CHAPTER 1

Social Radar
for Smart Power

Mark Maybury
The MITRE Corporation
202 Burlington Road
Bedford, MA 01730
maybury@mitre.org

ABSTRACT

The center of gravity in modern warfare not only includes military targets such as tanks, ships, planes, command and control facilities, and military forces but equally important the perceptions, intentions and behaviors of citizens and leaders. This vision document develops the metaphor for a *Social Radar*, describes a framework for a novel set of capabilities, and identifies the need to create a community of interest that can advance the concept, development, and deployment of a Social Radar capability.

ORIGINS

With the global scourge of the second world war fresh in his mind and foreign air power a clear and present danger to dense US metropolitan populations, President Eisenhower set into motion a series of events to create a US air defense system that would ultimately lead to the founding of The MITRE Corporation in 1958 and the creation of the U.S. Air Force Semi Automatic Ground Environment (SAGE).

While SAGE contained many innovations such as high resolution display, photonic pointing device, database, time sharing, and track management, a core component of the system was radar (radio detection and ranging), which was invented in 1941. Radar provided a superhuman ability to see objects at a distance through the air.

FIGURE 1.1 . SAGE Operator Seeing Through the Air

While radar enables stand-off tracking of airborne objects, sonar (sound navigation and ranging) was invented to provide an ability to see through water to detect and locate submerged objects. Additional invention enabled humans to see non visible spectra, infrared, providing an ability to see through the dark.

Each of these inventions provided unprecedented improvements in situational awareness by increasing our "vision" through air, water, and night. Sensor and processing advances have provided increasing levels of fidelity, distance, and spectra (e.g., multispectral ability to remotely see chemical gases and liquids or vegetation types and conditions). Methods (e.g., foliage penetration, ground penetration, etc.) have even been developed to overcome the use of cover (foliage), concealment (underground), camouflage, and deception (CCCD) to deter/mitigate detection by earlier systems. In spite of these advances, however, radar, sonar, and infrared are blind to human adversary attitudes and intentions and often even behaviors toward our messages and activities. Our failure to track and affect instability, poverty, disease, corruption, conflict and natural disasters is done our own expense.

PURPOSE

The objective of this vision document is to develop the metaphor for a Social Radar (defined below), to envision a framework for a novel set of capabilities (since a social radar will require a multi-modal solution), and to create a community that can define and refine the requirements for and solutions to identified social radar needs.

NEED

The center of gravity in modern warfare not only includes military targets such as tanks, ships, planes, command and control facilities, and military forces but equally important the perceptions, intentions and behaviors of citizens and leaders. While radar, sonar, and infrared vision serve our military forces well, they provide limited insight into the social, cultural and behavioral and activities of populations. While hard power will always play a key role in warfare, increasingly soft power (Nye 2004), the ability to not coerce but to encourage or motivate behavior, will be necessary in the future of our increasingly connected and concentrated global village.

A *Social Radar* needs to sense perceptions, attitudes, beliefs and behaviors (via indicators and correlation with other factors) and geographically and/or socially localize and track these to support the smart engagement of foreign populations and the assessment and replanning of efforts based on indicator progression. As a modern center of gravity, the perceptions, cognitions, emotions, and behaviors of populations encompass the hopes, fears, and dreams of many publics. Accordingly, a social radar needs to be not only sensitive to private and public cognitions and the amplifying effect of human emotions but also sensitive to cultural values as they can drive or shape behavior. Conventional radar requires signatures for different kinds of objects and events: it needs to be tuned to different environmental conditions to provide accurate and reliable information. Analogously, a social radar needs signatures, calibration, and correlation to sense, if not forecast, a broad spectrum of phenomena (e.g., political, economic, social, environmental, health) and potentially forecast changing trends in population perceptions and behaviors. For example, radar or sonar enable some degree of forecasting by tracking spatial and temporal patterns (e.g. they track and display how military objects or weather phenomena move in what clusters, in which direction(s) and at what speed.) A user can thus project where and when objects will be in the future. Similarly, a social radar should enable us to forecast who will cluster with whom in a network, where, and when in what kinds of relationships.

One long term lesson from counter insurgency operations (COIN) is that while certain individuals or groups will always remain hard liners committed to their cause and yielding only to hard power, the only known successful exit strategy from an insurgency is re-integration of the disaffected into the political process. With respect to COIN, a successful social radar (and underlying models) should be able to sense and assess the trends of social engagement and provide indictors (based on or feeding models) of the positive and negative effects of engagement actions and messages on desired outcomes such as reintegration.

4   SOCIAL RADAR

KEY SYSTEM PROPERTIES

For social radar to be as revolutionary as radar or sonar, it must exhibit some fundamental properties, including:

Global Access – Worldwide, real-time capture, processing and analysis to include even areas with limited connectivity, denied access, or active censorship.

Multilingual and Multicultural – Ability to transcribe, summarize, translate, and interpret across languages, cultures, and societies.

Multimodal – Ability to process multiple media (e.g., radio, television, newspapers, websites, blogs, wikis) and multiple modalities (e.g., text, audio, imagery, action) which present challenges such as text understanding, speech recognition, and image and video understanding.

Persistent – Conventional access to foreign public beliefs and opinions is via polling or focus groups which are expensive, episodic (in anticipation of or in response to events), manually intensive, and subject to interviewer bias and interpretation error. Automated, large scale, continuous analysis of communications is required to provide wide area, multidimensional, long term dwell.

Real-Time, Geolocated – Social media (e.g., YouTube, blogs, wikis, twitter, Facebook, Flickr) can be analyzed in real time to provide sometimes attributed and localized to regional/group foreign public beliefs, opinions and behaviors.

Social – Detecting and tracking interactions among humans (individuals, groups, tribes, societies) using direct and indirect indicators to sense perceptions, attitudes, beliefs, opinions, and behaviors as well as the ability to infer roles and relationships, support social network analysis, and enable social network psychology (e.g., differentiating personal roles such as instigator or peacemaker and structural roles such as maven vs. connector).

Multispectrum – Ability to capture and correlate perceptions, beliefs, attitudes, and behavior in multiple domains including politics (e.g., governance), economics, military/law enforcement (including crime and corruption), society, healthcare, education, and the environment.

Passive and Anonymous – Preserving the anonymity and safety of the sensing activity (e.g., deterring traceback to the origin of the sensor) often by relying upon sources and methods that do not require active polling or engagement (e.g., using human to human typically public communications to assess perceptions, attitudes, beliefs and desires). Passivity is also important because anonymous collection helps mitigate bias that is inevitable when the person/population is aware of the data collection.

Security and Privacy Preserving – Although there are legitimate needs to track activities in economic, political, social, health and other spheres, methods and technology are needed to preserve individual security and privacy.

SOURCES

To detect, model, and forecast a broad range of phenomena, social radar will rely upon a rich set of sources including but by no means limited to:

Broadcast Media – Global, regional, and local broadcast services in print, radio, and television.

Social Media – User created content that is captured and shared via services such as in wikis, blogs, flickr, twitter, and YouTube, as well as social networking sites (e.g., Facebook, Linked-in).

Domain Specific Sources: Specialized sources can enable the detection of signatures in various domains such as health (e.g., ProMed, WHO medical reports), economics (e.g. World Bank reports, SEC filings), governance (e.g., UN corruption reports), or security (e.g., IAEA safeguards inspections).

METHODS

Like radar, sonar, or LIDAR (Light Detection and Ranging) sensors, a social radar will need to be calibrated and have signatures developed to detect and track various phenomena. A fully functional social radar will require elements including:

Calibration – Ability to baseline, benchmark (e.g., compare with traditional media), focus and/or refine indicators to enhance fidelity, accuracy, signal to noise ratio.

Signatures – identification of particular individuals (biometrics) or groups (sociometrics), sentiments (e.g., lexical, acoustic, or visual signatures expressing various shades of positive or negative reactions), and/or behaviors (e.g., economic, political, social, cultural).

Foreground/Background – The ability to provide foundational and/or baseline data such as the geography, demography, socioeconomic, political, and/or cultural environment which can provide a background for the integration and interpretation of foreground sensed events.

Noise Mitigation – Algorithms and methods are needed to ensure high signal to noise ratios by minimizing noise arising from variations in the signal or from the background environment (e.g., an individual's true attitudes or behaviors toward a

message can be masked by their reactions to the messenger, local environment, or a global situation.)

De-cluttering - Algorithms and methods are needed to remove signals from irrelevant or duplicative signals from people, organizations, networks, topics, or events of non interest that interfere or obfuscate even a clean signal and thus impede sensemaking. Modeling of the various "terrains" (e.g., economic, political, environmental, social) promises to assist in developing countermeasures to clutter so that extraneous "returns" (i.e., passive interference) can be eliminated.

Jamming/Counter Denial – Just as radar needs to overcome interference, camouflage, spoofing and other occlusion, so too social radar needs to overcome denied access, censorship, and deception. Active interference against a social radar could mask targets, create false targets, or change how targets are sensed.

Correlation/Integration – Social "signatures" need to be correlated with indicators from other domains, such as demographic, economic, governance and health indicators. A particular challenge will be not only integrating across these domains but also integrating various levels of granularity within domains (e.g., micro versus macro economics; individual vs. group vs. tribal vs. national political models).

Spatio-Temporal Event Tracking – Density in time and space of phenomena intensity and progression as well as event correlation if not causation. Trend analysis is particularly challenging, as there may be a significant offset between stimulus and response.

Analytics – Sources and methods need to be developed to model, understand and forecast sociological events. For example, economic indicators might be microeconomic or macroeconomic. In health care, pandemic disease monitoring might use direct indicators (e.g., blood samples) or indirect ones (e.g., school closings, prescription supply and demand). Models across societies might help detect leading or lagging indicators as well as tipping points to forecast opinion or behavior change.

ARCHITECTURE

Figure 1 illustrates a high level systems architecture of a social radar including key sources, processing components and work flow. As detailed above, heterogeneous information sources include traditional news media (radio, television, print), polls, and surveillance sources as well as user generated, social media such as wikis, blogs, myspace, facebook, twitter, etc. These are processed using a variety of technologies and methods to support processes including media analysis, detection and tracking of signatures, and ultimately social indicator analysis. Indicators may be of group or individuals to include measuring perceptions, attitudes, sentiments, and intentions. Ultimately, these support collaborative analyses of military, law

enforcement, religious, political, economic and health dimensions to support a range of missions including strategic communication, counter insurgency or counter radicalism, and humanitarian relief.
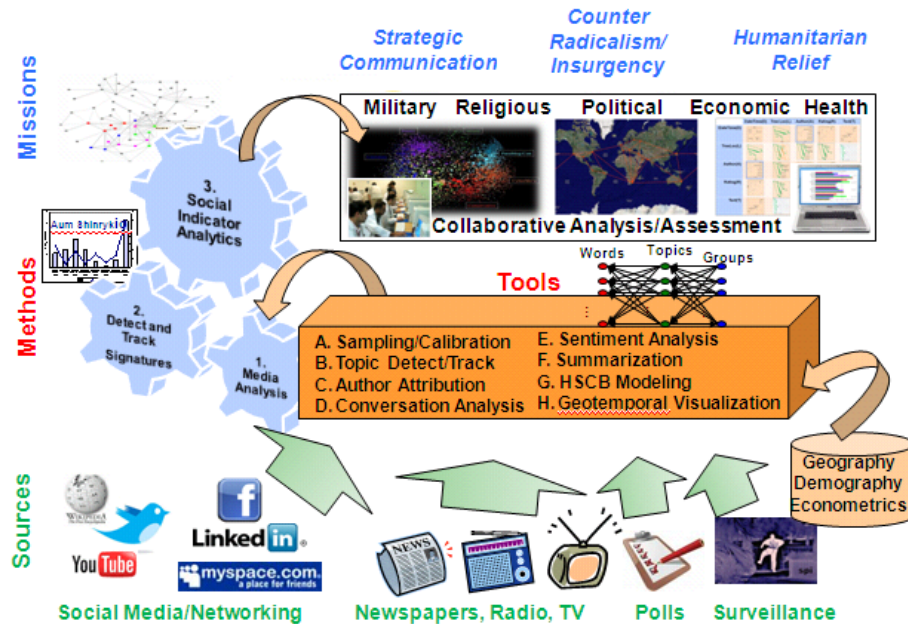

Figure 1: Social Radar Architecture

OPERATIONS

The creation of a social radar imposes the need for the development of sensors, signatures, and methods to collect, extract, process, correlate, and visualize social and behavioral phenomena. Tactics, techniques, and procedures will need to be developed to overcome sensor limitations in fidelity and coverage as well as denial and deception but also to discover how best to employ this new class of sensor or sensors. For example, sophisticated adversaries will employ viral communications that both infect (rapidly distribute) and affect vulnerable populations. Countering violent and viral communications require an ability to anticipate and counter message. Adversaries will actively "jam" social interaction, ranging from censorship to disruption of social media to physical intimidation.

A social radar should feed decision support tools and visualizations that can provide tailored support to defense, diplomatic, and development users performing a variety of functions ranging from security to stability to prosperity in roles encompassing policy formulation, public affairs, public diplomacy, intelligence, strategic

communication, information operations, disaster relief, and military engagements. Results might be visualized and explored by time, geography, demography, and topic, depending upon the task at hand. Also, there likely will need to be strategic and tactical systems, e.g., a mobile, hand held, local area and task oriented version will be necessary for individual, focused use.

SOURCES, INDICATORS AND SIGNATURES

Table 1 illustrates the range of some of the indicators, signatures and sources for various dimensions of a social radar such as military, political, and economic. This provides a sense of the range of open sources that can inform a social radar. For the political dimension, signatures that measure electoral fraud, trafficking (arms, drugs or human), laundering, public trust and the degree of freedom of the press can provide input to indicators such as the quality of governance, corruption, and balance of powers. These can be gleaned from reports from the United Nations, World Bank or Human Rights Watch, or journalistic reports and/or polling.

Table 1. Social Radar Example Sources, Indicators and Signatures

Elements	Military & Law	Political	Economic	Social	Health	Environment
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 RightsWatch	SARs, DEA Reports	Newswire	World Health Organization	World Health Organization
	Newswire	Pew/Gallup	Bloomberg	Social Media	ProMED	Environmental NGOs

MEASURING AND GUIDING ENGAGEMENT

MITRE's research program has taken the first steps toward realizing the social radar vision. We have initiated several projects specifically focused on analysis of traditional and social media to understand perceptions and sentiments. These include:

- **Sentiment Analysis for Strategic Communication Assessment (SASCA):** Sentiment analysis using natural language processing to monitor attitude and behavior trends in key strategic areas of operation. Principal Investigators: Dr. David Day and Dr. John Boiney

- **Forum and Blog Threaded Comment Analysis (FABTAC).** Analysis of forum comment threads (e.g., YouTube comments, blogs) to provide interactive visualizations and thread summaries for intelligence and operations. Principal Investigator: Dr. Christy Doran

- **Public Opinion Polling by Proxy (POP/P).** An exploration of the ability of social media (e.g., Twitter) to serve as a proxy for traditional opinion polling methods to overcome their latency, expense, and invasiveness. Principal Investigator: Dr. John Henderson

- **Exploring Soft Power in Weblogistan.** Developing foundational Farsi and Dari language processing tools to enable analysis of large volumes of foreign language blog and social media content. Principal Investigator: Dr. Karine Megerdoomian

- **Assessing Health Cognitions.** Integrating nationally-representative survey data into agent-based models of H1N1 virus transmission to assess the combined effects of individual health-protective attitudes (e.g., vaccination), behavioral intentions, and federal and local public health guidance. Principal Investigators: Dr. Jill Egeth and Dr. Jennifer Mathieu

TOWARD A "SOCIAL RADAR" COMMUNITY

Our grand vision of social sensing and tracking and the creation of a social radar will require a broad set of participants from a range of institutions including government, academic, industrial, non-governmental organizations (NGOs), and FFRDCs. Stakeholders must include users, developers, system integrators, and evaluators. This will by nature require an interdisciplinary set of skills from technical to operational to social sciences from communities spanning defense, development and diplomacy. Existing programs and partnerships (including coalition and international agencies) will need to be leveraged to address the many legal, data, processing, privacy/security and political/social impediments. Subject

matter experts will be needed from many disciplines including but not limited to economics, political science, military science, history, psychology, anthropology, sociology, medicine, and environmental studies. Major steps will include establishing requirements, formulating a concept of operations, and assessing impact on various stakeholder communities. While daunting, the result could be nothing less than revolutionary.

CONCLUSION

Social radar is a long range vision for a capability that is essential to address a new center of gravity in modern affairs: public perceptions and behaviors. Realizing this vision will require the development of new methods of sensing, collecting, (socio-cultural-behavioral) modeling, processing, interpreting and acting on this new class of sensor. Successfully created, social radar would provide critical situational awareness and guidance in order to engage all of government power smartly in modern defense, diplomacy, and development.

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