough understanding of necessary social or natural science knowledge to translate available information into threat indicators. Although there are some exceptions, military units conducting RAF missions do not have enough analysis capability to perform necessary socio-cultural analyses with the result that raw data is underutilized. Top-down data collection approaches, when done by RAF (or COCOMs) are aligned to specific operational needs and guidelines have been set up for CA.[2] At best however, it is inefficient across the entire DoD as the same data is being collected in the IC as well. At worst, Internet data collected/analyzed by troops is not properly analyzed nor integrated with other sources: providing misleading or incomplete information.

- RAF units on the ground can serve as reliable data collectors at the tactical level. However, what is first needed is a better understanding of what data needs to be collected. Typically, tactical data collection has supported short term tactical needs. There is untapped potential to use RAF data collection to support calibration and validation of automated information collection techniques. Since COCOMs can control some of the surveys performed in areas under phase 0 operations, survey questions that can be tied to easily observable attributes or behaviors would allow RAF data to easily support more strategic data needs. Tactical data collection can be used to:

    - disaggregate traditional data sources,

    - uncover hidden relationships unavailable at more strategic views, and

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[1] Flynn, M., Adelman, J., Amir-ghessemi, A., Astorino-Courtois, A., Berns, G., Bragg, B., Browne, D., Bruneau, E., Burkhalter, J., Busch, W., Cabayan, H., Casebeer, B., Chapman, A., Chiao, J., Cioffi-Revilla, C. Dimperio, E., DiEuliis, D., Drigo, M., Edwards, P., Ehlschlaeger, C., Farkas, E., Giordano, J., Hatemi, P., Hendrix, C., Knudson, E., Lee, J., Leetaru, K., Lyle, D., McDermott, R., McLean, S., Neff, R., Olcott, A., Rate, C., Rice, C., Stavridis, J. (2012). *National Security Challenges: Insights from Social, Neurobiological, and Complexity Sciences*. A. Astorino-Courtois, H. Cabayan, B. Casebeer, A. Chapman, D. DiEuliis, C. Ehlschlaeger, D. Lyle, C. Rice (Ed.). ERDC/SMA. URL: http://www.nsiteam.com/publications.html

[2] Ehlschlaeger, C.R., Burkhalter, J.A., Drigo, M.V., Hartman, E.R., Kemmet, L.A. (2014 in press). *Best-practice Methods for Open-source Human Geography Data Compilation for Civil Affairs*, ERDC Tech Report.

  - test the quality of data collected by satellites or from the internet.

- A better understanding of what data should be collected means that what is also needed are metrics in order to assess the level of success of RAF missions. Because responsibility for missions related to RAF are fragmented, agreed upon metrics for success are not in existence. Another challenge in developing metrics is the interagency nature of RAF missions in which military organizations and civilian USG agencies, particularly the State Department, share responsibility. Past stability missions have shown that military and civilian organizations often do not use the same metrics for success.

Whether at the tactical, operational, or strategic scale, phase 0 civil-military information collection is driven by a need to 1) provide better planning resources, 2) enhance situational awareness, and 3) assess past and ongoing operations. Research and analysis to address these issues at the tactical level were discussed above. Implementation of these goals, in combination with the expanded development of CIMDPS, both as a data repository and information management system, will be needed to improve both training and mission planning for RAF missions. Having an information management system that spans all RAF organizations will ensure easier information sharing, not just between tactical and operational units, but with assisting in the improvement of strategic level data development. Chapter 1.8 from Flynn et al. (2012) [1] discusses how tactical demographic information can be incorporated into "human topographic maps". Research from the OSD/ERDC Megacities-RSI project prototyped how tactical level data can augment thematic maps of socio-cultural conditions down to the neighborhood scale. These thematic maps can be used for both tactical and strategic level operational planning. The success of these missions will be critical for reducing global instability in phase 0 operating environments.

[1] Flynn, M., Adelman, J., Amir-ghessemi, A., Astorino-Courtois, A., Berns, G., Bragg, B., Browne, D., Bruneau, E., Burkhalter, J., Busch, W., Cabayan, H., Casebeer, B., Chapman, A., Chiao, J., Cioffi-Revilla, C. Dimperio, E., DiEuliis, D., Drigo, M., Edwards, P., Ehlschlaeger, C., Farkas, E., Giordano, J., Hatemi, P., Hendrix, C., Knudson, E., Lee, J., Leetaru, K., Lyle, D., McDermott, R., McLean, S., Neff, R., Olcott, A., Rate, C., Rice, C., Stavridis, J. (2012). *National Security Challenges: Insights from Social, Neurobiological, and Complexity Science*s. A. Astorino-Courtois, H. Cabayan, B. Casebeer, A. Chapman, D. DiEuliis, C. Ehlschlaeger, D. Lyle, C. Rice (Ed.). ERDC/SMA. URL: http://www.nsiteam.com/publications.html

Chapter Eight, Sentiment & Discourse Analysis: Theory, Extraction, and Application

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Abstract

This chapter summarizes the state of the fields related to automated sentiment and discourse analysis and illustrates applied case studies that use data collected from newly developed automated sentiment and discourse software engines. These socio-cultural studies focused on groups that showcase current capabilities that could support agencies and stakeholders throughout the DoD. The paper first focuses on the sentiment analysis domain then highlights new strides in automated discourse analysis. While the two domains are segregated for the purposes of explanation, there is significant overlap. Both require understanding of the language being analyzed as well as the actors and issues associated with the overarching research question. The empirical studies successfully use automated information obtained from texts to explain and forecast the violent behavior of groups.

Keywords

sentiment analysis, discourse analysis, ensemble modeling, forecasting, natural language processing, emotions, violence, social media

About Sentiment Analysis

When newspapers report that people on Twitter are happier about President Obama this week than they were last week, they are reporting the results of **sentiment analysis**, also known as **opinion mining.** That is the automatic extraction of feelings, likes and dislikes, or opinions from text. It is one of two types of **text mining** (**text analytics**; when applied to social media, **social media analytics**). The other type, known as **idea mining** or **information extraction**, aims to extract recurrent themes in the information content of the text (Evangelopoulos and Visinescu 2012).

The first half of this paper is an overview of sentiment analysis with its current technical and theoretical challenges, with particular reference to the SAE Text Analysis system and its sentiment analysis component, Pathos (hereinafter SAEtext/Pathos).[1] We do not attempt a complete literature review.

One of the first domains of sentiment analysis was online product reviews, particularly movie reviews, starting with Pang, Lee, and Vaithyanathan (2002), who generously shared their corpora with the broader community. In a product review, we already know what is being evaluated, and the text is often accompanied by a numerical rating of the product by the same author, thus providing a criterion to test against.

[1] *Pathos* is ancient Greek for 'sentiment.' The other components of SAEtext are the *Taxis* text classifier (Greek for 'classification') and the *Xenophon* event coder (named after an ancient Greek writer with a journalistic style). SAEtext is a product of Strategic Analysis Enterprises, Inc., Williamsburg, Virginia.

Nowadays, social media are a major focus and Twitter (**microblogging**) is especially suitable for analysis because they are short, rely on little or no context, and express the sender's spontaneous thoughts and feelings. They are often explicitly tagged for subject and are always accurately time-stamped. Often written just seconds before publication, they provide an especially fast-moving indicator and can even be used for real-time monitoring of unfolding terrorist incidents (Cheong and Lee 2011). There are of course numerous issues with twitter as well such as expressions written in short-hand and the use of euphemisms and irony (especially in hashtags). All of these are topics of ongoing research in the field.

Newspapers, blogs, and forums have their own problems. Many newspaper articles express little or no opinion or feeling (they are of low **subjectivity**). News events with good or bad consequences can be recognized, of course, but doing so is not exactly sentiment analysis. Editorials and blogs are more sentiment-laden, but also more complex. They often relying on context and expressing sentiment about more than one thing in a single text, making it necessary to divide the text up into subtopics (O'Hare et al. 2009) or identify specific entities within it (Godbole et al. 2007). Before jumping into the technical details of sentiment analysis, we begin with some definitions.

What Is Sentiment?

All of the discussion above and to follow assume that there is a coherent definition of "sentiment." Despite much work on sentiment analysis that has not been made clear. Sentiment has variously been assumed to be whatever correlates with positive or negative evaluation, inclination to buy a product, or inclination to vote for a candidate. Sentiment might be an emotion, a behavioral disposition, or a rational judgment.

The simplest formal model of sentiment is a scale from "bad" to "good" or "dislike" to "like." This is often called a **valence** scale, and it presumes nothing about the nature of sentiment. Multiple valence scales can be created, such as moral approval vs. emotional liking.

If sentiment is characterized as emotion it becomes possible to link sentiment analysis to psychology. Psychologists have several ways of classifying emotions.

Osgood, May, and Miron (1975) classify the emotional associations of words on a three-axis scale: Evaluation, Potency, and Activity (E, P, A). E corresponds to sentiment or valence as more commonly understood. A similar system is used in the ANEW database (Affective Norms for English Words, Bradley and Lang 2010, earlier version 1999). This is a collection of words, most of them seemingly emotionally neutral, rated for "valence, arousal, and dominance" by a large population of human raters.

Plutchik (1958, 2003) arranged eight emotions in a wheel (Figure 11, left). In his theory emotions can be mixed much like primary colors. There is also an intensity dimension along the length of each arrow.

Some of the mixtures predicted by the wheel make sense (such as fear + surprise), others are harder to understand (fear + trust), and one commonly observed mixture is forbidden by the wheel layout (fear + anger). Plutchik himself (2003: 80-83) cites the results of several other researchers showing that fear and anger are not opposites but are both fairly close to disgust. On this basis we employ in our work the, far from definitive, arrangement shown in Figure 11 (right).

Many psychologists use a system with five discrete emotions, happiness (joy), anger, sadness, fear, and disgust. That is Plutchik's system without anticipation, surprise, and trust (which arguably are cognitive states, not feelings) and without the wheel. Stevenson et al. (2007) reworked the original ANEW database with a new set of human raters using this system. However, this model omits Plutchik's "trust" axis, for which we see a need in both politics and advertising.

Insofar as it is based on counting words with emotional associations, sentiment analysis resembles a much older line of psychological text characterization called **content analysis** and implemented, for example, in the General Inquirer software package (Stone et al. 1966), still supported (http://www.wjh.harvard.edu/~inquirer/). In its current incarnation, General Inquirer rates text on several emotional scales as well as scales indicating the prominence of content areas.

A related content analysis system is Linguistic Inquiry and Word Count (LIWC, pronounced "Luke", Pennebaker et al. 2007). LIWC has been applied largely to psychology in a narrower sense – personality types, behavior, response to trauma, and minor mental illness. It rates texts along dozens of dimensions.

In our own work, we use both the positive to negative valence scale and the discrete emotion categories depicted in Figure 11 (below).

Where to Get the Dictionary

Sentiment analysis requires, at minimum, a dictionary (lexicon) of words rated for the sentiment they express. Where to get this dictionary is an important question.

Given a collection of product reviews accompanied by numerical or "star" ratings, or blog entries marked with mood icons, it is straightforward to use machine learning to extract the words that indicate positive or negative valence (Pang et al. 2002). This reduces sentiment analysis to text classification, perhaps with some measure of goodness of fit (as in the bag-of-words classifier in SAEtext), and requires no theory of sentiment or emotion beyond what is already given in the data set.

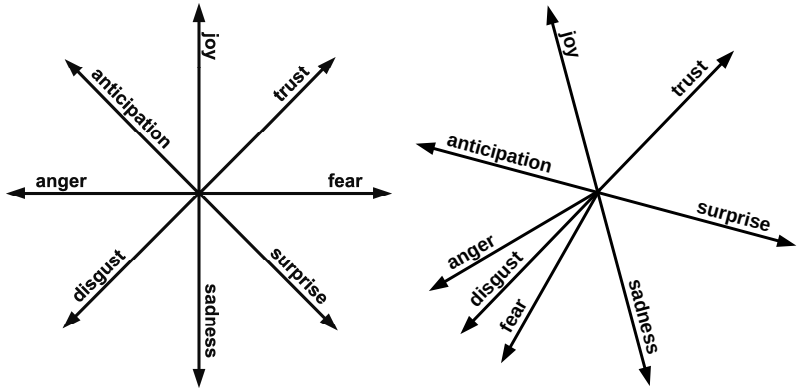

Figure 11, Plutchik's Wheel of Emotions (left) and a suggested rearrangement (right)

From there, the dictionary can be extended automatically, to some extent, by looking for patterns of usage that indicate synonymy or antonymy. For example, if something is described as *A and B,* then *A* and *B* probably convey similar sentiment; if the text says *A but B*, then *A* and *B* are probably opposites (Hatzivassiloglou and

McKeown 1997).

However, many texts do not come pre-tagged with ratings or moods, nor do they sufficiently resemble other available texts that do. Accordingly, one must use other sources for the sentiment dictionary, such as the ANEW data set (Bradley and Lang 2010; Stevenson et al. 2007) or other psychological corpora.

Another way of building or expanding the dictionary is to perform *ad hoc* experiments with human raters. Collect words that occur regularly in the texts of interest and are likely to indicate sentiment; use a thesaurus to expand the collection; and ask a panel of human raters to judge their sentiment values. Some have even crowdsourced the work via Amazon Mechanical Turk (Taboada et al. 2011). Human raters are used internally at SAE, with the results carefully checked for consistency.

Once such a dictionary is started, statistical and machine-learning methods can be used to refine and expand it (Grefenstette et al. 2006, Pitel and Grefenstette 2008, Agarwal et al. 2009, Lu et al. 2011).

Semantics of Sentiment

Structures to Represent Sentiment Expressions

The information content of a sentiment expression is more than just a number; sentiments are always *about* something. In product reviews, Liu (2010, 2011) represents every sentiment as a quintuple, <*object, feature, orientation, holder, time*>, tying it not only to a product but also to a feature of the product. Clearly, the first two elements, object and feature, are actually part of the ontology of product reviews. The third element is the sentiment *sensu stricto.* The author and time tags are properties of the text.

In theoretical linguistics, thematic relation theory (Gruber 1976) assigns noun phrases to roles such as *theme, agent, experiencer,* and *instrument.* Of these, only *theme* and *experiencer* apply to sentiment. Accordingly, in SAEtext/Pathos, the theme and experiencer are called by the more memorable names **evoker** and **reactor**. The reactor is the one who feels and evinces the sentiment evoked by the evoker. For example, if A praises B, A is the reactor and B is the evoker (which does not imply any action on B's part). The reactor is often the author of the text. Other attributes of the sentiment expression, such as date and time of utterance, are handled separately.

"Valence Shifters" – Intensification and Negation

"Valence shifters" (Polayni and Zaenen 2006) are words such as *not, slightly,* or *could* that modify the effect of a sentiment expression. Obviously, *not good* is not the same as *good,* which is not the same as *very good.* A pure word-counting approach will not detect this; somehow *not* or *very* needs to be combined with the adjective to alter its sentiment value. How to do so is not necessarily obvious.

Fitting numerical values to valence shifters is, on the surface, easy. If *bad* is –1 and *good* is +1, then maybe *very good* is about +1.6, and *very* is a multiplier with a value of 1.6. Taking this tack, Cliff (1959), Lilly (1968), and Taboada et al. (2011) surveyed human raters and assigned numerical values to a wide range of intensifiers.

Negation interacts with intensifiers in a poorly understood way. Clearly, if *good* and *very good* are positive, then *not good* and *not very good* are negative. However, *very good* is stronger than *good,* but *not very good* is weaker than *not good*. Negation not only reverses the polarity but also, in some way, reverses or shifts the scale. Taboada et al. (2011) model this by saying that negation subtracts a constant, rather than multiplying by a negative number.

From Text Classification to Text Understanding

The first generation of sentiment analyzers all performed **document-level sentiment analysis**, assigning a sentiment to an entire text, generally using a **bag-of-words** approach. That is, words were counted but not related to each other in any other way. To modernize an old joke, when a dog bites a man, it's not news; when a man bites a dog, it is news; and bag-of-word techniques can't tell the difference.

In product reviews, editorials, and blogs, finer-grained analysis is necessary. A sentiment analyzer that looks at units smaller than the whole text must recognize the named entities to which sentiments pertain (**named entity recognition**). This can be done with a dictionary or semi-automatically. Pronouns must also be co-referenced; otherwise, every occurrence of *he* or *it* will be an unknown entity.

The Holy Grail of natural language analysis is deep understanding, which requires **parsing** the entire text to recover its sentence structure, then constructing a full representation of the meaning. Doing this reliably on a large scale is not a solved problem. Qiu et al. (2009) use parsing to connect sentiment words to the entities they describe, but they use it only for dictionary development.

A Speech-Act-Based Approach

Sentiment Expressions as Speech Acts

The key idea behind the new approach to sentiment analysis taken by SAEtext/Pathos is that *expressing a sentiment is an act, and hence an event.* This follows from speech act theory (Austin 1962, Searle 1979) and particularly the *F*(*P*) hypothesis, which states that people do not communicate by transmitting ideas directly to other people – every proposition that they express is wrapped in a speech act intention, or to put it more technically, an illocutionary force. The triad of **locution** (act of speaking), **illocution** (intent), and **perlocution** (effect) is essential to all communication.

The act of speaking is performed by a specific speaker at a specific time (the last two elements of Liu's semantic quintuple). This immediately takes us beyond just measuring the author's sentiment; we can also measure *reported* sentiment. If a newspaper reports that A endorsed B and C denounced D and E, it has reported two speech acts, expressing the sentiment of A toward B and of C toward D and E respectively. We call these **dyadic** (A to B) or **multi-adic** (C to D and E) **sentiments** since each has an overtly expressed reactor and evoker, not just a single entity. The author's own sentiment (**monadic sentiment**) is a special case (as when the author writes *A is good*); the author is the reactor. Authors can also report sentiment while naming only the reactor and not the evoker, as in *A is happy.*

If sentiment expressions are events, they can be studied quantitatively like other events. We connect sentiment analysis to the well-established technology of quantitative analysis of political and military events (Schrodt 1994, 2001; Shellman 2006, 2008). Figure 12 depicts sentiment and event trends towards the Moro Islamic Liberation Front (MILF). One can see that attitudes and opinions

towards the MILF on a simple valence scale trend well with reported MILF actions. Below we describe in more detail how Pathos works.

SAEtext/Pathos infrastructure

The SAE Text Analysis System (SAEtext) comprises several tools: a general-purpose bag-of-words text classifier; a bag-of-word sentiment analyzer that handles some valence shifters; a political event coder and, most importantly, a dyadic sentiment (sentiment speech act) coding engine. The last of these, SAEtext/Pathos, is what we shall describe here.

On inputting an English-language text, SAEtext/Pathos breaks the string of characters into words; labels the parts of speech with a hand-optimized tagger; reduces each word to its dictionary form for easy recognition; performs chunk-style parsing; finds clause boundaries; and coreferences shortened names (e.g., *Jones* for *Colonel John Jones*) and pronouns (*he, she, they,* etc.) using heuristics based on those of Mitkov (2002).

Then, sentiment expressions (mostly verbs and adjectives) are connected to their respective reactors and evokers using a combination of template matching and syntactic heuristics. Finally, **discourse contexts** are classified; that is, sentences are marked as such if they are negative, conditional or hypothetical, future, or historical (referring to events long before the time of authorship). In that way, non-real and non-current sentiment expressions can be excluded from analysis.

Coding requires a dictionary of named entities (to which SAEtext/Pathos will suggest additions) and a dictionary of sentiment expressions (verbs, adjectives, etc.). The dictionary format essentially matches words by syntactic category Sentiment codes can have multiple components, such as dimension or emotion plus value, so that multiple emotions/sentiments can be coded in a single run. At the end of the day we can produce who said what about who and/or what and whether the expression was positive or negative, and moreover, which emotion was expressed. The next section shows how we can apply that information to study political and social conflicts.

So Why Do We Care?

A major hypothesis emerging from the social psychology literature is that individuals' choices are strongly influenced by their own and others' emotions. While experiments to that end have been conducted in labs around the world, there is a lack of empirical analyses focusing on how key actors involved in political crises react in response to different emotional impulses emanating from different types of actors. The research to date on how emotions impact conflict behavior has been largely descriptive in nature, lacking scientific rigor and unbiased empirical assessments. The primary purpose of this applied study is to describe our approach for breaking new ground in the study of emotions and their impacts on the strategic and tactical choices of individuals, groups, and governments while engaged in domestic and/or international political struggles. Much of the social-psychology literature focuses on how emotions influence one's behavior. In this study, we examine this relationship from a different perspective by developing and testing hypotheses on how societal emotions affect government leaders' behavioral responses toward their opponents and constituencies. Revolutionaries such as Mao Zedong and Che Guevara, along with US counter-insurgency doctrine, suggest that societal attitudes can have a decisive impact on the outcomes of conflict and irregular warfare. The victor in these often-protracted engagements usually holds the support of the population. Popular support is often conceptualized in terms of the extent to which one favors, likes, or trusts a person or policy position. Yet, some leaders gain support through coercion. For example, groups may violently attack civilians to spread fear and panic within a wider audience to

compel people to support their cause. Others, such as Hezbollah, provide social services to win over potential supporters. Governments and dissidents generally gauge public attitudes before taking action and then conduct themselves in ways that increase support—either through fear or trust.

Hypotheses

Emotions are critical to the natural goal-seeking process in that they signal circumstances that threaten or further one's goals. Emotions direct and energize behavior toward remediating threats or exploiting benefits.[1] Emotions are also linked to habitual behavioral patterns; understanding the effects of emotions could prove useful for identifying and predicting how individuals will respond to various emotional stimuli. Kuppens et al. hypothesize that different events evoke different emotions and that different emotions provoke different actions. Fearful people tend to *avoid conflict* while angry people tend to *take action*.[2] Matsumoto et al. argue that 'disgust' is the emotion that stems from 'repulsion' and tends to increase the desire to 'eliminate' the opposition.[3] This theory suggests the following testable hypotheses:

H1: If dissidents are feared by the population, dissidents will continue their violent actions to perpetuate fear in the population (so that the population avoids conflict with them).

H2: If people are angry at dissidents, dissidents will alter their behavior (e.g., lessen violent activities) to prevent actions by the general population that may be inconsistent with the dissidents' objectives.

Autocratic governments may react in similar ways. Fearful people mean submissive people. Angry people present potential threats to leaders. Machiavelli argued that it is better to be feared than loved. Thus,

H3: Autocratic leaders will increase violence in the face of fear and decrease violence in the face of anger.

Democratic leaders, on the contrary, can be removed from office by fearful populations through elections, a feature of democracy that does not require large-scale collective action nor the necessity of publicly declaring or denouncing support for a person or policy. As such,

H4: Democratic leaders will lessen violence when confronted by fearful populations.

Democratic leaders should respond similarly to angry and disgusted populations. Their tenure is more susceptible to the population's negative emotions, and power is easier to lose when the masses revoke support. Governments and dissidents are also cognizant of how different groups within the population feel about each other and can react to such information. Thus, we might expect to observe the following:

H5: If dissidents know people are angry, fearful, or disgusted with the government, they will continue to increase their violent activities to attempt to take over the state.

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[1] Cottrell and Neuberg, "Different Emotional Reactions."

[2] Peter Kuppens et al., "The Appraisal Basis of Anger: Specificity, Necessity and Sufficiency of Components," Emotion 3 (3) (2003): 254-269.

[3] David Matsumoto, Hyisung C. Hwang, and Mark G. Frank, "Emotional Language and Political Aggression," *Journal of Language and Social Psychology* XX (X) (2013): 1-17, accessed May 8, 2013, DOI: 10.1177/0261927X12474654.

H6: If democratic governments know people are angry, fearful, or disgusted with dissidents, they will increase their violent activities toward the dissidents to eliminate them.

H7: If autocratic repressive leaders know that society is angry, fearful, or disgusted with dissidents, they will lessen their own repressive activities against society so as to garner or retain societal support for the government.

There is no need to use repression when faced with unsupported dissidents; the dissidents will fizzle out without support from the masses. At the opposite end of the spectrum, governments and dissidents may try to build trust within a population as a way of gaining support. If there are high levels of trust between the government and society, the likelihood of the government using violence against the population should be low. Similarly, dissidents will use less violence during periods of high trust between the population and the dissidents.

H8: As trust increases between the population and the government, or between the population and the dissidents, government and dissident violence alike should decrease.

We examined these hypotheses using events data and emotions data collected for the Philippines and Egypt over the period 2001 to 2012. The events data came from a large Factiva corpus and the sentiment and emotions data came from Filipino and Egyptian bloggers identified on the World Wide Web. Because the Philippines is a democracy, and Egypt an authoritarian regime over our time period of analysis, we can examine the extent to which relationships between emotions and behavior operate differently in diverse regime types. In this study, we focus attention on the anger and disgust associated with unsupportive attitudes, as such expressions can also impact an actor's decisions. In short, we ask: How do societal emotions such as anger, disgust, fear, and trust influence government and dissident behavior? We are only able to share a portion of the results of this study here. One can find the full study in Shellman & O'Brien (2013) including the theory and hypotheses. We concentrate on the empirical results here. Figure 12 depicts the extent to which our model is useful in explaining levels of dissident hostility directed at both the government and society. The model-predicted values of hostility correlate with actual values at .93, indicating that we have an excellent model of dissident hostility. Our model of government hostility (not shown) exhibits a similar level of performance.

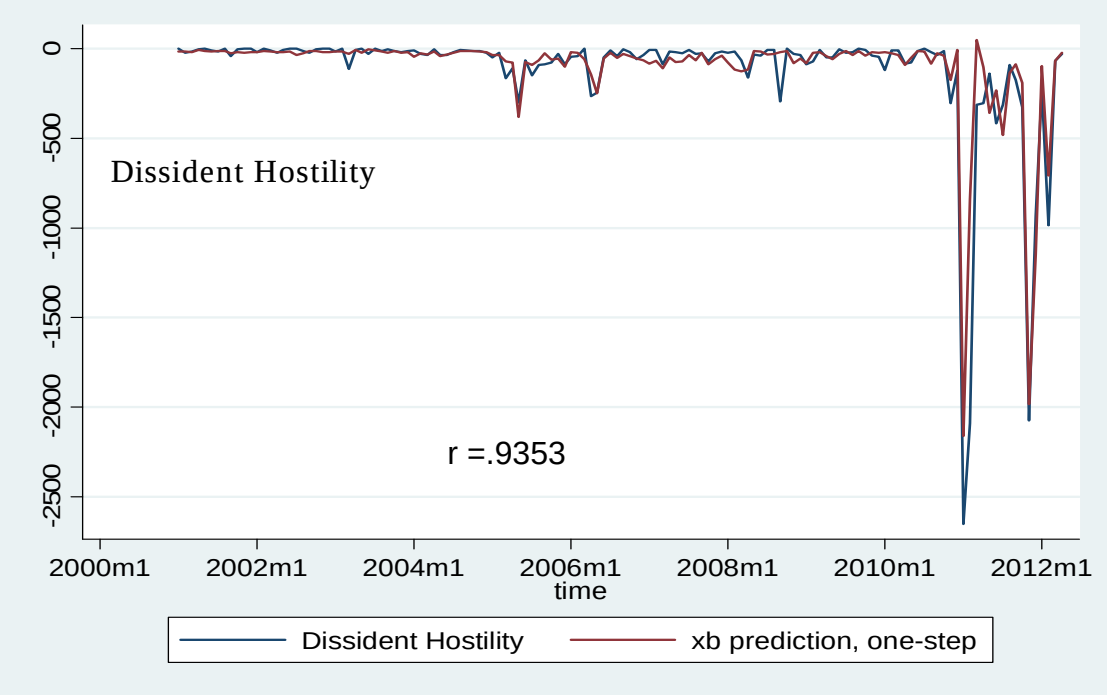

Figure 12, Model-Predicted Egyptian Dissident Hostility versus Actual Egyptian Dissident Hostility, 2001-2012

Table 3 displays the results of our time series estimating the effects of expressed emotions by societal actors toward government and dissident actors on dissident hostility in Egypt. Consistent with H2, dissident hostility declines as societal anger toward dissidents increases. Consistent with H1, we observe a very strong, positive relationship between societal fear of dissidents and dissident hostility, indicating that as fear increases so does violence. We also find support, consistent with H5, for the notion that dissidents respond to societal disgust toward their government with greater levels of hostility. Dissident violence against government institutions and symbols demonstrates that dissidents are equally disgusted with the government, and willing to take actions to overthrow the regime. Finally, consistent with H8, we observe that increased societal trust toward the government is associated with decreases in dissident violence. The coefficient on societal trust toward dissidents was also positive, yet it was not statistically significant. Taken together, these findings suggest that dissidents will exploit the emotions of fear and disgust in their effort to undermine government authority and people's faith in the government's ability to protect them from dissident actions, all of which furthers their aims.

Table 3, Effects of Expressions of Emotions on Levels of Dissident Hostility in Egypt, 2001-2012

Dissident Hostility	Coefficient	Robust SE	z	pr(z)
Gov to Dis Hostility	**0.4489497**	0.0437715	10.26	0
Gov to Dis Hostility 2	**-0.000505**	0.0000274	-18.42	0
Society to Dissident Anger	**-1.638102**	0.6779109	-2.42	0.016
Society to Dissident Fear	**28.36196**	2.450034	11.58	0
Society to Dissident Trust	0.0001268	1.578252	0	1
Society to Dissident Disgust	-0.6539234	0.5264639	-1.24	0.214
Society to Government Anger	**1.00773**	0.268879	3.75	0
Society to Government Fear	-0.2789526	0.7501911	-0.37	0.71
Society to Government Trust	**2.208435**	0.5360677	4.12	0
Society to Government Disgust	**6.968489**	0.9480729	7.35	0
_cons	-13.4036	3.651676	-3.67	0
MA	**-0.1316956**	0.0169177	-7.78	0
ARCH	**4.154678**	2.486187	1.67	0.095

When estimating the same model for Philippines' dissent, we found markedly similar results. In Figure 13, we display the substantive effects computed for societal fear and anger directed toward dissidents on dissident hostility in Egypt and the Philippines. The results suggest very consistent impacts, giving us greater confidence in the possible generalizability of these results to other cases. In the Philippines, as societal expressions of fear toward dissidents moves from 0 to -20 (the maximum), dissident hostility increases by more than 700 on a scale of -1698 to 0, with a mean of -206 and a standard deviation of 239. That result is more than two standard deviations above the mean. Similarly, in Egypt, as societal expressions of fear toward dissidents moves from 0 to -15 (the maximum), dissident hostility increases by almost 500 on a scale of -2700 to 0, with a mean of -118 and a standard deviation of 354. That result is more than one standard deviation above the mean change. The figures also show similarities with respect to slight decreases in dissident violence that result from increases in societal anger. While we found extreme similarity between Egypt and Philippine dissidents in terms of the impact of societal emotions on their behavior, we found the governments behaved quite differently. This is to be expected given the different constraints and freedoms associated with authoritarian versus democratic regimes. See the Shellman & O'Brien (2013) paper for the details.

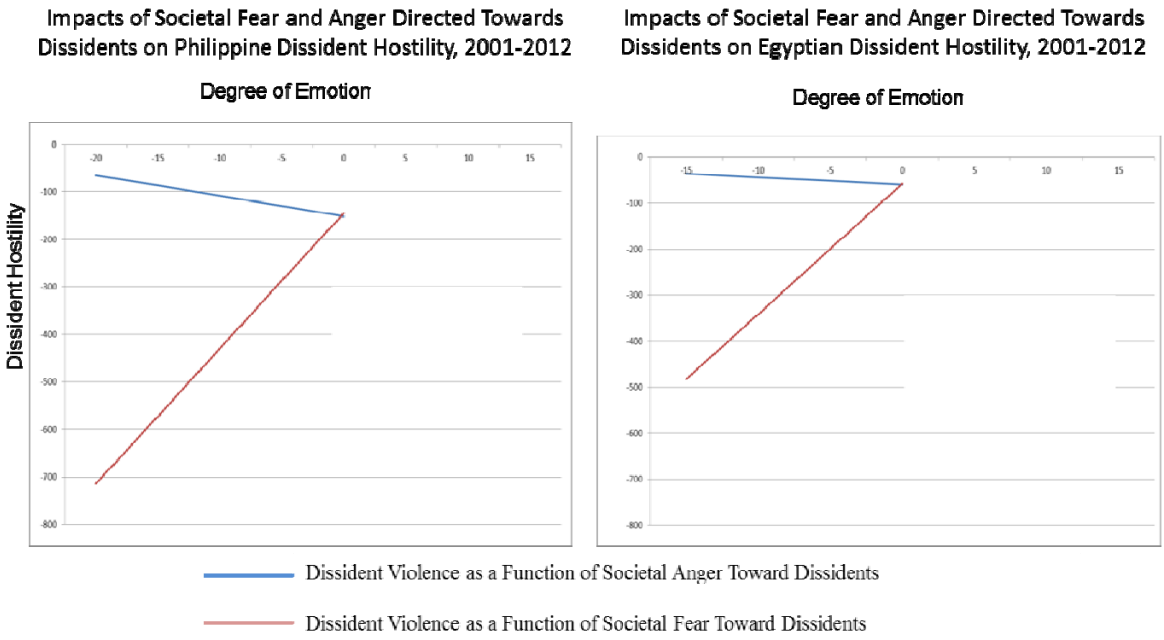

Figure 13, Impact Assessments of Fear and Anger on Dissident Hostility in the Philippines and Egypt, 2001-2012

Discourse Analysis

Overview

Having described sentiment analysis and SAE's associated capabilities, we now turn attention toward discourse analysis. In a project sponsored by AFRL, and conducted for the National Air and Space Intelligence Center (NASIC), Toman et al (2010) developed a methodology and codebook for tracking in-group alliance building and out-group distancing, as well as a template for measuring an author's *cognitive complexity*, which refers to one's ability to deal with complex issues in nuanced and balanced ways. There is some research that suggests that a group or leader's cognitive complexity, as expressed through spoken or written discourse, increases prior to developing cooperative relations with adversaries and decreases prior to violent attacks (Satterfield 1998). Thus tracking changes in in-group/out-group discourse mechanisms and cognitive complexity could provide analysts with advanced early warning of significant events with major national security implications. Although some progress has been made to develop automated tools for measuring changes in discourse in several contexts (Boisclair 2011; Brown et al 2008), most research to date relies on *manually* scoring text for important discourse markers, which is labor-intensive and too time consuming to keep up with the huge volumes of information produced by insurgent organizations, both online and off.

With this in mind, SAE performed a Phase 1 SBIR to assess the feasibility of adapting its natural language processing techniques (NLP) to automatically extract various measures of discourse from the *People's March*, and *People's Truth*, newsletters that were generated from 2005 to present by the People's War Group (PWG), a violent communist insurgent organization in India. From the *People's March* and *People's Truth*, we automatically extracted indicators for four different discourse features, and validated their predictive relationship to PWG bombing attacks throughout India:

- *Cognitive Complexity* is a psychological personality marker that refers to the extent to which an individual or organization differentiates and integrates an event. Differentiation is the number of distinctions or separate elements (i.e., factors, variables) into which an event is analyzed. Integration refers to the connections or relationships among these elements. Persons who are high in cognitive complexity are able to analyze (i.e., differentiate) a situation into many constituent elements, and then explore connections and potential relationships among the elements; they are multidimensional in their thinking. Higher complexity level (scoring higher on a 1-7 scale) is often indicated by the use of certain words and phrases including *on the other hand, it may be the case, it seems possible, one must also consider the possibility etc.).* Less complex discourse is often indicated by words and phrases suggesting an undifferentiated view of the word including *always, never, certainly, unquestionably, without a doubt, indisputable, irrefutable.* Complexity theory assumes that the more an event can be differentiated and the parts considered in novel relationships, the more refined the response and successful the solution. *Key finding:* We identified a strong negative correlation between the cognitive complexity of the documents and bombings conducted by the PWG. That is, just as Satterfield (1998) discovered, the level of cognitive complexity exhibited by the Naxalite literature systematically declined just prior to increases in their use of violence.

- *Idea density* is a psycholinguistic measurement for determining propositional idea density (P-Density) of an English Language corpus on the basis of part-of-speech tags. It's most commonly used in clinical settings to assess patients' proclivity for Alzheimer's disease and Mild Cognitive Impairment (MCI). P-density can be approximated by the number of verbs, adjectives, adverbs, prepositions, and conjunctions divided by the total number of words (Snowdon et al., 1996). It is the only technique widely accepted as a measure of one's ability to use world knowledge to structure propositions (Chand et al, n.d.). Thus, like cognitive complexity, idea density may be a useful diagnostic for detecting changes in the processing of semantic knowledge (Taler and Phillips 2008). *Key finding:* We found that idea density reflected in the PWG documents increased prior to attacks, indicating that higher levels of idea density may be exhibited when extremist movements become frustrated, unfocused in expressing their anger, and when organizations wield a wider range of accusations against their enemies.

- *Vocabulary diversity* is a measure of the range of vocabulary used in a text. Vocabulary diversity is low in cases where a single subject is discussed at length using simple language or redundant forms of language (i.e., much repetition). Vocabulary diversity is higher when many topics are discussed while introducing a wider range of vocabulary to discuss them. We incorporated MATTR (Moving Average Token Ratio) software, available as freeware from the University of Georgia, into our suite of analytics to measure vocabulary diversity. Fergadiotis (2011) found that MATTR generated scores that were better indicators of lexical diversity relative to other techniques. *Key finding:* Vocabulary diversity displayed a strong positive relationship to bombings. That is, the range of vocabulary used in the *People's March* and *People's Truth* documents seem to increase just prior to increases in Naxalite violence.

- *Emotional Sentiment:* In the social psychology literature, Matsumoto et al. (2012) make an argument that expressions of anger and disgust by in-group members toward out-group members precede mass violence. Others argue that fear and anger work in opposite directions in that fearful people tend to withdraw while angry people tend to act out. Much of this research uses data collected by hand or depicts narratives to corroborate theory. To test these hypotheses, we used our *Pathos* sentiment extraction techniques to measure ex-

pressed emotions by the PWG towards the government and other non-communist groups throughout their *People's March* newsletter. *Key findings:* emotions such as fear, anger, and disgust, have distinct, independent effects on future levels of violence; aggregating these emotions into a single composite measure of "positive" or "negative" can mask these independent effects and lead to spurious inferences.

Discourse Empirical Results

Using the PWG case, we developed a model using the discourse measures discussed above to explain and forecast bombings by the PWG as measured by the Jane's Terrorism and Insurgency Center event database. We found that many of our hypotheses and many of the hypotheses in the literature were confirmed using our completely automated discourse data. Figure 14 displays the calculated effects of various discourse indicators on the frequency of monthly Naxalite bombings in India, 2005-present. The x-axis on the first graph counts the number of emotional expressions in each document. For example, we found that while increased expressions of anger and disgust by in-group members toward out group members were followed by an increase in the frequency of bombings, increases in the number of fearful expressions were followed by a decrease in bombings. The first graph also shows that when we substituted "negative" sentiment which aggregates fear, anger, and disgust expressions the variable was insignificant as fear masked the effects of anger and disgust. The second two graphs' x-axis represent the proportion of cognitive complexity indicators and idea density markers within each text. The results support our hypotheses that increased cognitive complexity decreased subsequent bombings, while increased idea density was followed by increases in bombings.

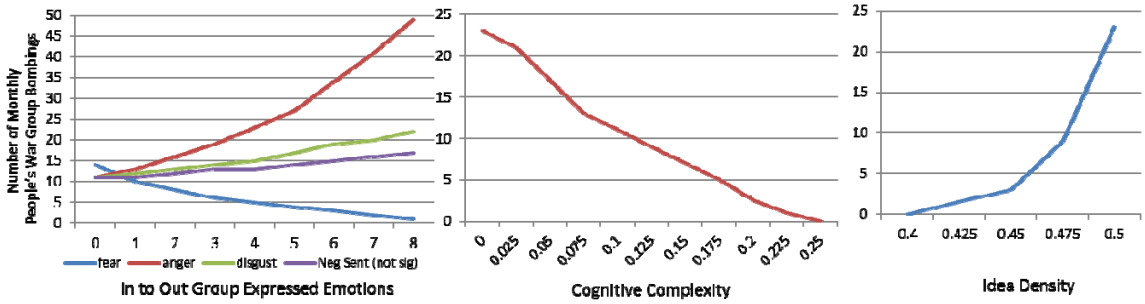

Figure 14, Effects of various discourse indicators on PWG Bombings in India

The overall model was very compelling. Figure 15 below shows the power of using these discourse markers to predict violence at least in the case of the People's War Group (we describe these modeling results in much more detail in our Phase 1 report). The blue line shows a monthly frequency count of PWG bombings throughout India. The red line shows our predicted level of bombings given our measures of vocabulary diversity, idea density, cognitive complexity, and in-to out-group displays of *fear*, *anger*, and *disgust*. A granger causality test (Joint F test of the lagged coefficients) confirmed strong statistical relationships. There is a 91% correlation between our model-fitted values and actual levels of bombings. The model only included our automated discourse indicators. There was no lagged dependent variable, structural indicators, event based or repression based measures included in the model. Discourse markers alone yield an incredibly, and somewhat surprisingly, powerful model of group-level violence.

The model predicted values and results reported in Figure 15 are contemporaneous in-sample results. Our forecasts (not shown here) revealed over an 80% correlation between out-of sample predictions made 6-months in advance and actual bombings during the forecasted 6 month periods.

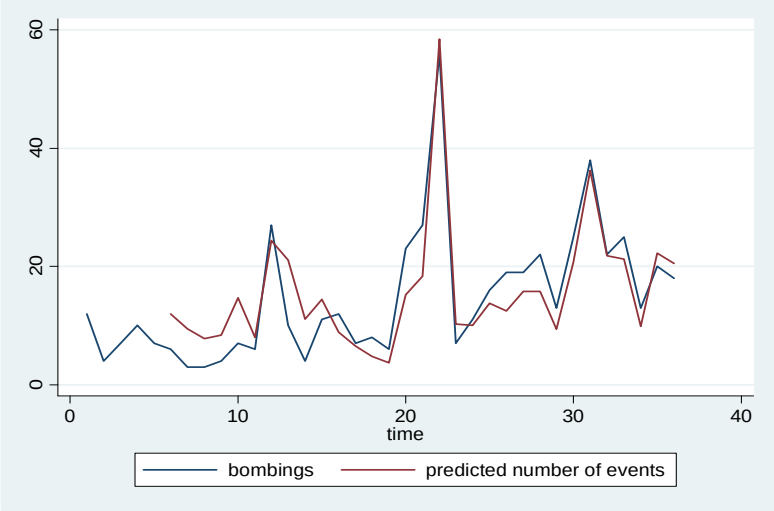

Figure 15, Actual v. Predicted PWG Bombings AS A Function of Several Auto generated Discourse Variables (6 month lagged IVs; No lagged DV, no event or repression variables – all discourse indicators)

Conclusion

Our study shows that newly developed automated sentiment analysis and discourse analysis engines produced data highly correlated with the ebb and flow of political violence in three separate cases (India, Philippines, and Egypt). The results reported in this article, while tempered by the limited set of cases examined, suggest the importance of continued efforts to uncover the mechanisms by which governments and opposition movements generate various emotional impulses and how, in turn, these emotions affect the decision calculus of their opponents. Shedding additional light on these relationships, and the contexts and boundary conditions (i.e., regime type) under which they apply, would help the research community better anticipate how these factors can serve to escalate or de-escalate violence and hostility. In order to do so we need to continue to break new ground in how we obtain near-real time data on the societal and group emotions, attitudes, rhetoric, and beliefs that shape the operational environment and impact political and social conflict outcomes.

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Chapter Nine, Integrating Social Science Knowledge into RSI

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Abstract

This chapter introduces a novel approach to making social science literature more easily accessible to analysts as they pursue deeper understanding of the human aspects of the operational environment (OE). The chapter includes a notional example of how analysts might use this approach in their work. The example addresses the topic of insurgency in an African nation, but the approach itself can be extended to important concerns such as stability in a partner nation and peacekeeping. The need for and possibility of computer-based support for access to and application of the social sciences literatures is also addressed.

Key Words

sociocultural analysis; reconnaissance; intelligence; surveillance; social science; academic literature; insurgency; Africa; sense making; assessment; JIPOE; content analysis; data mining

Bullet Points

- The Cultural Reasoning approach makes the social science literature available to non-specialists.
- The approach was developed with a focus on Insurgency in Africa but can be adapted to address other topics and regions.
- The Factor Map will allow analysts to understand how seemingly innocuous issues in the OE could be local expressions of conditions linked to insurgencies.
- Future RSI users will be able to see interrelations among components of a population's baseline understanding of their world.
- Prototype software tools that are under development will support dynamic interactions with social science literature.

Introduction

In the notional RSI [reconnaissance, surveillance, intelligence] process, the reconnaissance phase is dedicated to understanding the world as seen, experienced, valued, and practiced by the local population. Long-term reconnaissance allows a sense of what is "normal" to be assessed for a population. During the surveillance phase, changes in the baseline can be detected through a multitude of social science methods. When the changes are determined to merit further attention, intelligence activity can begin to clarify what the changes indicate, determine whether a threat appears likely, and suggest how national assets might shape events. (Flynn et al., 2012)

The RSI process envisioned by Lieutenant General Flynn et al. (2012) would transform Intelligence, Surveillance, and Reconnaissance (ISR) from a process of data synthesis by outsiders to one that seeks an insider's *understanding* of the population and its culture. Reconnaissance would be a long-term, broadly applied, and theoretically based process. It would develop an understanding of a population's own baseline view of the world, in part through the analysis of discourse and patterned behavior. Surveillance would be conducted primarily on populations whose beliefs and behaviors appear to be undergoing changes in response to grievances or actions by subversives. Intelligence operations would be conducted where needed to assess the implications for local stability and US interests of departures from the cultural baseline, and to devise appropriate responses.

Such a fundamental transformation of Reconnaissance and Surveillance will undoubtedly be accompanied by changes in other planning and analytical processes, particularly JIPOE (Joint Intelligence Preparation of the Operational Environment). Like the notional RSI, JIPOE is also concerned with developing an understanding of current conditions (characterized as situational awareness of a mission's OE) and how these conditions could change. JIPOE considers these changes in the analysis of Courses of Action and identification of potential threats. It has incorporated a number of concepts from, but is not necessarily based on, social science. Most JIPOE analysts are not subject matter experts in social science, but they will need to become familiar with the theoretical concepts linked to RSI, and to think about sociocultural issues and geospatial data in new ways. Conversely, in the current absence of doctrine and practical experience, Reconnaissance is likely to draw on existing processes currently used for assessing the OE as explicated in a variety of doctrinal sources, such as Field Manual 3-57, *Civil Affairs Operations*, and Joint Publication [JP] 2-01.3, *JIPOE*.

Although sociocultural analysis is covered in JIPOE doctrine via mnemonic devices, e.g. PMESII-PT [Political, Military, Economic, Social, Infrastructure, Information, Physical Environment, and Time] and ASCOPE [Area Structures Capabilities Organizations People and Events], there is little guidance on what information should be included in these categories when analyzing a particular situation, nor how the analyst can best identify and understand relationships among categories. Inspiration could come from the decades of social science research relevant to issues of interest to the military, which has been produced by such disciplines as anthropology, sociology, political science, geography, history, and economics. Military analysts who use social science literature often find it valuable, but few actually choose to use it. Barriers to its use include the time and effort required to identify relevant articles, to interpret and contextualize their results, to resolve apparent conflicts, and to navigate the complexity introduced by the diversity of social science disciplines, each with different methods, histories, and terminology. Yet providing analysts with better access to social science literature can result in improved understanding of the local population on its own terms and its impacts on the OE.

To improve analysts' access to social science knowledge, social science researchers based at the US Army Engineer Research and Development Center (ERDC) developed the Cultural Reasoning (CR) approach for pre-positioning social science knowledge from the academic literature so that it can be used to enhance mission-related assessment processes (Whalley et al. 2013). The CR project focuses on the social science literature about the creation and maintenance of insurgency in Africa. In this chapter, we will illustrate how the CR approach represents an alternative to the traditional literature review as a component of a notional JIPOE analysis. The CR approach involves the development of a knowledge map (which we call a Factor Map) that captures the themes or factors in a corpus of literature. In CR, links are maintained to Claims made in the articles about the various topics in the Factor Map that relate to the creation and maintenance of insurgency in Africa. We will show here how use of the Factor Map can provide analysts with an additional layer of sociocultural information that contributes to reconnaissance in support of a fundamental JIPOE goal — the holis-

tic understanding of the OE. Our discussion focuses on a prototype of the CR project's Factor Map, which allows users to explore interrelationships among more than 40 sociocultural variables found to be associated with insurgency in Africa. Software-supported versions of the tools currently under development will put the capabilities demonstrated here at the user's fingertips, making it possible for the analyst or planner to tap more easily into the vast knowledge in the academic literature.

The Factor Map: Insurgency in Africa

The Factor Map was developed by a multidisciplinary team of ERDC social scientists using a thoroughly documented, iterative process. The team first compiled a list of more than 80 factors viewed as possibly associated with the creation and maintenance of insurgency in Africa. A literature search supplemented with input from subject matter experts (SME) yielded an initial corpus of approximately 500 potentially relevant social science articles, which were evaluated to determine if and how each relates to insurgency. The team critically reviewed initial versions of the Factor Map; concepts and interrelationships were reevaluated, and SMEs aided in resolving problematic issues. Seven factors that are directly associated with insurgency (Direct Factors) and some 40 Indirect Factors were eventually retained after multiple reviews and revisions. Narratives and diagrams were prepared that explain how the Factors are associated with insurgency and how the Indirect Factors relate to Direct Factors. These relationships are based on the Claims made by the researchers whose articles comprise the Corpus. The Factor Map does not purport to be an exhaustive review of the insurgency process from the perspective of any of the disciplines represented in it; instead, it offers a concise snapshot of many of the factors that the literature recognized as influencing insurgency (Whalley et al. 2013).

Insurgency is located at the center of the Factor Map and is surrounded by the seven Factors found to be most closely associated with African insurgencies (see Figure 16): *Strength in Government Institutions*, *Ungoverned/Under-Governed Space*, *Government Economic Strength*, *Imbalance in Power Relations*, *Anti-Government Ideology*, *Grievance*, and *Recruitment by Anti-Government Actors*. Around the map's periphery are the Factors indirectly associated with insurgency. Indirect Factors that share a relationship with the same Direct Factor and that appear more likely to interact with one another than with other Indirect Factors are clustered together. *Economic Opportunity* and *History* occupy more than one location in the map because they interact with several groups of Indirect Factors.

The CR project characterizes the most fundamental results of the research conveyed in an individual article as Claims, and Claims form the basis for relationships between Factors. Where an article focuses on a clearly identified hypothesis, the central Claim often reports whether or not it was supported or rejected (Rhodes et al. 2013). Other Claims may simply be general statements about the nature of interrelationships among certain variables. Social science researchers often disagree with one another, but the existence of contradictory Claims does not necessarily mean that one is wrong. Each may be reasonable and useful for understanding certain situations. We will discuss Claims in greater detail below, but we turn first to an application of the CR Factor Map.

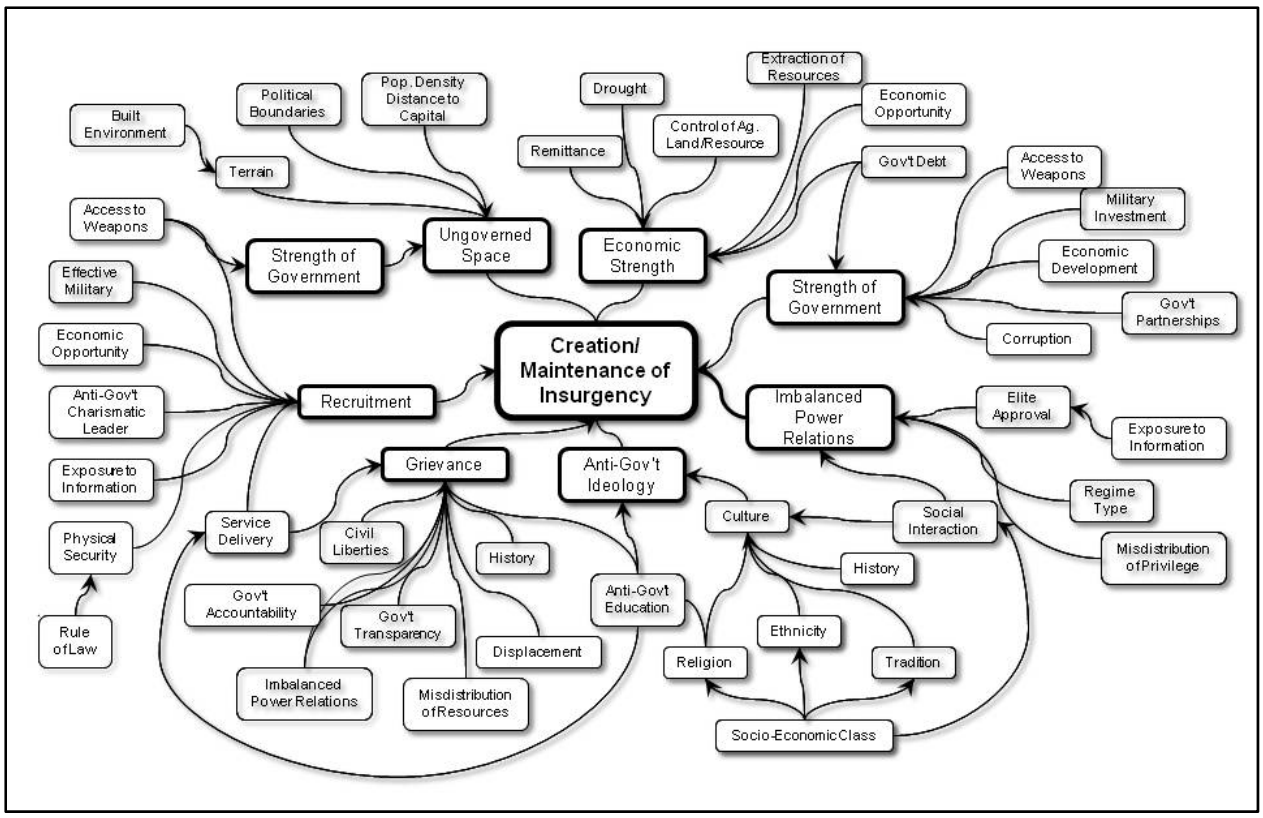

Figure 16, Cultural Reasoning Factor Map

To provide a realistic research and development context, the CR project outlined a notional humanitarian assistance/disaster relief mission to be conducted by US forces at the request of the government of Kenya. The notional mission would involve expansion of the airfield at Dadaab, near one of the world's largest refugee camps. Materiel and personnel needed for the expansion would be transported to Mombasa by sea, and then to Dadaab by land. We focus here on how one might develop an understanding of a specific subpopulation within the Kenyan city Mombasa that could inform a JIPOE analysis. We do not present a complete JIPOE analysis here; rather, we characterize the thinking surrounding the issue of Squatters. This summary will exemplify how use of the CR Factor Map can help to meet the goal for reconnaissance expressed in the statement by LTG Flynn cited above: "understanding the world as seen, experienced, valued, and practiced by the local population (Flynn et al. 2012)." Although we are not presenting a complete analysis here, we want to retain the focus of a JIPOE assessment in our example by considering how a particular situation in the OE could pose a threat to accomplishing the military mission.

Knowledge of the sociocultural components of human behavior is discovered through research and disseminated via the literatures of social science. Unfortunately, those literatures are created by and for persons with a level of subject matter expertise that is difficult to acquire over the course of a month, a year, or even a four-year undergraduate program. How can the analyst identify and extract from academic literature the facts and concepts that will contribute to a more holistic understanding of the OE? The CR approach and tools facilitate exploration of relationships between the empirical data developed during a JIPOE analysis and specific sociocultural factors derived from a broad sample of the social science literature.

Context: Mombasa, Kenya

Colonial land practices, political patronage along ethnic lines, and outright corruption led to a number of groups in Kenya losing access to their ancestral lands (Syagga 2002). Coastal people, who retain a distinct cultural identity, lost much of their own land during the late 19th and early 20th centuries. Dislocated people from the interior have migrated to the Coast for decades (Rakodi et al. 2000), and after Kenyan independence some acquired land there, including valuable tracts along Kenya's internationally known beaches. Mombasa continues to expand today, and hundreds of thousands of its poor are squatters and renters in vast informal settlements with inadequate access to water, sanitation, housing, roads, public space, and other basic services and infrastructure.

A protracted, high-profile land dispute in the Likoni area (located on the mainland south of Mombasa Island) provides a good example of land disputes involving an owner, squatters, and the government. The land owner purchased a 930-acre farm in 1975 and had by 1980 secured authorization to sell that land to developers. He still owned the property in 1999 when he fled the Kaya Bombo raiders, a gang of Coastal youth who perpetrated violence against political opponents. In his absence, his land was later occupied by squatters, who viewed it as abandoned. As a result of Mombasa's subsequent expansion, the tract is now home to some 120,000 squatters living in informal settlements that include churches, mosques, schools, and at least a few small businesses. Moreover, the tract in question is located near the mainland terminus of the heavily used Likoni Ferry. The owner won a court order to evict the squatters in 2001, but the police feared that a forced eviction would lead to wide-spread violence. As of 2013 the case had yet to be resolved and was still making local news.

Using the Factor Map: The Squatters Issue

Use of the CR approach will often begin after the analyst has compiled a great deal of information about the OE and has identified a number of important issues. These include conditions, trends, groups, and individuals that may represent significant elements of the OE. At that point, the Factor Map can help the analyst begin to make sense of the OE, and may well identify the need for additional information gathering. For the purpose of our example, we follow a particular sequence of steps for using the prototype Factor Map. Software tools for exploring the Factor Map and the Corpus will enable a user to have more freedom of engagement with the information depending on a user's information needs, time constraints, etc.

The first step in using the Factor Map is to map the analytical issues onto relevant factors. By mapping we mean identifying the factors to which analytical issues seem relevant. The Factor Map is both a sensemaking and an exploratory tool (Goffman 1974; Sieck et al. 2007; Whalley et al. 2013); it does not require one to start with data of any particular type or format. The Factors are intentionally defined in general terms, often by citing similar concepts (e.g., *Grievance* is defined as "complaint or resistance"). Factors do not necessarily need to be quantified. The analyst will often have already done enough research to be aware of trends and perhaps even potential tipping points (e.g., a rapidly increasing population density, inequality among sub-populations, or intensity of violence). Mapping is done intuitively at present, based on the analyst's experience, lessons learned, and training. However, emerging software tools will allow for keyword searching across a corpus, and additional development could provide systems that suggest possible mapping of issues to Factors for review by the analyst. Our example will consider one issue, but analysts would typically identify a number of analytical issues, each of which may map onto a number of Factors. Experience will help the analyst achieve an effective balance between mapping issues onto too few or too many Factors.

We illustrate the mapping process using the issue of squatters. In Figure 17, the Factors onto which we have mapped the Squatters issue are shaded in gray. The large number of squatters in and around Mombasa is a legacy of colonial land policies, post-independence political patronage and corruption, and the influx into the city of people seeking new opportunities. Awareness of these historical facts leads us to map the squatters issue onto the Factors *History, Corruption in Government, Government Transparency, Displacement, Pro-Government Control of Agricultural Land/Resources, and Perceived Maldistribution of Resources*; (mapped factors are shaded gray in Figure 17). Many of the squatters (and about one-quarter of all Mombasa households) are impoverished and have few prospects for improving their situation, leading us to map Squatters onto *Socio-Economic Class* and *Economic Opportunity* (Rakodi et al. 2000) as well. The city of Mombasa lacks the capability (*Strength in Government Institutions, Economic Development*) and arguably the will (*Government Accountability*) to resolve land disputes, particularly those that involve large numbers of squatters and well-connected land owners (Balala 1999; Martini 2012). Incremental progress is being made in improving access to essential services such as water, sanitation, trash collection, and medical care, but conditions in the informal settlements remain inadequate for most residents (*Service Delivery*) (Lavallee et al. 2008; Rakodi 2000:162). Security is particularly problematic due to poorly trained and corrupt police, and the existence of criminal youth gangs; thus, the informal settlements are mapped as *Ungoverned/Under-Governed Space* (Afrobarometer 2006). By mapping these relationships, the analyst is simply asserting that, based on his/her growing understanding of the OE, the Squatters issue may represent an example or expression of each of the mapped Factors. Mapping encourages the analyst to explore possibilities that may represent, or could evolve into, potential threats. Absent the mapping process, one might not recognize the relevance of and the interrelationships between these possibilities.

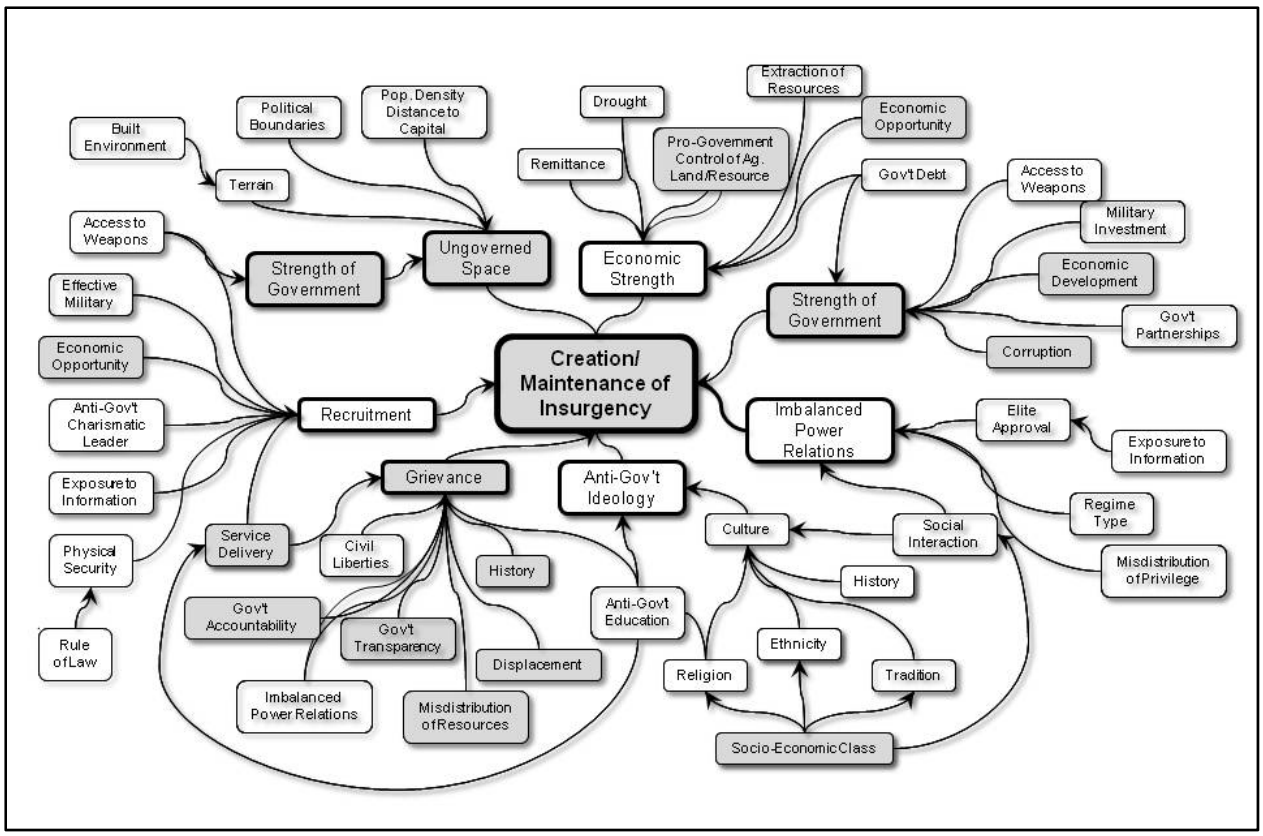

Figure 17, The Squatters issue is mapped onto the Factors shaded in gray

The next step in the iterative, sensemaking CR approach is to examine the interim results of mapping, taking into account how the Factors are distributed and interconnected. Figure 17 shows that we have mapped squatters onto a number of Indirect Factors that are associated with the Direct Factor *Grievance*. Coastal people share a distinct cultural identity, and many resent immigrants from the interior who have acquired ownership of Coastal land by means of ethnic patronage or other corrupt practices (Rakodi et al. 2000:158, 161). Many also resent that the outsiders often outcompete them for jobs. Regardless of their origin, many residents of Mombasa's large informal settlements resent the government's inability to provide essential services and security. Many of Mombasa's residents live under appalling conditions in vast informal settlements, but economic inequality is particularly visible in some areas, including the juxtaposition of walled elite neighborhoods with overcrowded informal settlements, and malls offering consumer products that few can afford. In short, living conditions in Mombasa's vast informal settlements are one of many sources of grievances and thus help create fertile ground for insurgencies (Rakodi et al. 2000:169).

Mapping analytical issues onto Factors is an iterative process. For example, in this exercise, we initially saw no reason to map squatters onto *Anti-Government Education* or *Religion*, but that decision may warrant reconsideration. Education is highly valued by African youth as a possible escape from poverty. In Kenya, education is viewed as the government's responsibility, but the public schools suffer from inadequate funding and many children from the poorest families cannot attend because of the cost of supplies and meals (Benoit 2013). The government's inability to provide adequate and affordable schools is a source of grievance. At the same time, there is growing concern in Kenya with the radicalization of Islamic youth, some of whom are marginalized by high levels of unemployment and their minority status in a primarily Christian and ethnically divided nation. This

youthful, marginalized minority may therefore be susceptible to radicalization by the Mombasa Republican Council (MRC, a coastal separatist group) and Al-Shabaab, the Somalia-based terrorist organization (IRIN 2013). The potential interplay between grievances associated with religion, a failed educational system, lack of economic opportunity, ethnic divisions, etc. might lead the analyst to reconsider how he/she maps the Squatter issue.

Insurgents also challenge the government's legitimacy (Hutchison and Johnson 2011) by providing other essential or strongly desired services more effectively than the government (often achieved by suppressing the government's effectiveness). For example, tribal leaders may mediate disputes between squatters and landlords (many squatters pay rent), and gangs may offer protection from some crimes in return for bribes. Leaders of ethnic groups who are in disfavor with the ruling government and youth gangs are sources of anti-government education. Ethnic affiliation remains a dominant factor (and accounts for a great deal of violence) in Kenya, and that would be much more apparent if additional analytical issues were mapped. In Mombasa, there is concern that the MRC could leverage the land dispute and the poor settlement conditions to mobilize the residents of Likoni against the government.

Claims

Claims convey an article's salient points concerning individual Factors and how they relate to other Factors and to the creation and maintenance of Insurgency. Claims reside in the CR Knowledge Base, and software tools now under development will support the analyst's search through Claims associated with Factors.

After initially mapping issues onto Factors, subsequent steps in the CR approach include a) browsing through Claims to identify those relevant to our analytical issue (Squatters) and to the mapped Factors, b) using Claim content to identify particularly relevant articles, c) identifying general relationships among factors onto which we have mapped issues, and d) capturing examples of specific relationships that are documented in articles. All of these actions will help us understand the local Squatter issue in the broader context of Insurgency, and actions c) and d) are likely to help us determine whether Squatters or other mapped issues that do not appear to be problematic are in fact examples of situations or conditions that have been found to be associated with insurgencies elsewhere in Africa. In the interests of brevity, we will exemplify the process using a single Claim.

The article by Omenya and Lubaale (2012), "Understanding the Tipping Point of Urban Conflict, the Case of Nairobi, Kenya," explores various types (political, landlord-tenant, economic, and domestic) of intra-city violence. The authors show how social institutions contribute to tipping common conflicts into and out of violence. Omenya and Lubaale are interested in tipping points and chains of violence rather than Insurgency, but their research clearly identifies relationships among factors associated with Insurgency.

The Claim states that there are "…moments or tipping points where small shifts in human behavior result in radically altered circumstances, thus violence. These are when: there is no more space for development; politicians use abusive language; there is arbitrary and very high increases in rent; police harass youths; messages forewarning ethnic attacks are received; the onset of crude ritual killings; tenants refuse to pay rent; there are disagreements between followers of various political parties; perceptions of election rigging are unacceptable; disruption of political meetings/rallies; rigging of elections; and the community perceives decisions to be unjust" (Omenya and Lubaale 2012:35).

Information that Omenya and Lubaale (2012) provide to support and illustrate the statement that we characterize as a Claim leads us to identify several Factor-to-Factor relationships (shaded gray in Figure 18). Stated in the most fundamental way, *Service Delivery, Socio-economic Class*, and *Civil Liberties* can all inhibit *Insurgency*. Aspects of the situation that are captured under the following Factors are seen to contribute to the development of *Insurgency*: *Exposure to Information, Ethnicity, Grievance, Political Boundaries, Unbalanced Power Relations, Corruption*, and *Rule of Law* can cause *Insurgency*. We do not specify all possible relationships, only those that the article in question addresses.

As the user maps analytical issues onto the Factor Map and considers the implications of Claims about Factor relationships, he/she is actually exploring the content of the Corpus of social science literature. The Factor Map provides some structure but few restrictions on this exploration, and the user is free to think creatively about how such Factor relationships may be expressed in his/her own data. For example, the version of the Factor Map illustrated in Figure 18, which highlights the Factors associated with our example Claim, shows that *Civil Liberties* is linked with (and represents a) *Grievance* that is, in turn, linked to *Insurgency*. We had not initially mapped Squatters on to the Factor *Civil Liberties* (Figure 17) but the Omenya and Lubaale Claim indicates it would be appropriate to do so. Those authors provide information that paints a vivid picture of how the government's frequently inept and/or politically motivated, and/or corrupt mishandling of landlord-tenant relations allows some landlords to violate Squatter's *Civil Liberties*.

The types of violence discussed by Omenya and Lubaale appear to be very common in Nairobi and Mombasa's vast squatter settlements. In the recent past, elections have been accompanied by serious ethnic violence. Many Squatters harbor strong grievances against the government, the socio-economic elite, Somali immigrants, other ethnic groups, etc. Incremental improvement in living conditions is occurring, and analysts (like local politicians and bureaucrats) might underestimate the likelihood of a cataclysmic popular uprising. Applying the CR approach would reveal that conditions in the Kenyan squatter settlements are, in fact, local expressions of Factors known to have been associated with other African insurgencies.

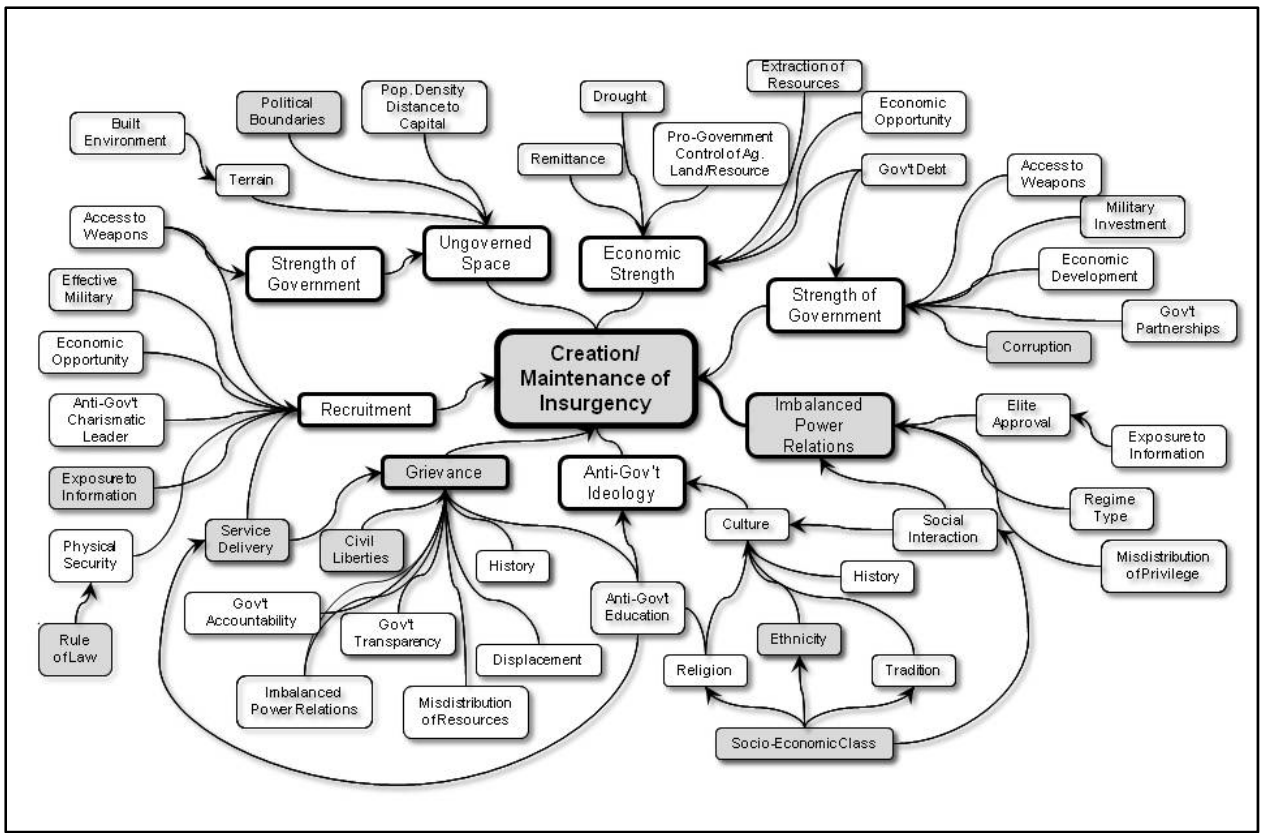

Figure 18, Factors Associated with Claim derived from Omenya and Lubaale (2012) are shaded in gray

Conclusion

CR is intended to contribute to a more insightful understanding of an OE. It is not a substitute for the data gathering and assessment processes that comprise JIPOE. We have demonstrated how the Factor Map, which is based on Claims derived from the Corpus, can be used to better understand the squatter situation in Mombasa. Such an understanding improves the likelihood that possible threats to the mission will be recognized, evaluated appropriately, and incorporated into an analysis of Courses of Action.

The CR approach makes the knowledge content of a large corpus of social science literature available to the RSI analyst. While it will not be the primary means for achieving the goal of RSI's Reconnaissance phase, it will contribute to that effort to understand "the world as seen, experienced, valued, and practiced by the local population" (Flynn et al. 2012:20). Mapping analytical issues onto broadly defined Factors will help analysts understand a population's reality as it is expressed by and in conditions, groups, and individuals. Dynamic interaction with Factor Maps provides a broad-reaching, novel sensemaking methodology that enables understanding.

The CR project chose to focus on Insurgency as it developed its approach, prototype Factor Map, and other tools. JIPOE and RSI analysts will be concerned with many other broad topics; possible examples include stability, inequality, and violent extremist organizations. The CR team is exploring data-mining techniques that have the potential to assemble corpora and develop Factor Maps far more rapidly than could be done using traditional literature reviews. Traditional literature reviews

assemble sources that the researcher must synthesize. In contrast, the CR approach produces tools that can guide an analyst's exploration of a corpus of social science literature that to the non-specialist might seem like an impenetrable mass of observations and explanations. In short, the CR approach makes the social science literature far more accessible.

The CR approach is an iterative, sense making process. It must include the following components: 1) a corpus of literature; 2) a standardized approach to annotating claims and metadata derived from the literature within the corpus; 3) a semantic knowledge base that represents 1) and 2); and finally, 4) a Factor Map that represents factors within articles but maintains links between Factors, Claims, and literature. These four components form the foundation of computer-aided knowledge exploration and visualization tools that will allow the analyst to interact dynamically with the content in the social science literature (Figure 19) (Tolone et al., 2013; Perkins et al., Forthcoming).

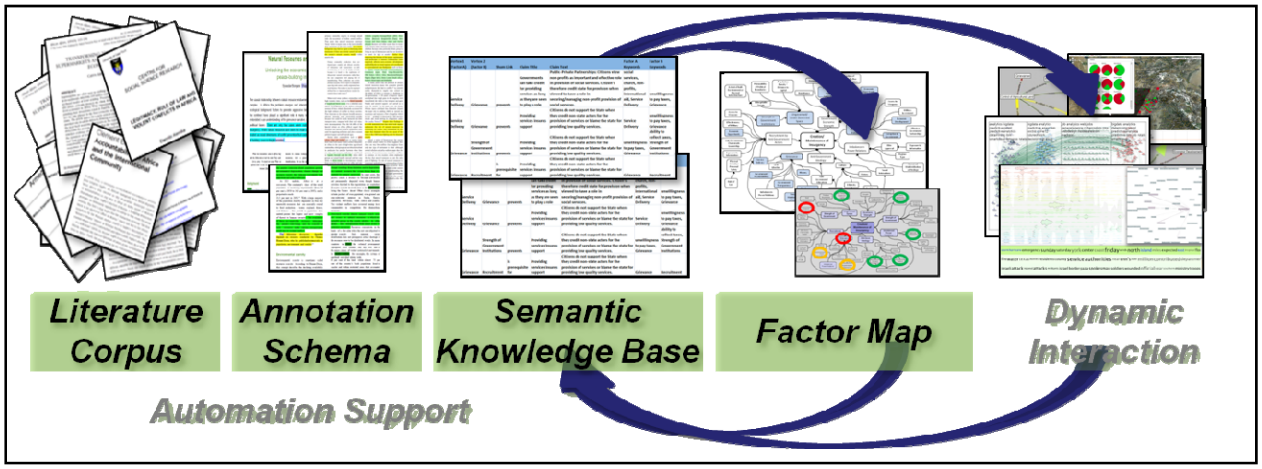

Figure 19, Key Components of the Cultural Reasoning Project

Our goal remains constant: to pre-position social science knowledge to benefit military sociocultural analysis.

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Chapter Ten, Automating Early Warning of Food Security Crises

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Abstract

There are several ways that early warning of food security crises can be automated and assessed remotely. This paper summarizes ways to link remote or operational observations to food security analysis. The paper describes two components of remote monitoring. First, a description is presented of a method that automates the use of using remote sensing information to understand the impact of weather on food production. Second, a method is presented that allows for the monitoring food prices and the impact of growing conditions and international food and fuel prices on food access.

Keywords

Food Security, Remote Sensing, Decision Support Index, Remote Monitoring, Nutrition Outcomes

Introduction

The World Food Summit of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life". Food security is a complex phenomenon that includes both physical and economic access to food that meets people's dietary needs as well as their food preferences. Food security is based on four pillars:

- Food availability, which is sufficient quantities of food available on a consistent basis;
- Food access, or having sufficient resources to obtain appropriate foods for a nutritious diet;
- Food use, or the ability to use the food you consume through having adequate basic nutrition and care, as well as enough water and sanitation.
- Food stability, or being able to access and use food at all times throughout the year.

Early warning systems have been set up over the past three decades to identify emerging crises and enable early and appropriate response from the international community. These systems use both remote observing systems as well as in-country personnel who conduct analyses and write technical updates. The focus of these reports is to provide timely and rigorous early warning and vulnerability information on emerging and evolving food security issues for a particular country or region. The US Agency for International Development's Famine Early Warning Systems Network (FEWS NET) is the US government's system for monitoring early warning systems. FEWS NET uses a suite of communications and decision support products to help decision makers act to mitigate food insecurity once it is identified through analysis. These products include monthly food security updates for 25 countries, regular food security outlooks, and alerts, as well as briefings and support to contingency and response planning efforts.

The information and analysis provided by in-country personnel is critical for understanding the local situation. Before humanitarian assistance is provided, all local actors, including civil society, international organization, local, state and national government officials as well as the executive branch of the national government must agree not only that there is a severe problem, but what the response should be. Thus the in-country personnel that FEWS NET employs play a critical role in understanding of the

In-depth studies at the country-level on livelihood strategy and markets provide additional information supports country-level food security reporting as well as program and policy development in the region. FEWS NET also works to strengthen early warning and food security networks. Activities in this area include developing capacity, building and strengthening networks, developing policy-useful information, and building consensus around food security problems and solutions.

Remote Monitoring of Food Insecurity

Recently FEWS NET has developed a remote monitoring capacity that focuses on providing food security analysis in countries that are not friendly towards the United States, and in regions that usually do not need humanitarian assistance. The remote monitoring initiative was designed to provide a flexible and inclusive service by using global and regional dataset to inexpensively add to the current portfolio of countries that FEWS NET covers. Because it does not open offices in remote monitoring countries, FEWS NET can rapidly add new capacity in new areas. Each remote monitoring country has had a study done that enables the identification of food security indicators that are then monitored regularly for anomalies that may lead to increased food insecurity. Subsequent, ongoing food security monitoring is done by FEWS NET staff in nearby country offices, in collaboration with in-country food security partners. The list of current remote monitoring countries is Angola, Burundi, Central African Republic, El Salvador, Guinea, Honduras, Lesotho, Liberia, Madagascar, Nicaragua, Senegal, Sierra Leone, Tanzania, Tajikistan, and Yemen (FEWSNET 2013).

The monitoring variables are related to one of the four components of food insecurity that have been shown to directly impact food security of a community or household. These include the information on

- The country's biophysical conditions that may affect food production;
- Analysis of a country's markets and trade, both domestic and international;
- Analysis of a country's macro-economic conditions; and
- Provision of recent nutrition and poverty baseline information.

In order to transform monitoring information into actionable intelligence, FEWS NET develops indicators in each of these areas that are then monitored for change. Two key variables are monitored routinely for change in all remote monitoring countries. These are food price dynamics and growing conditions for food production. Both these analyses take significant expertise to understand the impact of anomalies at different times and places. Remote sensing observations of weather on agriculture is particularly challenging to interpret, given the diversity of types of observations and the difficulty of understanding the significance of a negative weather anomaly at different times of the year (Brown 2008). For example, if a decline in rainfall during the very end of the growing season occurs, how will the analyst know if this signal will affect food security? A decision support

tool has been developed that will help the food security analyst use satellite data in areas where they may have little or no expertise.

Calculation of Decision Support Interface Values for FEWSNET Remote Monitoring

The Decision Support Interface (DSI) represents a new product that is part of a growing suite of remote monitoring tools using existing data products to assist in assessing crop-growing conditions. Developed by the Climate Hazard Group at the University of California Santa Barbara, the DSI indicates areas where remotely sensed data show that further investigation into food security conditions may be needed. It allows the analyst to access remote sensing information in an integrated tool that:

- screens remote sensing data for the active growing period, so that anomalous weather conditions out-of-season are not shown;
- weights the remote sensing information for periods that are more important for ultimate crop yield;
- removes non-cropped areas such as urban, forest, water and parkland where weather-related production changes are unlikely to be important for food security; and
- standardizes the impact of weather-related food security impacts to provide a simple decision interface to prompt the user to seek more information.

It is designed to be a first-check of conditions for both core monitoring areas as well as those where standard FEWS NET monitoring information may not be available. Initially developed for Africa, the DSI integrates different products and methods into a single assessment of crop-growing conditions.

Two primary data inputs drive the DSI: National Oceanic and Atmospheric Administration produced satellite rainfall estimates (Xie and Arkin 1997) and expedited Moderate Resolution Imaging Spectroradiometer (eMODIS) Normalized Difference Vegetation Index (NDVI) (Jenkerson et al. 2010). The temporal monitoring unit is a quasi-10-day period encompassing either the first ten days (1st-10th), second ten days (11th-20th), or remainder of the month (21st-end). Rainfall accumulations at durations of 1, 3, 6, 9, and 18 ten day periods are used to capture rainfall conditions for various intervals of the crop calendar. NDVI data are a composite of greenness values over a 10-day period, smoothed in time to correct for atmospheric contamination. Spatial averages of these input data are extracted for defined agricultural regions.

The agricultural areas synthesize the best available data for each country, and contain information about typical start and end of the growing season used to determine the period of monitoring for each agriculture region. Spatial averages of rainfall and NDVI for each region are assigned two percentiles, one – termed empirical – based on the ranking of the agricultural weather compared to historical weather for the interval, and a second – termed theoretical – based on a parametric distribution of the current year compared to historical amounts. Percentiles for the multiple rainfall intervals and NDVI are translated to drought severity categories based on criteria used in the U.S. Drought Monitor product produced by the U.S. Department of Agriculture and the National Drought Mitigation Center (UNL 2013).

Drought categories range from 0-4, capturing a range of conditions from abnormally dry to exceptional drought, respectively. Events not in the driest third of either the empirical or theoretical are assigned a value of -1 (non-dry conditions). The resulting DSI number calculated for each agricultural polygon is a blend of the drought category values for both percentile rankings for all rainfall

intervals and the NDVI. The weights assigned to each of the input values change with the progression of the growing season, gradually favoring longer-term rainfall accumulation and NDVI values. Locations that are not in the monitoring season are not assigned a DSI value. It is anticipated that this product will become a regular, complementary piece of the FEWS NET monitoring activities, and be expanded to additional monitoring regions of the globe, and include a public web interface allowing users to visualize the spatial characteristics of the DSI values, as well as investigate the individual input values contributing to the DSI for a polygon. Figure 20 shows a sample of the country-level DSI ranking.

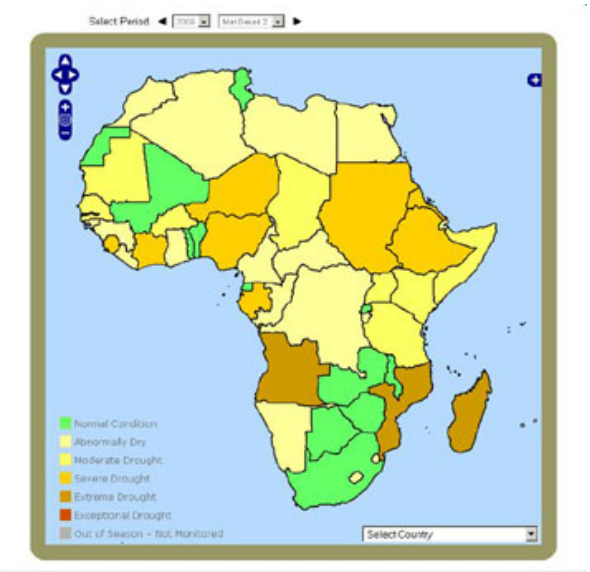


Figure 20, Decision Support Index tool, showing different levels of drought

Market and Food Price Analysis

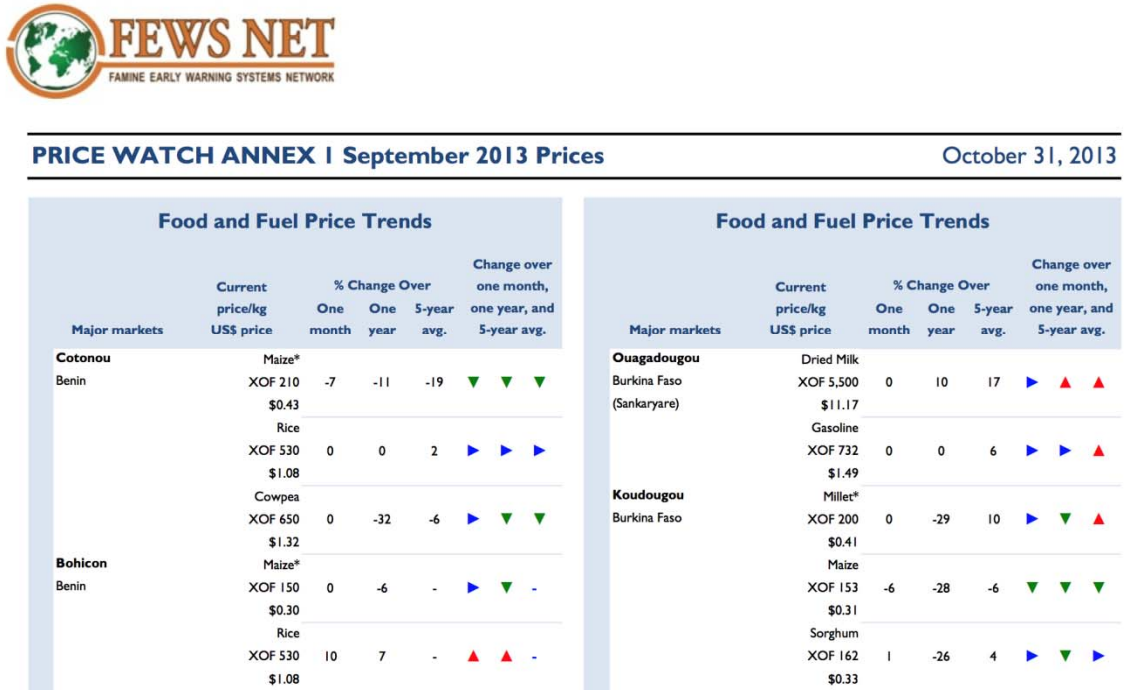
The DSI provides insight into threats to food production. New analysis on local food prices will allow analysis of likely threats to food access, particularly in urban areas. Many food insecure live in urban areas or are rural farmers who must purchase food in the market to feed their families when their own production cannot meet their own needs.

Food access refers to the affordability and allocation of food. When food prices increase rapidly over short periods, intense pressure is put on governments and social networks to respond (Bellemare 2013). The recent food price crisis in 2008 caused an increase in food prices of 51 percent between January 2007 and March 2008. This increase in food prices was associated with food riots in several developing countries across Asia, Africa, Europe and the Americas (Bush 2010; Paarlberg 2011; Schneider 2008). The Haitian prime minister Jacques-Édouard Alexis resigned in February 2008 after riots over food price spikes (Collier 2011; Gouel 2013), and was not the only government to be threatened by instability due to rapid price increases.

For these reasons, monitoring food prices is a critical part of food security assessment, and can be done remotely very effectively. At the moment, FEWS NET does not monitor food prices in an integrated way with biophysical shocks. New research is being done which will allow for an integrated assessment in the near future (Kshirsagar and Brown 2013). Understanding how food prices

change with shocks from international prices of food and fuel as well as to local weather shocks is an important aspect of price monitoring.

Food price monitoring is currently done by providing a monthly Price Watch Report and Annex system, which reports on food price movements one month before the date of the report (Figure 21). Thus for the October 31, 2013 report, the prices are for September 2013. Each report provides a set of key messages for the main regions that are experiencing changes in their prices, as well as notes on movements in global commodity and fuel prices (Brown et al. 2012).



FEWS NET
FAMINE EARLY WARNING SYSTEMS NETWORK

PRICE WATCH ANNEX | September 2013 Prices October 31, 2013

Food and Fuel Price Trends

Major markets		Current price/kg US$ price	% Change Over: One month	One year	5-year avg.	Change over one month, one year, and 5-year avg.
Cotonou	Maize*					
Benin	XOF 210	$0.43	-7	-11	-19	▼ ▼ ▼
	Rice					
	XOF 530	$1.08	0	0	2	► ► ►
	Cowpea					
	XOF 650	$1.32	0	-32	-6	► ▼ ▼
Bohicon	Maize*					
Benin	XOF 150	$0.30	0	-6	-	► ▼ -
	Rice					
	XOF 530	$1.08	10	7	-	▲ ▲ -

Food and Fuel Price Trends

Major markets		Current price/kg US$ price	% Change Over: One month	One year	5-year avg.	Change over one month, one year, and 5-year avg.
Ouagadougou	Dried Milk					
Burkina Faso	XOF 5,500	$11.17	0	10	17	► ▲ ▲
(Sankaryare)	Gasoline					
	XOF 732	$1.49	0	0	6	► ► ▲
Koudougou	Millet*					
Burkina Faso	XOF 200	$0.41	0	-29	10	► ▼ ▲
	Maize					
	XOF 153	$0.31	-6	-28	-6	▼ ▼ ▼
	Sorghum					
	XOF 162	$0.33	1	-26	4	► ▼ ►

Figure 21, Snapshot of the FEWS NET Food Price Watch Annex

Food Price Indices to Monitor Change

Food prices in remote, rural markets are often isolated from the international market (Minot 2012). By creating food price indices that incorporate locally important food stuffs such as beans, potatoes, teff, sorghum, millet, cowpea, cassava, yams, in addition to the international commodities used by the international community (rice, wheat, corn), we can better assess local access to food.

A price index is a normalized, weighted average of prices for a given class of goods during a period of time. Food price indices are based upon weighted averages of food commodity prices in international export markets, expressed in terms of their value in a base period, and calculated on a monthly basis. The food price indices of the FAO the International Monetary Fund (IMF), and the World Bank (WB) are indicators of worldwide trends in food commodity prices, and are often used to indicate the ability of the poor to purchase food in a variety of locations. All three indices are constructed using the same formula (Laspeyres index), but the sets of commodities and markets that they include, as well as the weights that are assigned, vary depending on the index. The FAO cereals index comprises wheat, maize, and rice. To take into account the importance of the wheat,

maize, and rice prices used in the index, the commodities are weighted with world export shares in 2002–04, as provided by the FAO statistical database.

In research presented in Brown et al (2012), the food price data is made into indices using information on local production systems and patterns of food consumption. We created a National Cereals Price Index for 35 food insecure countries using prices of commodities that are important in the diet of food insecure communities. We made regional indices for West Africa, Southern Africa, East Africa, Central America and Central Asia for: cereals only, non-cereals only, and all food prices available indices, and for capital cities only, non-capital cities and all markets indices to allow easy comparison with the FAO cereals index (Brown et al. 2012). Regional indices were constructed to compare directly to the FAO cereals index for five regions, and to include markets (all non- capital cities) and commodities (all food prices which were not maize, wheat and rice) to highlight the relevance of our regional price indices for food security. FEWS NET has been using these indices in its reporting (Figure 22).

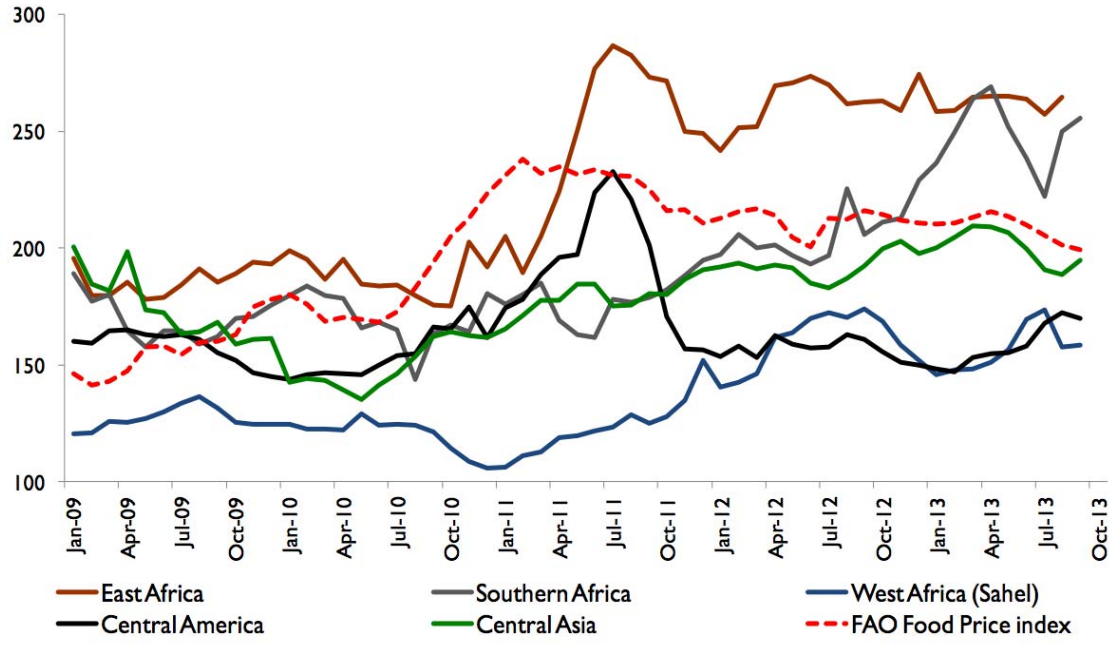


Figure 22, FEWS NET regional price indices and FAO Food Price Index, January 2009 – September 2013

By understanding the impact of international prices and local weather shocks, as measured by remote sensing, an improved understanding of the functioning of local food markets and the likelihood that extreme weather or international price shocks have affected local food access and therefore food security. This information can be integrated into the remotely produced Food Price Annex and other monitoring tools to improve an understanding of the likelihood of food security problems. Because of the delay between observation of prices and integration of the data into a database and the reporting on recent changes, there is room for a 'predictive' element to this report. Projections of price movements one or two months into the future using econometric modeling could allow an assessment of changes today and next month, improving the ability of FEWS NET to respond to rapid changes in food prices.

Conclusions

Remote monitoring of food security problems is possible and can be very helpful, but it would by necessity require significant investment in the necessary indicators in any new location, as well as funding to follow up on a problem once it has been identified. Food security is complex and can be caused by many non-observable problems such as poor government policy, an atmosphere of violence and fear, and disruptions in trade that cannot be seen remotely. However, remote observations can have a significant contribution to our knowledge of and response to problems as they emerge. To this end, FEWS NET and others have already begun these monitoring programs and are moving forward with them.

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Chapter Eleven, Identifying and Understanding Trust Relationships in Social Media

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Abstract

The explosion of social media use over the past decade has yielded an unprecedented amount of data from which analysts can extract information and derive insights. To accomplish this, analysts need to use computer-based tools to filter, search, identify, interpret, and prioritize social media data. Social network analysis techniques provide a starting point for these capabilities but do not yet provide a complete solution. Analysis techniques, statistics, and metrics still need to be created that address the specific problems associated with social media. This paper uses a Twitter example to develop and test a suite of four metrics that identify information-based trust relationships for potential use in natural disasters, demonstrations, and violent crises.

Keywords

Trust relationship identification, trust in information, social media, social network analysis, metric development.

Introduction

The recent proliferation of social media has changed the information landscape for a wide variety of social behaviors including natural disasters, demonstrations, and violent crises. People experiencing these events now use a variety of social media, such as Twitter, to share information in real time, information that authorities can use to identify and help victims. However, given the massive amount of social media data that can be generated during crises, it is difficult to identify the relatively rare messages with important and valuable information. Doing so requires performing several related analysis activities including filtering away irrelevant messages, accurately evaluating the remaining messages, and correctly identifying their potential value. These activities may change according to the type of data being analyzed, who is analyzing it, and for what purpose it is being analyzed. Given the large amounts of social media data to be reviewed during crises, a computer-aided solution that helps evaluate this information quickly and correctly is clearly required for government organizations (SRG 2013; Goolsby 2013).

During crises, significant amounts of social media data need to be examined by operators and analysts, so proper consideration must be given to the computer-based tools they require. Analysts and other users need to perform a range of operations on social media data, which includes searching for relevant information, assessing its value, and prioritizing it. One of the best ways to understand data intuitively involves visualizing it, but visualizing very large networks of the kind generated by social media is difficult to accomplish with naïve solutions as they yield incomprehensible graphics. Cluster analysis provides a way to filter and simplify networks making them easier to visualize. Clusters or groups can be identified by locating the trusted relationships that define the group. In social media, these relationships are established through, "trust in information." Social network analysis provides a starting point with its network statistics and analysis techniques, but identify-

ing clusters and groups within social media data remains an ongoing research area, which we address by identifying trust relationships.

To ensure that analyst needs are adequately addressed, previous experience with human, socio-cultural, and behavioral (HSCB) models is leveraged and applied to the analysis of social media (Pfautz et al. 2009). First, theory is extracted from the research community and used to inform social media analyst tool development. Specifically, a theory of "trust in information" is developed, summarized, and used to identify trust relationships within social media data. Second, a suite of metrics are crafted and adapted to identify sources of expert information during crises rather than the more easily identified or "central" information sources such newscasters or senior government officials. That is, we seek to identify the trusted experts from whom these central people get their information. These metrics are created to explore a larger social media analysis palette as opposed to relying on the more commonly used centrality measures that simply identify the raw numbers of connections that underlie most social network analyses (Roberts and Everton 2011). Third, once these new social media analysis techniques have been developed, they are then tested, evaluated, and validated. Such testing provides evidence that social media analysts can believe and understand the results provided by the analysis techniques, which will help them to be employed and used (Pfautz et al. 2009). The developed trust metrics are tested on an anonymized Twitter data set from the autumn of 2011 Occupy Wall Street (OWS) movement. The results indicate that trust relationships can be found within social media using the developed metrics specifically and with computer-based tools generally. In conclusion, we discuss our trust and social media results in their research and operational contexts.

Trust in Information

Trust is central to the study of society, groups, and organizations because it provides the fundamental and basic motivation behind people coming together to cooperate for a common purpose (Arrow 1974; Poteete et al. 2010). Concepts about trust, however, are becoming more complicated as people communicate and form networks through social media (Henry and Dietz 2011). Traditional trust studies focused on cases from small, isolated, and institutional settings (Hahn et al. 2006; Ruttan 2006), or drew conclusions from highly controlled experiments (Bouma et al. 2008; Vollan 2008). Such studies are insufficient to address real-world social interactions (Sabatier 1999), let alone the increased complexity of modern social media. This section extends traditional definitions of trust in three parts. First, traditional trust concepts are discussed as "trust in action." Second, the complexities presented by social media are discussed. Third, a set of "trust in information" concepts are offered to address the analytic challenges posed by modern networks and social media.

Traditional notions of trust are based upon small group settings in which repeated face-to-face interactions are the norm (Siegrist et al. 2007; Renn 2008). Through multiple, reciprocal, and long-term social interactions, trust among the small group members is built up over time. Trust in action is rooted in such settings and is based on a set of related behaviors, three of which are long-term and one short-term (Coleman 1990; Sztompka 1999). First, people have varying levels of willingness to take trusting actions, in which trust is defined as risking something of value based on the actions of others. Second, people exhibit varying levels of aversion to betrayal—that is, situations in which something of value is lost based on the actions of others. Third, people also exhibit varying degrees of altruism as defined by concern for the well-being of others. Fourth, people calculate and modify betrayal odds based on direct calculation, a short-term behavior that uses currently available information. So the first three personal behaviors—willingness to trust, aversion to betrayal, and altruism—are long-term characteristics that are resistant to short-term changes. The fourth,

calculation of betrayal odds, is more short-term and thus more modifiable. Together, these four behaviors form the analytic baseline of trust in action.

Trust in action—based as it is in small group, face-to-face settings—needs to be modified to address real-world social processes that encompass larger numbers of people and more complex dynamics (Sabatier 1999). The recent growth of social media provides the potential for larger empirical studies of trust to be performed (Adali et al. 2010), and the increased importance of these social media provides the incentive to undertake such studies. Initial research indicates several important and emerging system features. Trust studies in large social networks exhibit *polycentrism*, the presence of multiple decision centers or groups, each with its own rules and relationships (Young 2002). As trust studies transition from small group settings to social media, polycentrism will prove an increasingly salient system feature. The empirical data available from social media also provides the potential to yield insights into the ways that trust evolves over time and leads to collaboration among seemingly divergent groups (Fehr 2009). This evolving conception of trust can also lead to group formation that reinforces polycentrism, as people who have collaborated in the past tend to collaborate in the future. Separate groups with different beliefs and internal structures may also lead to different information uptake and processing dynamics through "confirmation bias," in which people tend to believe information that confirms what they already know (Munro and Ditto 1997). Finally, trust in social media will be based on the information available through social media rather than real-world actions observed in a face-to-face setting, which will have social consequences. These questions pose research opportunities for both social media and the networks that emerge from them because, while much information is available, that information needs to be organized, fitted, and understood in order to provide trustable social media insights.

Trust in information provides a framework for trust studies in social media by considering both behavioral indicators (reflected through communications network structure) and information content. Two key features of network structure are important for trust in information. The first network feature concerns two-way relationships, such as transitivity and reciprocity, that represent interactions with the potential for trust in social media (Fehr and Gächter 2000; Rasmusen 2001). The second network feature concerns reputation or centrality, which indicates status or leadership within the social network. Such status within a network can, in turn, lead to preferential attachment dynamics, in which those with many social connections or high status then tend to exhibit even more connections over time (Snijders et al. 2006). As well as network position, the content of the messages that pass among the members of the network also need to be considered because it is through messages that individuals ascertain whether others are similar to themselves. Similarity between those in a network, i.e. *homophily*, plays an important role in social media dynamics because people tend to trust those who exhibit similar traits, thoughts, and opinions (McPherson et al. 2001). This process of self-selection helps to drive group formation and polycentrism, so determining just how those in social media determine similarity and how those homophily-driven processes play out is an important feature of trust.

To conclude, trust in information leverages trust in action by focusing on network position to determine transitivity, reciprocity, reputation, and centrality. Analyzing message content to determine similarity and homophily among individuals is recognized as important but is not addressed herein. Our initial attempts to implement these ideas are discussed in the following section.

Trust Metric Development

We now present structure-based metrics that focus on the identification of trustworthy individuals in social media data. As discussed above, our concept of trust in information considers network

structural elements rather than message content, which is outside the scope of this study. We began by formalizing a conceptual hypothesis: that a social media user (that is, a *node*) who regularly interacts with high-profile and highly-connected users (e.g., news sources, senior government officials, celebrities, etc.) could provide high-value and potentially trustworthy information. This hypothesis leads to two graph-theoretic definitions. We define *first-order influence* as simply the degree to which a user receives attention from others in a social network. First-order influencers are not necessarily inherently trustworthy—news sources may be biased or untrustworthy in many areas of the world, and the same is true of other high-profile figures such as celebrities. For subject matter experts who have indirect influence, the quantity of attention is not as important as the quality of that attention as these trusted relationships allow their expertise to be distributed and shared. It is this insight that allows for the identification of trust relationships. We define *second-order influence* as the degree to which a user *indirectly* receives attention in a social network as shown in Figure 23. Second-order influence measures the propagation of a user's ideas into the larger social network by means other than direct messages: for example, when a news anchor broadcasts information provided by a university professor. We hypothesize that second-order influencers are more likely to provide trustworthy information, since first-order influencers look to them for expert, timely, and detailed knowledge. In our OWS Twitter data set, we had access to the messages, but not to follower data, for the users in question. In situations like this, a simple metric like degree centrality performed on a directed and unweighted Twitter "mention network" can identify users with high first-order influence. Without resorting to computationally-intensive and unreliable content analysis techniques, we exploit a simple Twitter social convention, retweeting, to track second-order influence. While this specific mechanism is unique to Twitter, the general concept applies to most social media (e.g., resharing on Facebook), email systems (forwarding or quoting), and collaborative data sharing and office productivity software (through mechanisms as simple as cutting and pasting).

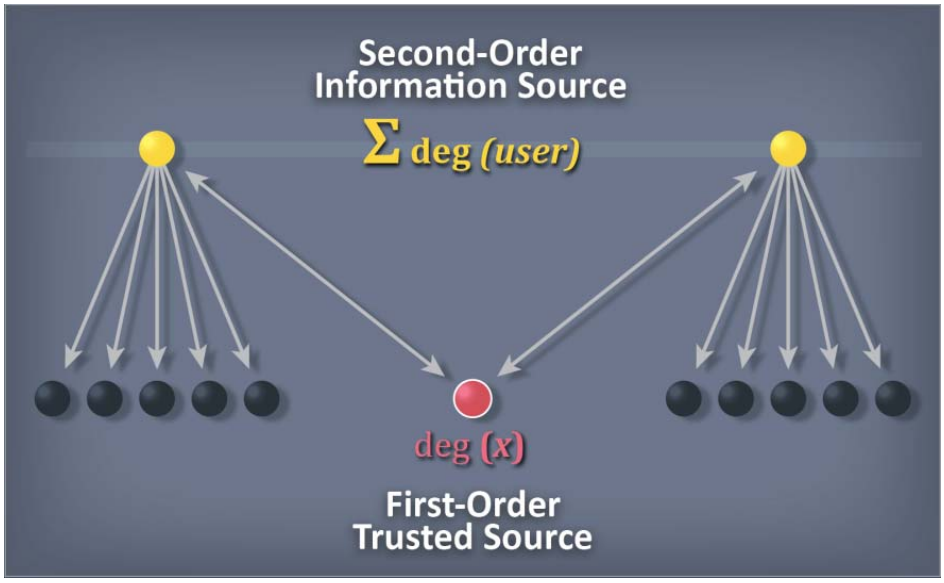

Figure 23: First and Second-Order Influence

In our test data, we consider users to have high second-order influence if they are frequently retweeted by users with high first-order influence. Several metrics, such as Katz centrality or the PageRank metric that underlies Google's search engine, can identify users with high first-order influence, but our desired property is slightly more specific. Due to frequently dense connections be-

tween high first-order influence users, these users also have very high second-order influence, usually the highest in the network. For this study, we wanted to locate users with high second-order and low first-order influence. This distinction is not as simple as eliminating users with high first-order influence from the result set, as we will see in the discussion below. These users, we theorize, would include on-the-scene local reports. These might be as diverse as trusted family members or news reporters reporting on natural disasters. They might also include the man from Abbottabad who used Twitter to report on helicopter noise during the Osama Bin Laden raid. Identifying and tracking these users would remove the delay associated with them being retweeted by high-profile news sources and would remove any filtering being done by those sources. To locate these users, we developed and tested a suite of four potential metrics.

$$\text{DSO} = \sum_{user \in adj(x)} \deg(user) - \deg(x) \quad \text{(Eq. 1)}$$

Equation 1 defines the Decremented Second-Order (DSO) Centrality algorithm, which is calculated for every user *x*, also called "node *x*," in the network. The term deg (x) denotes first-order influence—the number of users who are connected directly to user *x*. In Figure 23, for example, user *x* is represented by the red dot and has a deg (x) of two because it is connected to the two yellow dots. The term $\sum_{user \in adj(x)} \deg(user)$ denotes second-order influence—the sum of all the users (or nodes) who are connected or *adjacent* (adj) to user *x*. In Figure 23, these adjacent users are represented by the yellow dots, each of which has 6 connections for a total of twelve. Completing the example, user *x*, the red dot in Figure 23, has a DSO Centrality value of 12 – 2 or 10. DSO is a straightforward, naïve approach that proved insufficient for several reasons. First, the natural degree distribution of the network was broad enough that the average degree of the network was significantly greater than 1. In fact, we considered subtracting the degree of the central user multiplied by a coefficient equal to the average degree of the network, but rejected this as too closely associated with a single data set, making it harder to generalize. Second, we found that users with high first-order influence often had considerably higher second-order influence than the users we were looking for, leading them to continue outperforming our target users.

$$\text{SSO} = \sum_{user \in adj(x)} \deg(user) \,/\, \deg(x) \quad \text{(Eq. 2)}$$

Our second metric, Scaled Second-Order (SSO) Centrality (see Equation 2), took a different analytic approach. Rather than the linear difference of second and first-order degree centralities, we instead take the ratio of the two (or equivalently, we calculate the average degree of users who refer to the central, first-order user). So continuing the example, Figure 23 has an SSO score of 12/2 or 6. This metric proved much more successful. The comparatively larger second-order influence of high-profile users was effectively reduced to simply the number of high-profile users referred to them, which was considerably lower than the values for low-profile users referred to by high-profile ones. This metric provided good progress towards our goals, but has several drawbacks. Most notably, it does not provide higher values for users who are mentioned repeatedly by high-profile users or for users who are mentioned by multiple high-profile users.

$$\text{LBSO} = \sum_{user \in adj(x)} \log(\deg(user)) \quad \text{(Eq. 3)}$$

Based on the results from the DSO and SSO metrics, we developed a new pair of metrics, each a refined version of the previous two. We began with a refined version of the DSO Centrality metric, Logarithm-Based Second-Order (LBSO) Centrality (see Equation 3). So Figure 23 yields an LBSO score of (ln(6)+ln(6)) or 3.58. Rather than effectively subtracting 1 from every adjacent user's de-

gree before adding it to a running sum, we instead take the logarithm of each user's centrality before adding it to the sum. This still has the effect of removing all nodes with degree 1 from the sum, but it also reduces the impact of the medium-profile users. Ultimately even this proves ineffective as it fails to resolve the problems that stem from the comparatively higher second-order influence of high-profile users over the users for which we were looking.

$$\text{EWSO} = \frac{\sum_{user \in adj(x)} \deg(user) \cdot edgeweight(user,x)}{\deg(x)} \quad \text{(Eq. 4)}$$

Our refined version of the SSO Centrality metric is called Edge-Weighted Second-Order (EWSO) Centrality (see Equation 4). To calculate it, we incorporate additional graph information to the equation by giving edges (based on mentions) a weight equal to the log of the number of mentions between the relevant pair of users. From this, we calculate a weighted degree average by multiplying each adjacent user's degree by the weight of the edge between them and the first-order, central user *x* before adding them to the sum (we call this sum, before it is divided by the central node's degree, the weighted second-order degree centrality). This successfully promotes users repeatedly mentioned by the same high-profile source over those who are only mentioned a single time. This approach still results in the highest scores being achieved by users only ever referenced by a single high-profile user, but this is considered acceptable as ultimately any metric that does not suffer from this problem requires a way to categorize nodes into "low-profile" and "high-profile," and as both iterations of the linear difference metric prove, this ends up being a highly network-specific question.

After comparing all four metrics, we determined that Edge-Weighted Second-Order (EWSO) Centrality generally was the most successful at identifying users with high second-order influence and low first-order influence. These metrics are empirically tested in the following section.

Trust Metric Testing

We test the trust metrics by applying them to an anonymized OWS data set, which contains 600MB worth of tweets, and then compare the metrics against one another to test their ability to identify promising second-order influencers. The running time to analyze the data set was under five minutes. Each of the algorithms rely upon a summation of the degree of surrounding users, meaning that running an algorithm on a network of N nodes will require an analysis of each node's degree, and for each node, those degrees must be operated on and summed. This process scales linearly, meaning that these metrics are likely to prove effective for all conceivable applications.

Table 4 presents four result sets, each corresponding to one of the four algorithms developed: (1) Decremented Second-Order (DSO) Centrality, (2) Scaled Second-Order (SSO) Centrality, (3) Log-Based Second-Order (LBSO) Centrality, and (4) Edge-Weighted Second-Order (EWSO) Centrality. Each result set focuses on and is ordered by a single metric, with the highest value nodes from that metric presented in order. The node IDs and values for the other metrics are provided to allow for comparison of results across metrics and to identify correlations among their results.

Table 4: Result sets for the four developed metrics with their ten highest values highlighted

Decremented Second-Order (DSO)				
Node ID	**DSO**	SSO	LBSO	EWSO
19	**560**	1.43	12.2	2.77
1818	**391**	1.18	5.26	1.74
62	**386**	2.018	10.9	3.32
367	**236**	3.19	12.0	5.86
2035	**207**	0.207	0.0414	0.207
259	**195**	1.18	2.50	1.56
20	**187**	3.39	6.80	4.23
826	**181**	2.58	3.96	3.39
212	**171**	2.06	3.90	3.29
1194	**163**	3.57	9.74	6.41

Scaled Second-Order (SSO)				
Node ID	DSO	**SSO**	LBSO	EWSO
14043	0	**188**	2.68	394
14006	0	**188**	1.28	188
5316	0	**145**	1.16	145
16907	0	**123**	1.09	123
14627	0	**123**	1.09	123
14314	0	**123**	1.09	123
14088	0	**123**	1.09	123
14087	0	**123**	1.09	123
13525	0	**123**	1.09	123
12827	0	**123**	1.09	123

Log-Based Second-Order (LBSO)				
Node ID	DSO	SSO	**LBSO**	EWSO
344	122	5.21	**14.0**	11.1
19	560	1.43	**12.2**	2.77
367	236	3.19	**12.0**	5.86
62	386	2.01	**10.9**	3.32
4452	63	11.8	**10.6**	17.8
385	81	6.13	**10.6**	15.9
1194	163	3.57	**9.74**	6.41
2206	144	5.10	**9.71**	7.41
436	133	4.09	**9.20**	6.26
1309	66	5.45	**8.70**	12.0

Edge-Weighted Second-Order (EWSO)				
Node ID	DSO	SSO	LBSO	**EWSO**
14043	0	188	2.68	**395**
11455	0	123	2.61	**294**
11454	0	123	1.86	**208**
2778	0	123	1.86	**208**
1062	0	123	1.86	**208**
14006	0	188	1.28	**188**
5316	0	145	1.16	**145**
16907	0	123	1.09	**123**
14627	0	123	1.09	**123**
14314	0	123	1.09	**123**

The upper left result set is ordered by the naïve algorithm, Decremented Second-Order (DSO) Centrality. The table lists the nodes with the highest second-order influence decremented by the first-order influence, as shown in Equation 1. Little insight is provided by the first result set, but this metric provides an analytic baseline for the subsequent metrics.

The top results for Scaled Second-Order (SSO) Centrality are illustrated in the top right result set of Table 4. The top scoring SSO node, 14043, also correlates with the highest value for Edge-Weighted Second-Order (EWSO) Centrality. Note that all of the highest scoring SSO and EWSO nodes have zero values for their DSO metric, indicating that the different metrics highlight significantly different nodes. Reviewing this conclusion, we see that the SSO Centrality algorithm works as designed: it focuses its attention on individuals that do not have high first-order centrality (or degree) but, nevertheless, have high influence. However, as noted in the previous section, this algorithm does not provide higher values for users that are mentioned repeatedly by high-profile users. This point will not become fully clear until we study EWSO Centrality.

The top results for Log-Based Second-Order (LBSO) Centrality are presented in the bottom left result set of Table 4. This algorithm was designed to "filter out" or lessen the impact of linkages to other nodes with low first-order influence by summing the logarithms of its neighbors' first-order influences. This method was generally successful, but looking at the top results reveals many top "log-based" influencers also have high DSO scores. This means that the LBSO algorithm works as advertised but fails to perform a second step of filtering out users who are high first-order influencers in addition to second-order influencers. In practice, additional predicate logic can filter out first-order influencers to better reveal the non-obvious trusted sources, but that approach may be subject to scalability issues.

The top results for Edge-Weighted Second-Order (EWSO) Centrality are presented in the bottom right result set of Table 4. Results are similar to those for SSO, as one might expect since the two algorithms are related. The highest EWSO results contain only nodes with minimal first-order influence, which is a positive outcome. The intention of adding edge weighting in this algorithm was to promote users who were mentioned frequently by individuals with high influence. The results indicate that we succeed in promoting those users, since the table reveals that users must satisfy three general criteria simultaneously: they must have (1) low first-order influence; (2) high Scaled influence (a direct but naïve indicator of second-order influence); and (3) high Log-Based influence (a more sensitive metric of influence). Based on these results, we conclude that EWSO Centrality is a viable metric to identify non-obvious sources of trustworthy and high-value information.

Conclusion

The proliferation of social media has changed the information landscape for a variety of social events and activities. In this study, we leverage the experience gained developing HSCB models to design a suite of social media analysis metrics. First, the theory of "trust in information" was extracted from the research community and reviewed to understand evolving notions of trust in a social media context. Second, a suite of metrics was developed to identify trusted information relationships in natural disasters, demonstrations, and violent crises. Third, the developed trust metrics were then tested with OWS Twitter data to validate them as well as to increase their believability with and usability by their intended end users, social media analysts. The test results indicate that trust relationships can be found within social media using the developed metrics.

Comparisons between HSCB model-based and social media analysis extends beyond simply using similar techniques to establish believability with their respective user communities. Despite multiple decades using HSCB models to analyze complex social systems (Forrester 1971), commanders and senior decision makers still remain reluctant to believe their results or to use them for decision support. In contrast, initial reports coming back from overseas military operations indicate that commanders and senior decision makers are much more predisposed to believe and use analyses based on empirical data (MORSS 2013), though it remains to be determined whether this believability will extend to social media-based analyses (Goolsby 2013). The relationship between models and data, however, need not involve choosing between one analysis technique and the other as they are intimately linked (Zacharias, MacMillan, and Van Hamel 2008). Data are needed to inform theory and models, just as theory and models are needed to interpret data. It may have been the case that, historically, too much emphasis was placed on models informed by too little data. The ongoing development and use of social network analysis techniques based on newly available social media data may help to reset that balance in ways that provide novel analysis and improved decision-support capabilities.

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Epilogue: Notes on this Socio-cultural Analysis white volume as well as the Understanding Megacities with the RSI Paradigm white volume

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Abstract

This chapter will summarize the research presented in this white volume (SCA-RSI) as well as the research in the Understanding Megacities with the RSI Paradigm (UM-RSI) white volume as they relate to phase 0 operational design and planning. This epilogue will draw heavily on "lessons learned" while performing research for the OSD sponsored Megacities-RSI project at ERDC.

Keywords

Phase 0, Operational Planning, Socio-Cultural Analysis, Megacities, RSI Paradigm

Introduction

The purpose of this epilogue is to offer our opinions on the current gaps facing combatant commands' planning and accessing stability operations in urban areas, especially megacities, and to the upcoming changes in Socio-Cultural Analysis (SCA). These opinions are heavily based on publications and research from the SMA "Megacity-RSI" project, in which USPACOM, ERDC, the Naval Postgraduate Center, and NSI Inc. were the primary researchers.[1] Given the nature of SMA's objectives and the issues most relevant to the SMA "Megacities-RSI" research effort, we will only discuss those issues directly related to phase 0 operational planning (figure 24). This is because most of the SCA research over the past decade has been in phase II-IV environments, which has a very different time frames, information collection capabilities, and operational goals than phase 0.

Observations on the RSI `Data to Decision' Paradigm

Planning for Stability, Resiliency, and/or Security in Phase 0

At recent military conferences as well as chapters in UM-RSI & SCA-RSI, the terms stability, resiliency, and security were used virtually interchangeably. Some researchers prefer using the term resiliency over stability as resiliency acknowledges that resilient human systems do change over time but may not cause the state to become instable. It could be argued that different combatant commands have distinct security challenges causing decision makers to use divergent language.

Because different regions of the world have different security challenges, each combatant command faces different operational challenges. Combatant commands must rely on the intelligence community and academia to provide some of the socio-cultural, infrastructural, and environmental infor-

[1] Of course, many other organizations assisted in the Megacities effort. Page i of both white volumes contain an extensive list of agencies and companies presenting their research to this effort. Also, the National Geospatial-Intelligence Agency helped with their vision of research gaps and provided extensive help before the start of the Megacities-RSI project.

mation for planning purposes because they lack the capacity to develop all of the necessary information, as well as the appropriate analysis tools and techniques in house. Combatant commands must provide a mechanism to allow the intelligence community, military research labs, and academia the opportunity to support their planning needs. One such mechanism is the development and publication of frameworks.

For example, USPACOM's Socio-Cultural Analysis Team developed five frameworks in order to communicate their needs and aid the interagency communication necessary to support USPACOM mission planning, which they share with operational partners and researchers.[1] The frameworks are in various stages of completion covering the areas of Humanitarian Crisis, Intrastate Violence, Recalcitrant States, Power Rebalancing, and Economic Instability. Each framework connects the USPACOM Theatre Campaign Objectives to the indicators and metrics necessary to monitor locations within their AOI. The SMA Megacity-RSI project, led by PACOM researchers, with help from NSI Inc., improved and fleshed out the Humanitarian Crisis (HC) and the Intrastate Violence frameworks. These frameworks divide each theatre campaign objective into categories. The categories are described by conditions, which contain factors for analysis. The factors are represented by indicators and metrics. The daunting challenge is the number of metrics necessary to fully understand USPACOM's decision making needs: the HC framework currently requests 275 metrics. While there is still much research that must be done to determine the relationships between framework categories to conditions, conditions to factors, factors to indicators, and indicators to metrics, it is now easy for the intelligence community, and researchers to provide more appropriate information, enabling potential assessment of the data needs for SCA planning.

ERDC's Urban Security project has taken up the challenge of identifying those metrics that can automatically collected during phase 0 operational planning that will support USPACOM's frameworks. As illustrated in figure 24, and discussed heavily in many chapters of UM-RSI and SCA-RSI, certain data can be collected inexpensively and without human risk in areas under phase 0 conditions. The Urban Security project is currently analyzing how many of the USPACOM HC metrics can be ascertained from population surveys, host nation census, media analysis, and remote sensing techniques to provide neighborhood scale information. Neighborhood scale information is needed to map out what is happening within complex urban environments. As conflicts or crises begin occurring, the ability to create detailed demographic information via censuses or surveys declines rapidly, with people risking their lives just to collect this information. The quality of the information also drops as the conflict grows more intense. While remote collection techniques diminish as conflicts increase, the increased number of soldiers on the ground will provide access to greater amounts of unstructured and lower quality data (from a social science perspective).

[1] While the following discussion focuses on USPACOM, virtually every command the authors have contact with are developing frameworks, some more formal and robust than others, to describe their decision making processes and information needs.

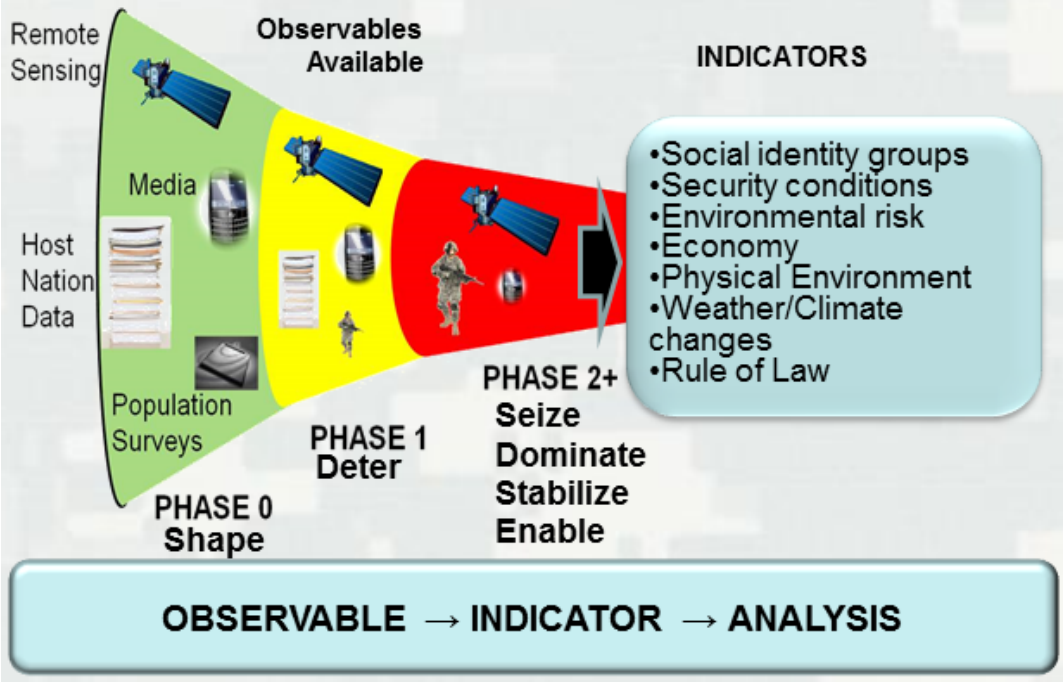

Figure 24, From `Data to Analysis' in the Shaping Phase

Figure 25 presents the phasing model commonly used. However, COL Pursley has recently argued that the phasing model doesn't represent the best framework for understanding campaign planning.[1] He envisions a Pre-Phase 0, when the intelligence community and military researchers engage in dialogue through collaborative knowledge tools to analyze the human, physical and cyber domains to develop real-time situational awareness for planning. In pre-phase 0, the information would be collected in decision maker or analyst-defined dashboards illuminating threats to stability, identify potential indigenous partners, guiding phase 0 preparation of the environment activities, and inform Irregular Warfare contingency planning. The dashboards would rely on cloud-computing with geo-spatial visualization of digital information including socio-cultural information, social media monitoring, biometrics, autonomous language translation and other data mining tools.

It is fair to say that in the near future, it will be far easier for the intelligence community and military researchers to understand diverse military decision maker needs, providing useful information aligned to specific operational needs. Whether we need to formalize a new phase, more clearly delineate information collection responsibilities to the appropriate USG agencies, or expand the definitions of "Prepare" and "Prevent" actions in phase 0, it is clear military decision makers need better intelligence for phase 0 planning.

[1] COL David M. Pursley, Director, Commander's Initiative Group, Special Operations Command Africa, personal communication document "Pre-Phase 0 (Digital Human Domain)", version 12 June 2014.

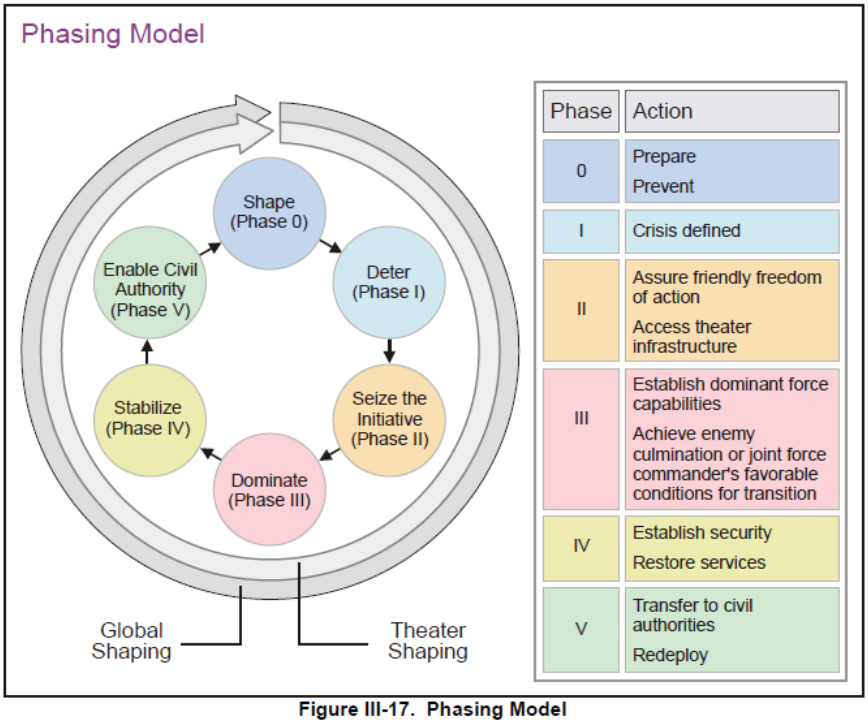

Figure III-17. Phasing Model

Figure 25, Notional Campaign Plan Phasing Model from JP 5-0, August 2011

ISR or RSI, Getting to the Best Intelligence

Before discussing the implications of reconnaissance and surveillance on mission planning capability development, we must first place their differences and similarities into context by defining the relevant terms more precisely. The following are from the U.S. Air Force ISR Agency[1]:

- **Intelligence** is the product resulting from the collection, processing, integration, evaluation, analysis and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. (The term) is also applied to the activities that result in the product and to the organizations engaged in such activity.

- **Surveillance** is the systematic observation of aerospace, surface or subsurface areas, places, persons or things by visual, aural, electronic, photographic or other means.

- **Reconnaissance** is a mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or adversary, or to secure data concerning the meteorological, hydrographic or geographic characteristics of a particular area.

While tightly integrated, these definitions highlight subtle differences. Reconnaissance (R) conveys a sense of mission to collect targeted data. It is therefore active in intent, and data collection is typically periodic as per the mission. Surveillance (S) traditionally implies a more passive and continu-

[1] http://www.afisr.af.mil/questions/topic.asp?id=1751

ous observation. Intelligence (I), as described above, is a reactive concept where by data observed and reported by reconnaissance and surveillance are analyzed both to determine what the information means and how it might impact other, existing intelligence assessments.

These delineations, however, are beginning to blur as 'missions' stretch in time and technological advancement is enabling what was previously persistent surveillance to become surveillance-on-demand. Imagery and other means that support both reconnaissance and surveillance are overlapping to increasing degrees, resulting in similarly conflated functional concepts. How important these distinctions are depends strongly on whether we view intelligence, surveillance, and reconnaissance as steps in an application or co-existing, symbiotic functions where no ordinal characteristics are implied.

The RSI paradigm was mentioned primarily in the context of the Megacities effort to define synergistic methodologies for "Phase 0 reconnaissance in a rapidly changing urban environment with minimal ground assets". Specifically, the RSI framework describes a reconnaissance phase dedicated to understanding a target environment via population researchers and non-traditional information collection avenues. The "population centric" basis for the RSI paradigm is distinct from the "State-centric" Cold War intelligence processes that focused heavily if not exclusively on the capabilities and doctrines of the opposing force. Conducting assessments over time allows analysts to derive a baseline for the population under study. Surveillance then detects changes to this baseline by a variety of methods ranging from imagery to social science methods and their synthesis. When detected, intelligence evaluates the meaning and likelihood of potential threats as well as suggests actions to shape future outcomes. The RSI view ties in strongly to the "conflict continuum", which describes greater access to certain types of data and information pre- and post-war and severely restricted access during kinetic conflict. By emphasizing longer-term data collection and analysis activities, RSI emphasizes sustaining the intelligence process instead of completing an assessment as frequently embodied by traditional ISR.[1]

Ultimately, the RSI paradigm seeks to integrate scholarly insights manifested via sociocultural, environmental, and infrastructural analysis with traditional intelligence methods to create a more complete operational view. To paraphrase Jane Holl Lute[2], scholars and operators tend to ask different questions. Scholars want to know 'why': Why do people do "X", and therefore how will they act? Operators want to know 'what': What do I not understand? What is the problem? What can I do about it? RSI, valiantly, seeks to harmonize these sides to produce 'better' intelligence that can aid development of options to hopefully avoid conflict a priori (or illuminate better options if unavoidable). The challenge is that non-traditional methods must join with more rigorously ordered and established organizational practices. So even as a new paradigm, current descriptions of RSI in recent publications are still trapped within a sequential process as it strives to cope with a highly non-linear world.

Adding to this complexity is that social theories that have been hypothesis tested to be correct in one part of the world may not be accurate in other parts of the same state, much less in other parts of the world. A system that accurately captures social/economic/political understanding in rural

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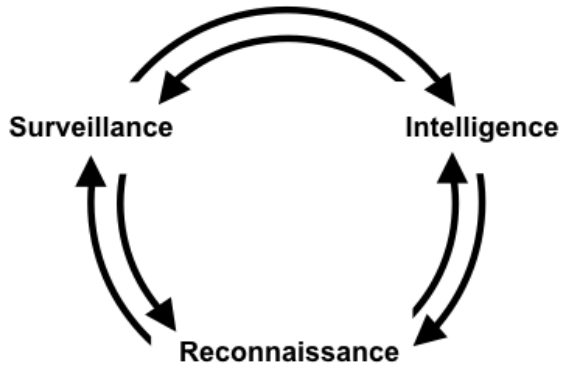
[1] LTG Flynn has presented the 'continuum of conflict' framework at the 2012 and 2013 SMA conferences as well as written about the context and the RSI paradigm in: Flynn, M. T., Sisco, J., & Ellis, D. C. (2012). "'Left of Bang' - The Value of Sociocultural Analysis in Today's Environment". *Prism*, 3(4): 12 - 21.

[2] Lute, J H, Deputy Secretary, U.S. Department of Homeland Security (April 2011). "U.S. Keynote: Community Partnerships to Counter Violent Extremism", in *Council on Foreign Relations Symposium on UK and U.S. Approaches in Countering Radicalization: Intelligence, Communities, and the Internet*, Georgetown University.

areas may be completely inappropriate in nearby urban areas. "Highly integrated cities" with formal economies, high quality infrastructure, and heavily regulated flow capacity will respond very differently to various stimuli than a similar sized city with a loosely integrated systems.[1]

`Long Data' and RSI

To capture data and insightful relationships derived from long-term study (avoiding for the moment any distinctions between reconnaissance and surveillance), one might envision a set of tools or suite thereof to help collect and process the vast `long data' appropriate for socio-cultural information characterizing the human domain.[2] Alone, or itself as a static development, such a toolset will not be sufficient to support understanding a complex environment. It is not just that the interrelationships and interactions must be somehow dynamically captured and represented. Rather the potentially lethal aspect is that the very context of what defines an entity or relationship in the tools (or models) can change. Changing the order or length of the intelligence process will not sufficiently cope with this nonlinearity. How can we rapidly adjust to such possibilities?



On face, the RSI paradigm seems to define an 'R-S-I' sequential process. Implicitly, however, it appears to require 'R-I-S-I-Repeat'. RSI is reaching toward – and needs – functional synthesis over ordinality. If the 'new stable' across the globe is a state of continuous change, then the intelligence process must adapt to new data in similarly continuous ebb and flow across its functions. The figure at left illustrates a continuous feed from one function to the others without implying order or hierarchy. Flow from one function to another can occur on the inner and outer circles in the depiction of this process simultaneously.

This is easy to illustrate, but challenging to realize in a way that coordinates nonlinear, non-ordered, non-stop communication streams to effectively produce timely, digestible, and informative results that enhance a Commander's decision making. The difficulty for scholars and operators alike is that a host of unforeseeable factors will determine if a COCOM's mission is to aid a region when stability begins to fail (Phase 0 active support) or simply to monitor the region's state and relevant dynamics in the event the Commander is directed to intervene. The intelligence process must support preemptive or reactive operations, Phase 0 or kinetic, without knowing beforehand which will be required.

In chapter one of this volume, Christopher Holshek and Melanie Greenberg note that "DoD doctrine is full of operational explanations for conditions like 'stability', but it designs to define the end

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[1] See Bailey, M.; Dixon, R.; Harris, M.; Hendrex, D.; Melin, N.; Russo, R. (2014). A Proposed Framework for Appreciating Megacities: A US Army Perspective, Small Arms Journal. http://smallwarsjournal.com/jrnl/art/a-proposed-framework-for-appreciating-megacities-a-us-army-perspective-0 for a more complete discussion of representing different types of megacities and a framework for holistically representing them.

[2] While the term 'long data' is mostly used to describe data spanning 100's or 1000's of years, our use of this term is for time series data that extends beyond multiple cycles of a phenomenon, for example, boom and bust economic cycles or politics that cycle between more socialistic and more capitalist policies. We need to look beyond short term trends within a cycle to truly understand most social phenomenon. See http://www.wired.com/2013/01/forget-big-data-think-long-data/ for a discussion on long data.

states..." (p. 4). Resilience of living systems is characterized by the existence of multiple potential stable states. Change, however small, is continuous such that system states may drift or even suddenly lurch into new realizations of "stability". In time, RSI and its SCA baseline should support our ability to discern when to allow a system to be resilient instead of trying to force a system to remain inside bounds we view as stable. A focus on Phase 0 RSI and a newfound depth of accompanying SCA should strengthen our understanding that vulnerabilities to any part of a system (or to other, interconnected systems such as our own) are no more static than the systems themselves. There will frequently be no "one right answer" and whatever the portfolio of "answers", they must be as dynamic and context dependent as the operational environment and indeed, the global system, they strive to address.

Megacities as a "Problem Terrain"

Compared to regular urban regions, megacities have more complexity in smaller areas. Megacities are also much more dynamic due to in-, intra-, and out-migration: this requires information to be updated more often to remain useful. Combatant commands must also plan and be prepared for operations across their entire AOI. The information collection techniques must, by necessity, be as automated as possible covering all urban spaces.

This epilogue won't attempt to repeat all the lessons explained in UM-RSI. The goal of that white volume was not to demonstrate THE solutions to every problem, but to lay out the problems and (sometimes) provide what the direction we need to go in order to get to the solution. The main condensed points are:

- **Megacities are potential battle spaces:** The US Army MUST fully understand megacities because potential enemies will use terrain that they think will provide the best outcomes. The authors have often heard "we shouldn't fight in megacities," but the Army recognizes, with articles[1], and with ongoing wargame exercises[2], that phase 0 operations are already occurring, and kinetic operations will likely occur in those environments. Since kinetic operations are likely to cause greater harm to both blue and green forces, the USG and partner nations should proactively perform "prevent" (or deterrence) phase 0 actions to ensure red forces are not in a position to turn megacity neighborhoods into battle spaces.

- **Megacity geography is different than in regular urban areas:** A city of 10 million people does not act the same nor creates the same products as two cities of five million people each. Lobo et al. (2013) declares the "total factor productivity" (TFP), or the amount of economic productivity per capita, will increase by 11% for every doubling of a city's size, all other factors being equal.[3] Others have argued that ALL productivity is made that much more efficient by doubling the size of a city: from improving a person's chance of getting a

[1] Bailey, M.; Dixon, R.; Harris, M.; Hendrex, D.; Melin, N.; Russo, R. (2014). A Proposed Framework for Appreciating Megacities: A US Army Perspective, Small Arms Journal. http://smallwarsjournal.com/jrnl/art/a-proposed-framework-for-appreciating-megacities-a-us-army-perspective-0

[2] Unified Quest 2014 developed a scenario set in a fictitious region containing a megacity. An epilogue author, invited to the wargame as a consultant, met with Red (anti-US forces), Blue, and Green (mainly civilian social groups and other non-combatants) Teams during the scenario development sessions. The Red Team, recognizing the megacity as a nexus of transportation, economic, and non-state political activity, is planning tactical operations exploiting the physical and human terrain in the fictitious megacity. The Blue Team was also cognizant of the risks and responsibilities in that location.

[3] Lobo, J.; Bettencourt, L.M.; Strumsky, D.; West, G.B. (2013). Urban Scaling and the Production Function for Cities, PLoS ONE 8(3): e58407.

date on a Friday night, to increasing the efficiency of illicit trafficking. These efficiencies are gained due to the decreased amount of infrastructure to support similar activities. Anyone who has ever adjusted parameters in a dynamic simulation model will tell you that small changes in some parameters can cause massive changes in that system's dynamics and equilibriums. Also consider that people act differently when you crowd them into small areas. There are some parts of Dhaka Bangladesh, for example, where up to 4,500 people live in an area the size of a football field, or 360' by 160'. In addition to difficulty the social sciences have in accurately representing these complex and complicated environments, it increases the difficulty that the DoD can be prepared for conflict in these areas.

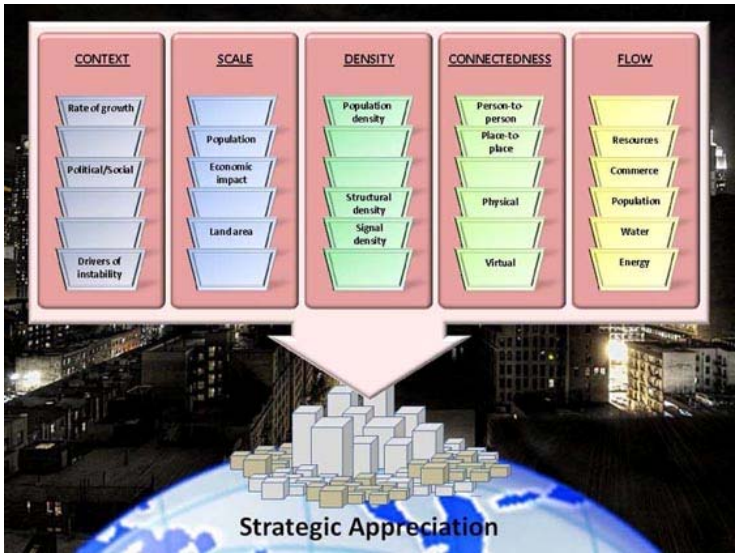

Figure 26, A Proposed Megacity Framework from the Army's Strategic Studies Group[1]

- **Megacity frameworks will be different than other frameworks:** As stated earlier, frameworks are a mechanism to allow complex ideas and systems to be communicated between people, agencies, and organizations. Each command organizes its operational design and planning methodology differently than each other. It is likely that each COCOM will need its own framework for strategic operational planning. Civil Affairs should have their own frameworks for the operations they participate in. A framework for a megacity should be different than a framework representing rural economies, as the Army SSG has argued (figure 26). In fact, if a megacity was significantly different than another, it might require a different framework.

- **Techniques exist to understand Megacities, but…:** The complexity of megacities, the contrasting theories available to choose from, and the current lack of validated information prevents a turnkey approach to representing them. Decades ago, it was popular for geographers and other social scientists to develop "characterizations of cities"[2]. While these theoretical models are a good starting point for scientists to begin characterizing a city, the DoD

[1] Bailey, M.; Dixon, R.; Harris, M.; Hendrex, D.; Melin, N.; Russo, R. (2014). A Proposed Framework for Appreciating Megacities: A US Army Perspective, Small Arms Journal. http://smallwarsjournal.com/jrnl/art/a-proposed-framework-for-appreciating-megacities-a-us-army-perspective-0

[2] The "Ford Model for Latin American Cities" is one of the most cited theoretical urban models: See Griffin, E.; Ford, L. (1980). "*A Model of Latin American City Structure*." Geographical Review, 70(4).

needs a standard way to communicate a specific city's characteristics to operational planners to improve the odds of mission success.

Concluding Thoughts

Those of us that have read all the chapters in UM-RSI, SCA-RSI, and similar research in the military community should realize that we are only scratching the surface of representing the socio-cultural aspects in urban areas to prepare for military operations.[1] Once satellite imagery became available to environmental scientists in the 1980's, those disciplines slowly transformed from mostly qualitative techniques developing hard and expensive to validate theories to disciplines mixing qualitative and quantitative techniques allowing a faster cycling of the incorrectly named `Hegelian Dialectic'

"Thesis → Antithesis → Synthesis → Thesis" cycle

of scientific advancement.[2] (While this dialectic cycling is good for discovering falsehoods about the universe, it is also good for improving our understanding of specific places at specific times by discovering the falsehoods within our frameworks and models.) It is not that quantitative techniques did not exist in the 1970's. However, those methodologies were dozens of times more expensive to perform: thus only occurring infrequently. One by one, social science disciplines will be getting access to the `big data' necessary to inexpensively perform quantitative analyses. Once organized to each science discipline's needs, `big data' will reduce the cost of performing hypothesis testing. Social science disciplines will gradually incorporate quantitative techniques into sub disciplines that previously seldom used those methods. We've yet to perform rigorous hypothesis testing on most of the social science theories discussed in phase 0 operations. Hypothesis testing will need to be performed on the popular (and currently unpopular) social science models/theories for the different geographic and societal domains in which the DoD is likely to operate. The frameworks, conceptual models, and computational models will likely look very different after validation of each model component for each AOI.

[1] The word "prepare" in this context refers to the formal Phase 0 "Prepare" action, not just for the planner, but for the IC and other organizations supporting the information flow to each action's decision makers.

[2] Johann Gottlieb Fichte is considered to be the originator of the triad "thesis, antithesis, synthesis".