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SMART POWER



Social Radar

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A MITRE Corporation Initiative



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Welcome to the Social Radar Issue

In modern international engagements, the perceptions, intentions, and behaviors of citizens and leaders are as important as conventional military components such as tanks, planes, and command-control facilities. Over the last 50 years, the United States government has invested substantial resources in developing tools for employing military forces in the context of physical terrain. Today, as psychological and sociocultural dynamics take on an increasingly important role in international relations, the time has come to develop a social radar capability that will enable near real-time detection and tracking of human dynamics—perceptions, attitudes, beliefs, and intentions.

This issue outlines MITRE's broad vision for social radar. In the articles that follow, we briefly discuss how the radar metaphor links modern computational social science tools to the age-old challenges of detection and tracking. We also identify some specific capabilities and technologies that are needed to realize the social radar vision. Finally, we highlight some of the efforts already in progress to develop social radar elements that are robust, resilient, and responsive.

As suggested in our last newsletter, smart power demands a combination of innovative strategies, methodologies, tools, and relationships. Accordingly, even the most sophisticated social radar will only be as effective as the strategies and relationships that enable it. Nevertheless, we believe the advancement and integration of social science and information technology can offer powerful tools for whole-of-government smart power engagement. If you have comments, questions, or ideas about how to make social radar a reality, please contact me at maybury@mitre.org or (781) 271-7230.

Mark J. Maybury

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Social Sensing for Smart Power

As a detection and tracking capability, the idea of social radar continues a tradition of sensing innovations. The development of RADAR (RADio Detection And Ranging) in 1940 was a watershed in the quest for heightened situational awareness. Enabling a superhuman ability to visualize airborne objects at a distance, radar would become a core component of the U.S. Air Force Semi-Automatic Ground Environment (SAGE), one of MITRE's very first projects for the Department of Defense. Similar advances in other domains enabled the sensing of objects through water (sonar) and in the dark (infrared). This work continues today, as new technologies improve our ability to see through various forms of physical cover, concealment, camouflage, and deception (CCCD).

In spite of these advances in our ability to observe distant and obscure objects in physical space, we lack a parallel system for tracking the complex flow of international sentiments and events. Existing radar technologies are blind to the attitudes, intentions, and in some cases even the behaviors of our adversaries. With increasing global interdependence, this failure to systematically track and affect the human dynamics of such phenomena as instability, disease, corruption, conflict, and natural disaster is often at our own expense.

These gaps suggest the basic requirements for a social radar system. Social radar must be able to:

- **Sense and track** international perceptions, attitudes, beliefs and behaviors—often via indirect indicators
- **Identify, correlate, and calibrate** signatures to sense a broad spectrum of phenomena manifested across political, economic, social, environmental, and public health domains
- **Locate information in geographic, temporal and demographic spaces**, reporting not only what and when but also where and by whom
- Provide insight into the **motivations and intentions** of various actors and societies and **forecast** the likelihood of future trajectories

Once realized, social radar can provide a strong foundation for both planning and assessment of smart power engagements.

In the remaining sections of this issue, we will explore in greater depth the key characteristics, sources, and capabilities of social radar. We will also highlight some current work that is beginning to translate the social radar vision into reality.



SAGE operator seeing through space.

The Smart Power Cube

The smart power logo represents the essence of whole-of-government solutions to today's pressing national security concerns. The cube's multicolored facets illustrate the complementary instruments of diplomacy, development, and defense interlocking to form a balanced approach to today's global challenges.

A Director of National Intelligence (DNI) Perspective

"The Intelligence Community must narrow the gap between our capacity to 'sense data' and our capabilities to 'make sense of data' in handling an exponentially increasing volume and variety of data and information."

National Intelligence Strategy, Director of National Intelligence, August 2009

“I am extremely pleased with the MITRE team that is supporting our Human Social Culture Behavior (HSCB) Modeling Program, and the social radar vision concept is another example of the thoughtful support we have been getting.”



Dr. Robert Foster

*Director, BioSystems (Retired)
Defense Research & Engineering
Office of the Secretary of Defense*

“Social radar and related work are providing the catalyst for an inflection point in our understanding of human dynamics and influences in asymmetric and irregular warfare environments.”



CAPT Dylan Schmorow

*USN, Ph.D.
Acting Director, BioSystems
Director, Human Social Culture
Behavior Modeling Program
Defense Research & Engineering
Office of the Secretary of Defense*

Key Characteristics of Social Radar

MITRE’s long-range vision for social radar is founded upon a number of key system properties, enabling a monitoring system that is:

Global in Reach – Worldwide, real-time capture, processing and analysis, including coverage of areas with limited connectivity, denied access, or active censorship.

Multilingual – Transcription, summarization, translation, and interpretation across languages and cultures.

Multimodal – Processing and analysis of diverse media and modalities, from blogs to radio broadcasts to televised imagery.

Persistent – Continuous, international monitoring of attitudes, sentiment, and social movements via automated, large-scale, cross-media content analysis.

Real-Time, Geolocated – Real-time analysis of open sources, enabling geographically localized measurement of foreign public beliefs, opinions and behaviors.

Socially Aware – Detecting and tracking critical social networks and interactions as well as the dynamics of roles and relationships among key international figures and groups (e.g., political parties, business and academic leaders, non-state actor groups, publics) via direct and indirect indicators.

Multispectrum – Ability to capture and correlate perceptions, beliefs, attitudes, and behavior across the full spectrum of interrelated domains—politics and government, labor and economics, military, crime and law enforcement, health care, education, and the environment.

Unobtrusive – Measuring public sentiment and social movements using indirect methods and sources, such as content analysis of public communication. This minimizes the cost, attribution, and biases associated with polling or focus groups.

Security and Privacy Preserving – Methods that will safeguard individual and group security and privacy.

Some of these key system properties are already well-established, while others are just now emerging. As these individual functionalities are refined, coupling them into an integrated social radar capability will present a significant systems engineering challenge.

Social Radar Spotlight

As an initial step toward the social radar vision, MITRE's Measuring and Guiding Engagement research program funds a number of innovative projects. We spoke with two of the program's funded researchers, Dr. David Day and Dr. John Boiney, to discuss their project *Sentiment Analysis for Strategic Communication Assessment (SASCA)*.

Q: Give us a general overview of the project.

Boiney: *We are developing a prototype tool that will detect and analyze sentiment on mission-critical topics using open source, multilingual news and other media text. The technology will also identify the opinion holders to whom these attitudes are being attributed. Our initial goal is to develop a capability that will allow our government partners to detect shifts in both the volume and sentiment of key issues. We also plan to develop features that enable trend monitoring, breakdowns for analysis across sources and topics, and a text-highlighting capability that will allow users to zero in on key sentiment indicators within documents.*

Q: Where do you see this project fitting into the social radar vision?

Day: *Well, we think it really hits the sweet spot, which is dynamic, unobtrusive monitoring of foreign sentiment. That is fundamental to social radar.*

Q: Where did the idea come from?

Boiney: *A little while back, some of our colleagues held a series of briefings with a diverse set of government sponsors, focusing on their strategic communication-related needs. What came through loud and clear was a need to assess the effects of their strategic communication (SC) efforts. My background is in news media dynamics and public opinion, so I reasoned that sentiment analysis of media coverage should allow us to detect signs of positive or negative reaction to strategic communication. This helps get at the perennial Measures of Effectiveness (MOEs) challenge.*

Q: What kind of technology will you use to do this?

Day: *There are various methods and techniques that we plan to build on. Sentiment is often communicated through the use of word choice and idiomatic phrases, so a starting point is to obtain and extend lexical resources that capture these various associations. A key challenge in automated analysis of journalistic text is to distinguish the target of the sentiment being expressed from the opinion holder to whom this viewpoint is being attributed. For this, we expect to turn to a combination of partial parsing (or "dependency parsing") to identify the extent of the text fragment being attributed to someone, and statistical models (such as support vector machines) to classify the target or "opinion" that is being attributed.*

Q: How do you see this capability building on what's already out there?

Boiney: *Opinion surveys are the standard method, but they have some drawbacks. Polling is intrusive, expensive, and it can be affected not only by sampling error but also by variations in question wording. In addition, the problem for our government partners is finding a poll that will monitor the topics, questions, and regions that matter most to them—and do it on a frequent basis in a consistent fashion. Polls cannot provide this kind of unobtrusive, user-driven, "on-demand" coverage.*

Q: Assuming you achieve your current goals, what would be next?

Boiney: *I think it will be useful to see how trends in media correlate with other measures of mass opinion, such as polling data. It will also be possible to use the sentiment analysis to design better, more tailored polling questions. In terms of the technology itself, we hope to eventually expand the focus to include additional open sources. MITRE is funding research initiatives that focus on a variety of different media sources, so there is good potential for us to collaborate with our colleagues and leverage their work in this area. We also see this technology enabling the development of more sophisticated models of how attitudes develop and spread. So, there is a lot of potential.*



Dr. David Day

David Day holds a Ph.D. in Computer Science and Artificial Intelligence from the University of Massachusetts at Amherst. He has been pursuing research and development in natural language processing for the past fifteen years. In addition to his work on SASCA, Dr. Day contributes to a range of government-funded language technology projects and serves as the Associate Department Head for MITRE's Human Language Technology Department.



Dr. John Boiney

John Boiney holds a Ph.D. in political science. In addition to his sentiment analysis work, John provides systems engineering support for the Human Social Culture Behavior (HSCB) Modeling program, a five-year social science research program funded by the Office of the Secretary of Defense (OSD).

“The analogy you draw between physical sensing systems and social radar is powerful and likely to be readily understood by military decisions makers. Further, it is a very good organizing framework for social science research within the DoD.”



Dr. Michael J. Young
 Chief, Behavior Modeling Branch
 Human Effectiveness Directorate
 Air Force Research Laboratory
 United States Air Force

Core Capabilities of Social Radar

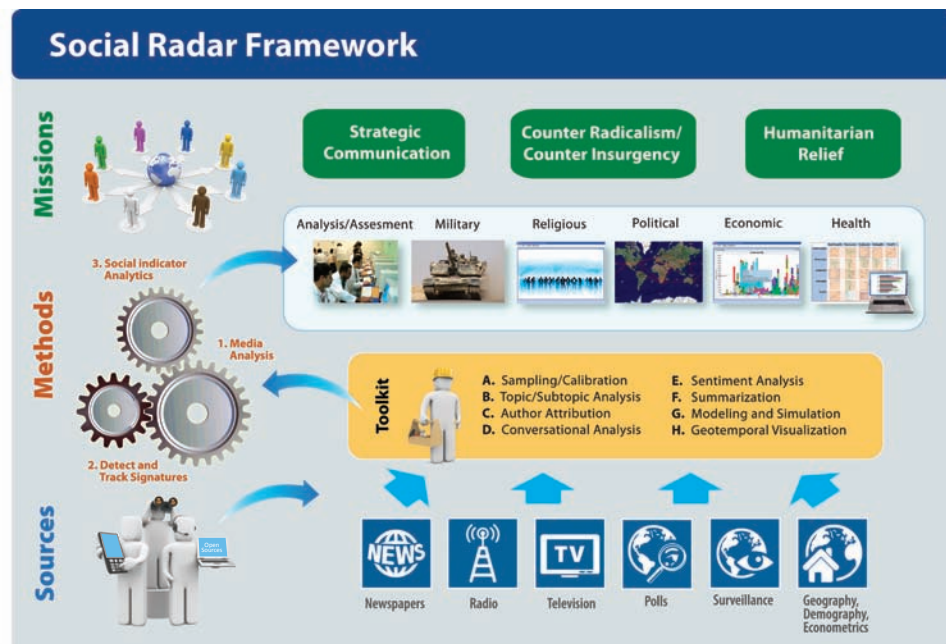
A robust Social Radar System that can continuously sense across multiple domains, as illustrated in Table 1 (*next page*), requires several core capabilities, including:

1. Signature and Indicator Identification – Individuals, groups, and social phenomena (e.g., negative sentiment, mob formation, disease transmission) have signatures—unique features that can be detected through diverse methods, such as visual and acoustic biometrics, sociometrics, and other small- and large-scale behaviors (e.g., word choices in a newspaper article, geographically significant school closings, financial transaction patterns). Combinations of these signatures can become indicators that social radar can use to detect and track key social phenomena, such as social unrest, disease transmission, economic change, and government regime stability.

2. Noise Reduction and Fidelity Enhancement – A fully functioning social radar system will implement data reduction and enhancement methods to minimize various forms of “noise.” Sources of such noise can range from duplicative or irrelevant data signals to deliberate countermeasures, such as restricted access, censorship, or deception. Appropriate signature weighting and decision algorithms for multi-signature indicators will enable social radar to maximize “signal-to-noise” ratios and manage uncertainty.

3. Calibration and “Baselining” – Drawing on diverse information sources (see Table 1, next page), a social radar system will be able to establish baseline levels or “normal ranges” for key social phenomena, such as public attitudes and unrest, economic conditions, and political-government functioning. The establishment of validated baseline or benchmark levels will enable social radar to detect departures from this normal range, so that significant or unusual developments can be identified rapidly and accurately (e.g., by minimizing “false negatives” and “false positives”).

4. Tracking and Forecasting – Tracking the presence, intensity, and persistence of events over time and across geographic space is an essential social radar capability. Planners and policy makers must be able to understand—and, as much as possible, forecast—the course and trajectory of key events and phenomena. In addition to the core signature and indicator data, this capability will draw on emerging statistical and computer simulation models.



Social Radar Elements

	<i>Military and Law</i>	<i>Political</i>	<i>Economic</i>	<i>Social</i>	<i>Health</i>	<i>Environment</i>
Indicators	Violent Border Conflict	Quality of Governance	GDP	Displacement	Medical Access	Water/Air/Soil Pollution
	Criminal Activity	Corruption	Employment, Poverty	Education Quality	Medical Outcomes	Climate
	Human Rights	Balance of Powers	Infrastructure	Hunger, Dissatisfaction	Mortality/Disability	Natural Disaster
Signatures	Violent Incidents	Electoral Fraud	Currency Stability	% Homeless, % Refugees	Care Access, % Insured	CO2, Smog, Water Quality
	Public Safety	Trafficking, Laundering	Consumer Prices	% Graduates, Literacy Rates	Absenteeism	Temperature, Precipitation
	Grievances	Public Trust, Free Media	Land Rights Grievances	Grievances	AIDS, Birth/Mortality Rates	Emergency Preparedness
Sources	UN Reports	UN Reports	World Bank	UN, NGOs	UN, NGOs	Satellites
	Polls	World Bank, Human Rights Watch	SARs, DEA Reports	Newswire	World Health Organization	World Health Organization
	Newswire	Pew/Gallup	Bloomberg	Open Sources	ProMED	Environmental NGOs

Table 1. Social Radar Example Sources, Indicators and Signatures

From Vision to Reality: The Road Ahead

Realizing the social radar vision will require methodological advances and careful attention to the needs of the defense, intelligence, diplomatic, and development communities. From a technology standpoint, social radar must equip users to anticipate, track and counteract adversaries' viral messages, and it must employ creative strategies for dealing with disruption, censorship and spoofing of social media. With respect to end users, social radar must feed intuitive, tailored sense-making and decision support tools that will aid everyone from strategic planners to on-the-ground personnel. These tools must address diverse needs, from public affairs to disaster relief to intelligence and military engagements.

Achievement of these goals will require a collaborative community that brings together diverse experts from government, academia, industry, and non-governmental organizations (NGOs). Such cross-domain collaboration is the essence of smart power in action. Stakeholders should include operational end users, developers, system integrators, and perhaps even the general public. Subject matter expertise must represent the full range of social sciences, as well as military science, history, public health, and environmental studies. Major steps will include establishing requirements, formulating a concept of operations, and assessing the impact on various stakeholder communities. While daunting, the results could be nothing less than revolutionary.

We look forward to your ideas and contributions on the journey toward social radar.

The Smart Power Initiative

MITRE's Corporate Initiative in Smart Power envisions the coordination and amplification of all instruments of national power through innovative strategies, methodologies, tools and relationships. Our primary objectives are to (1) provide government leaders with methods and tools for social radar and engagement; (2) facilitate planning and coordination of government actions across the Diplomatic, Information, Military, and Economic (DIME) spectrum; and (3) enable the acquisition community in the design of effective, affordable, resilient smart power systems.

About MITRE

As a trusted not-for-profit adviser to the U.S. government, The MITRE Corporation applies expertise in systems engineering, information technology, social-behavioral sciences, human language technology, and enterprise modernization to address our sponsors' critical needs. MITRE manages four Federally Funded Research and Development Centers, including centers for the Departments of Defense and Homeland Security. MITRE also serves a range of other government sponsors and maintains an independent research and development program.



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