PROPOSAL In Response To BAA 11-026, ARO FY2012 MURI TOPIC 8
Predictive Models of Cultural and Behavioral Effects on Societal Stability

Proposed Title:
Evolution of Cultural Norms and Dynamics of Socio-Political Change

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1 Background and Motivation

On December 17, 2010, a policewoman confiscated the unlicensed vegetable cart of a twenty-six-year-old street vendor named Mohammed Bouazizi, in the Tunisian town of Sidi Bouzid. Feeling humiliated by abuse, he went to a local government building, poured gasoline on himself, and lit himself on fire, creating a combustible mixture of economic despair, social frustration, and political yearning throughout the region [1]. In the weeks and months afterward, the flames consumed not only Bouazizi- who died on January 4, 2011 but the regimes of Tunisian president Zine El Abidine Ben Ali, Egyptian president Hosni Mubarak, and Libyan leader Muammar al-Qaddafi, while severely threatening the rule of Khalifa ruling family in Bahrain, Yemeni President Ali Abdullah Saleh, and President Bashar Al-Asad of Syria [1]. Middle East experts were as surprised as everyone else by the speed and ferocity of Arab revolts. While most experts were busy outlining stability and persistence of such autocratic regimes [2], hidden forces that lead to the revolt and its spread were ignored, leaving policy makers surprised and unprepared for what followed. The past 11 months have made it clear that questions related to political change, cultural dynamics, and societal transformations are not only of first-order importance for social science, but also central for a scientific approach to policy making and planning. While advances in traditional game theory, political economy, development economics and political science have enabled us to provide a posteriori analysis, the aforementioned challenges require a new set of theory, modeling, field experiments and algorithmic tools that are amenable to analysis of sociopolitical change. This will require analytical techniques and explicit modeling of conflicts of interest and possible cooperation between distinct parties. Since many of the central questions of political, cultural and societal change involve interactions among individuals and groups with different identities, this will also require advances in study of collective phenomena when decision making is purely local and the sources, reliability and trustworthiness of information is unclear and information from neighboring nodes is much more than “externalities”.

As a result, social science alone is far from satisfactory for addressing these issues. What is needed is an analytical framework for analysis, prediction, and ultimately control of these socio-political phenomena. To address this important void, we have brought together a world-class team of experts with a history of strong collaboration, who have been at the forefront of an interdisciplinary research agenda on this topic with expertise that spans mathematical systems theory, economics, political science, algorithmic and computational game theory, operations research, and network science. We believe that our team of experts is uniquely qualified to significantly advance the state of the art and create a systematic quantitative, theoretical and experimental framework for predictive modeling, analysis, and control of evolution of cultural norms and sociopolitical change. Our team of experts has literally written the book on the topic (e.g., Acemoglu, Jackson, Kleinberg) and all team members have been pioneers in development of a rigorous discipline of mathematical and computational social science that combines modeling, theory, empirical analysis, behavioral lab experiments, large datasets, and field experiments and surveys. Our goal is to view the aforementioned challenges through a unified yet interdisciplinary lens that goes beyond social and political sciences, and adequately covers the full spectrum from rigorous math-based theory and modeling (Jadbabaie, Acemoglu, Ozdaglar, Blume, Kleinberg, Jackson, Kearns, Dahleh, Shamma) to large scale data extraction, analysis, and multi-agent simulation (Kearns, Leskovec, Jadbabaie, Shamma), to controlled lab experiments (Kearns, Jadbabaie), and field surveys (Christia, Jackson) (cf. Figure 1).
2 Biography of key investigators

- **DARON ACEMOGLU** is the Charles P. Kindleberger Professor of Applied Economics at MIT. His many awards and honors include the John Bates Clark Medal, T. W. Shultz Prize, Sherwin Rosen Award, and Foreign Policy magazines “Top 100 Global Thinkers”. He has published extensively on the topics of this MURI, including two books.

- **LAWRENCE BLUME** is the Goldwin Smith Professor of Economics & Information Science at Cornell and has done extensive research on general equilibrium theory and game theory as well as on networked economic systems. He is a fellow of the Econometric society and CESifo.

- **FOTINI CHRISTIA** is an Assistant Professor of Political Science at MIT and has performed extensive ethnographic, survey and field experimental research in war-torn areas of the Muslim world, and on development and the role of institutions in conflict and post-conflict contexts. She has written about her experiences from Afghanistan, Yemen, Iran, the West Bank and Gaza and Uzbekistan for Foreign Affairs, the New York Times, the Washington Post and the Boston Globe.

- **MUNther DAHLLeH** is the Professor and Associate Head of EECS at MIT. He has extensive research experience in networked control, and social and economic systems and is the 3 times winner of the George Axelby Paper Prize of IEEE Control Systems Society, winner of Donald P. Eckman and O. Hugo Schuck awards of the American Automatic Control Council (AACC).

- **MAThew O. JACKSON** is the William D. Eberle Professor of Economics at Stanford University. He has been a pioneer in the area of social and economic networks and is the author of a manuscript with the same name. Awards: Arrow Prize, Fellow AAAS, Guggenheim Fellowship.
ALI JADBABAIE is the lead PI and Professor of Electrical & Systems Engineering, Computer and Information Science, Operations & Information Management at Penn and the founding Co-director (with Kearns) of Penn’s Market and Social Systems Engineering Program. He has been actively involved in co-leading many MURIs and has published extensively in the area of networked dynamic systems and social and economic networks. His awards include ONR YIP, O. Hugo Schuck Prize (AACC) and the George Axelby Best Paper Award.

MICHAEL KEARNS is the National Center Chair in Resource Management and Technology, professor of Computer and Information Science, and Operations and Information Management at Penn and director of Penn’s Market & Social Systems Engineering Program. He has served as member, vice-chair and chair of DARPA’s ISAT study group and has been a member of PCAST NITRID working group on networks.

JON KLEINBERG is the Tisch University Professor at Cornell and a member of NAE and NAS, a recipient of the McArther, Packard, and Sloan Fellowships, and an ONR YIP. He has published extensively in the area of network science, algorithms, and social and economic networks.

JURE LESKOVEC is an Assistant Professor of Computer Science at Stanford, and has extensive research experience on mining and modeling large social and information networks, and their evolution. He has won many best paper awards including SIGKDD.

ASU OZDAGLAR is the Class of 1943 Career Development Associate Professor of Electrical Engineering and Computer Science, MIT. She has published on optimization theory, game theory and social and economic networks and is a recipient of the Donald P. Eckman Award of AACC.

JEFF SHAMMA is the Julian T. Hightower Chair in Systems & Control, Professor of Electrical and Computer Engineering, Industrial and Systems Engineering, and Computer Science at GeorgiaTech. He has published extensively on robust control, game theory and social and economic networks and has lead many DoD research programs. He is a winner of the Donald P. Eckman Award (AACC) and a former member of the Air Force Scientific Advisory Board.

References
