

PROPOSAL WHITE PAPER
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MINERVA RESEARCH INITIATIVE

Multi-Source Assessment of State Stability

Submitted by

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Topic # 3-B Cyber norms and governance

1.0 What is Proposed?

We propose a three year program (with two option years) of basic research to develop new capabilities in predictive state stability modeling and improve our understanding of the fundamental issues surrounding state stability in a cyber-mediated environment. Our primary objective is to understand the way in which media – social and traditional – can be used to effect state stability or instability by individuals, groups and corporations. A secondary objective is to identify indicators in social media and traditional media that can be used as signals of changes in trust, norms, lines of stability, and lines of alliance or competition that could predict state instability.

2.0 Identification of the Research and Issues

“Of all the states on the map of the world in 1816, nearly half no longer exist today.” (Tanisha M. Fazal *State Death: The Politics and Geography of Conquest, Occupation and Annexation*, Princeton University Press, 2007, p.1)

The wave of revolutions in the Arab world, commonly referred to as the Arab Spring, took the world by surprise. To some extent the recent consulate and embassy attacks were also unforeseen. Despite the rich literature on inter state conflict, state stability, revolution and regime change the Arab Spring could not be predicted nor fully accounted for by the existing theoretical traditions in the social sciences. As protests and demonstrations broke out in one country after another, questions arose as to what mechanisms supported the diffusion of ideas and actions, promoting or inhibiting violence, and eventually enabled successful regime change. New communication technologies and social media were touted as critical to these revolutions. The belief in the power of the Internet was such that in some cases embattled leaders turned off access, e.g., Egypt, Libya, and Syria. Conventional wisdom still asserts that “social media help people mobilize and revolt against governments” and argues that Twitter and Facebook directed many of the mass anti-government demonstrations during the Arab Spring and recent embassy events. Yet, the role the media and use of such technology cannot be considered the cause of the Arab Spring. A variety of critical factors all played a role including but not limited to: environmental change, violation of cultural norms, changing economic conditions, human rights violations, government corruption, dissatisfied youth, increasing food prices, global famine, increased foreign presence, and the persistence of absolute monarchies. Outcomes varied in different countries each of which followed different patterns in part due to varied histories with democracy and authoritarian control, and their respective rhetoric of change.

Social media is increasingly becoming a major source of information for populations. The majority of news sources, e.g., BBC and CNN use Twitter and Facebook to spread breaking news. Social media is also a major outlet for citizens to express their concerns. For example, in the recent attacks, such as that on the Libyan consulate the top “tweeters” were news sources and the Libyan Youth group. Both appeared to play different roles and have different geo-temporal tags. Who follows whom, and the retweet network appear to be different for corporate, group, and individual users as do the cyber-norms. How these different uses and users of social media impact social change is not known.

The Arab Spring and the recent consulate and embassy attacks demonstrate that not only do we have minimal ability to forecast societal level changes, we lack a fundamental understanding with respect to the ways in which trust is forged and broken between individuals and institutions in a computer mediated communication environment. We lack a fundamental understanding of how various lines of influence at different levels (individual, group, and state) serve to coalesce to effect change: these lines include social and informational influence of one actor on another, coordination and competition among stakeholder groups, and diplomatic and economic influence of one state on another. As such we need a better way of understanding the forces of governance that impact stability, particularly in an environment where social media plays a role.

This project will ask and answer questions such as:

- *How* do corporations, groups, incumbents and revolutionaries, use social media to upset or maintain the balance of power, establish norms, and engage in governance activities?
- *What* are the indicators of state instability and changes in norms that can be observed in social media and traditional media?
- *How* is trust established, broken and maintained between the incumbent power and the populace or groups of interest?
- *Who* are the trusted information brokers in social media and do they have distinctive footprints in the associated social and knowledge networks?
- *What* is the role of social media and traditional media in mediating and forging these trust relations?
- *What* are the lines of balance critical for state stability and are there cultural variants?
- *What* is the role of social media and traditional media in maintaining this balance or creating imbalance?
- *How* does external influence by individuals and foreign states impact state stability through social media, traditional media, and other diplomatic and economic channels?
- *Does* a state's position in the various influence networks make it more or less vulnerable to stability inducing or destabilizing events?
- *How* does the information passed through social media and traditional media, and the state's position in the media based influence networks, impact stability?

3.0 Proposed Methods

We propose to identify mechanisms for forging trust, building norms, and stabilizing and destabilizing groups; identify early indicators of change in groups and the structure of alliance and competition; identify the lines of balance necessary for state-stability; develop relevant indicators of balance; and develop and test the associated metrics for all indicators. We propose to use mixed-source data – news, social media, trade and geographic information, and archival ethnographic information, of both current and historical for a set of 20 countries in the Middle East and Africa. We then propose to evaluate these indicators and associated metrics using data to be collected on these countries and other countries in the Pacific Rim. We anticipate that this research will lead to a new theory of communication mediated state stability, a dataset of stability inducing/reducing events, and a set of indicators/metrics for assessing state stability. We also propose to develop a series of *within* and *between* state influence network models for the various lines of influence. These networks will include both those extracted from social and traditional media, but also historical alliance and hostilities, overall trade levels, and scholar-student networks. The ultimate aim of the project is to develop a predictive tool for social and traditional media's impact on state instability.

Analytcs: Project investigators will use a mixed-methods approach employing detailed ethnographic analysis, text-analysis in which text-mining using latent dirchlet allocation techniques for topic identification, co-sign analysis for similarity among topics are used, geo-statistics, dynamic network analytics and visual analytics are used for reasoning about the extracted data. This is used in a progressive and “stepped” fashion to first identify norms, the lines of balance, critical issues, and indicators of stability, balance, and trust. Then, secondly, we identify groups, topic foci for groups, changes in these indicators and characterize patterns of instability using geo-temporal network and visual analytics. Groups will be identified based on network structure, topic cohesion, and location. And thirdly, a mixture of statistical approaches are used to characterize behaviour, and estimate the likelihood of anomalous change. Overall – the methodological approach is designed to leverage rich ethnographic description and analysis to provide explanations and interpretations of the statistical, network and visual

analytics of the geo-temporally tagged social and knowledge (topic) network data that is extracted from multiple sources.

Data: We will use social media data and news data that we have been continuously collecting on 18 Middle East Countries and 2 additional African countries since the start of the Arab Spring. In addition we will use new data collected in these countries and in “emergent issue” countries. This collection uses the Tweet Tracker (ASU), Blog Tracker (ASU) and REA (CMU) data collection engines previously developed. All data will be cross-classified by country, topic/issue, geo-location, and time. E.g. for data from the recent consulate and embassy attacks – twitter data is tagged by topic, location (when feasible) and by hour; news feeds by topic, location and day. This tagging supports cross-media analysis. In addition, we will augment the social media data with historical political alliance data, trade data, and various scientific networks. Multi-source data for multiple countries is critical as some sources, such as trade and social media, are not available for some countries.

Challenges: There are a number of challenges that need to be addressed in this research. First, the large number of tweets and news articles puts this in the realm of “big data.” We utilize a post-gress database, scalable network metrics, topic-based data filters, and big-data visualization techniques to handle this data. Second, the data is multi-lingual. We use a combination of bling and topic extraction techniques that do not require translation. We also have students and researchers who can speak and read Arabic which is the most common second language for the data we will use. Third, the role of social media in governance and state stability is unknown. We take a multi-theoretical stance and will be working to develop grounded theory in this area. Fourth, only about 1% of tweets are geo-tagged. We recognize that geo-temporal analysis will require secondary geo-identification, estimates of region of influence, and discrimination of talk about an area versus talk from within an area. We anticipate that this research will lead to fundamental advances in this area. We also plan secondary explorations of alternative social media including: Blogs and Chinese twitter (which has more geo-tagged data) will also be examined to add robustness to the overall assessment. Fifth, corporations such as news agencies and government units are increasingly using social media to communicate. We plan to separate the corporate from the individual use and explore the flow of influence within and between these sources.

4.0 Potential Implications for National Defence

Military leaders have a need to rapidly evaluate, assess, and reason about state stability when they go into new situations, in such a way that data can be easily transitioned among units. This is as true in HA/DR missions where the disaster itself may precipitate instability as in IO and Public Relations where the military needs to understand it’s image and take non-kinetic steps to avoid conflict. Due to the length of time it takes to convert raw data into the form needed by the various formal models, military analysts rarely use formal predictive models for predicting critical changes in population sentiment, likelihood of revolution and overall state stability. This research lays the groundwork for a state stability modeling system that is reusable, easily instantiable from empirical open source data, and adaptable to different socio-cultural environments. The key indicators and social-topic network models developed in this project will provide the DoD with an underlying core capability to enhance predictive modeling for regime change, and support the development of joint HA/DR operations, irregular warfare operations, and IO operations. The proposed work will support these needs by providing tested theory, new metrics for alerting users as to change at the group and state level, indicators of change and associated metrics for use with multiple data sources. We consider the region specific challenge that, more often than not, Islamic parties benefit from such regime transitions. Thus, this project will generate predictive models to assess how regime transitions might democratize, or perhaps, shift towards Islamist based political parties and what this would mean for the US policy.

Information dominance requires early anticipation of threat so as to deter major events and mitigate the situation. This research will aid DoD decision-making and policy efforts by developing improved

theory and methods for identifying and anticipating potential hot zones of unrest, instability and conflict using traditional and social media. This research will provide guidelines for what can and cannot be learned from the different media, and will generate new procedures for collecting, refining, visualizing and reasoning with social media data.

The proposed use of social media and traditional media will also support the increased need of the DoD to assess, maintain and manage their presence in cyber-space, establish trust through social media and track the emerging coalitions among groups in regions of interest.

5.0 Team and Management Plan

5.1 Team.

Dr. Kathleen M. Carley is a Professor of Computation, Organizations and Society at Carnegie Mellon University and director of the center for Computational Analysis of Social and Organizational Systems. Dr. Carley's books include Kathleen M. Carley, et al., 2008, *Behavioral Modeling and Simulation: From Individuals to Societies*, Washington, DC: National Academy Press and Zhiang Lin and Kathleen M. Carley, 2003, *Designing Stress Resistant Organizations: Computational Theorizing and Crisis Applications*, Boston, MA: Kluwer.

Dr. Mia Bloom is an Associate Professor of International Studies at the Pennsylvania State University and director of the South Asia Initiative for the Schreyer Honors College. Dr. Bloom's books include *Dying to Kill: the Allure of Suicide Terrorism* (2005), *Living Together after Ethnic Killing* (2007 with Roy Licklider), and *Bombshell: Women and Terrorism* (2011). Dr. Bloom is a member of the editorial board of *Terrorism and Political Violence* and has published articles in *Civil Wars*, *Security Studies*, *International Security*, and *Political Science Quarterly*. Bloom is also a contributor to CNN's *Security Clearance* Blog.

Dr. Huan Liu is a Professor of Computer Science and Arizona State University and director of the Data Mining and Machine Learning Lab. Dr. Liu's books include Lei Tang, Xufei Wang, and Huan Liu. "*Community Detection via Heterogeneous Interaction Analysis*", Data Mining and Knowledge Discovery, Springer, August, 2011 and Geoffrey Barbier, Lei Tang and Huan Liu. "*Understanding Online Groups through Social Media*". WIREs Data Mining and Knowledge Discovery, May 20, 2011.

5.2 Management Plan.

Kathleen Carley, CMU will be the overall lead and handle metric development, news data collection, and statistical, network and visual analytics. Mia Bloom, PSU will lead the identification of indicators of stability and lines of trust, assess cultural differences across countries studied, and identify relevant SMEs to assess overall findings. Dr. Huan Liu, ASU, will lead the data extraction and social media analysis. Theory development will be a joint endeavour. Coordination will be handled by twice yearly meetings, monthly computer-mediated telecons, a shared twiki, and by all students meeting at the CASOS Summer Institute for joint training and dissemination of ideas beyond the project team.

6.0 Summary of Estimated Costs

The proposed work is expected to cost: \$500,000 per year for 3 years – total \$1,500,000. With two option years at \$500,000 each.