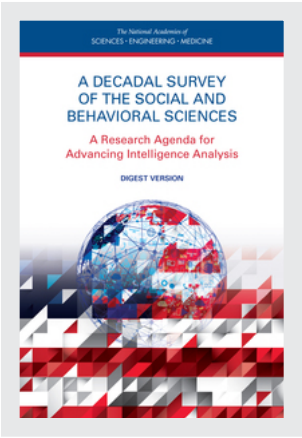

A Decadal Survey of the Social and Behavioral Sciences: A Research Agenda for Advancing Intelligence Analysis: Digest Version (2019)

DETAILS

38 pages | 6 x 9 | PAPERBACK
ISBN 978-0-309-67032-6 | DOI 10.17226/25648

CONTRIBUTORS

Committee on a Decadal Survey of Social and Behavioral Sciences for Applications to National Security; Board on Behavioral, Cognitive, and Sensory Sciences; Division of Behavioral and Social Sciences and Education; National Academies of Sciences, Engineering, and Medicine

SUGGESTED CITATION

National Academies of Sciences, Engineering, and Medicine 2019. *A Decadal Survey of the Social and Behavioral Sciences: A Research Agenda for Advancing Intelligence Analysis: Digest Version*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25648.

A DECADAL SURVEY OF THE SOCIAL AND BEHAVIORAL SCIENCES

A Research Agenda for Advancing Intelligence Analysis

DIGEST VERSION

Committee on a Decadal Survey of Social and Behavioral Sciences for Applications to National Security

Board on Behavioral, Cognitive, and Sensory Sciences

Division of Behavioral and Social Sciences and Education

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

THE NATIONAL ACADEMIES PRESS
Washington, DC
www.nap.edu

THE NATIONAL ACADEMIES PRESS 500 Fifth Street, NW Washington, DC 20001

This activity was supported by contracts between the National Academy of Sciences and the Office of the Director of National Intelligence, Contract No. 2014-14041100003-009. Support for the work of the Board on Behavioral, Cognitive, and Sensory Sciences is provided primarily by a grant from the National Science Foundation (Award No. BCS-1729167). Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project.

International Standard Book Number-13: 978-0-309-67032-6
International Standard Book Number-10: 0-309-67032-2
Digital Object Identifier: https://doi.org/10.17226/25648

Additional copies of this publication are available from the National Academies Press, 500 Fifth Street, NW, Keck 360, Washington, DC 20001; (800) 624-6242 or (202) 334-3313; http://www.nap.edu.

Printed in the United States of America

Suggested citation: National Academies of Sciences, Engineering, and Medicine. (2019). *A Decadal Survey of the Social and Behavioral Sciences: A Research Agenda for Advancing Intelligence Analysis: Digest Version*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25648.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

The **National Academy of Sciences** was established in 1863 by an Act of Congress, signed by President Lincoln, as a private, nongovernmental institution to advise the nation on issues related to science and technology. Members are elected by their peers for outstanding contributions to research. Dr. Marcia McNutt is president.

The **National Academy of Engineering** was established in 1964 under the charter of the National Academy of Sciences to bring the practices of engineering to advising the nation. Members are elected by their peers for extraordinary contributions to engineering. Dr. John L. Anderson, is president.

The **National Academy of Medicine** (formerly the Institute of Medicine) was established in 1970 under the charter of the National Academy of Sciences to advise the nation on medical and health issues. Members are elected by their peers for distinguished contributions to medicine and health. Dr. Victor J. Dzau is president.

The three Academies work together as the **National Academies of Sciences, Engineering, and Medicine** to provide independent, objective analysis and advice to the nation and conduct other activities to solve complex problems and inform public policy decisions. The National Academies also encourage education and research, recognize outstanding contributions to knowledge, and increase public understanding in matters of science, engineering, and medicine.

Learn more about the National Academies of Sciences, Engineering, and Medicine at **www.nationalacademies.org**.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Consensus Study Reports published by the National Academies of Sciences, Engineering, and Medicine document the evidence-based consensus on the study's statement of task by an authoring committee of experts. Reports typically include findings, conclusions, and recommendations based on information gathered by the committee and the committee's deliberations. Each report has been subjected to a rigorous and independent peer-review process and it represents the position of the National Academies on the statement of task.

Proceedings published by the National Academies of Sciences, Engineering, and Medicine chronicle the presentations and discussions at a workshop, symposium, or other event convened by the National Academies. The statements and opinions contained in proceedings are those of the participants and are not endorsed by other participants, the planning committee, or the National Academies.

For information about other products and activities of the National Academies, please visit www.nationalacademies.org/about/whatwedo.

COMMITTEE ON A DECADAL SURVEY OF SOCIAL AND BEHAVIORAL SCIENCES FOR APPLICATIONS TO NATIONAL SECURITY

PAUL R. SACKETT (*Chair*), Department of Psychology, University of Minnesota
GARY G. BERNTSON, Department of Psychology, The Ohio State University
KATHLEEN M. CARLEY, School of Computer Science, Institute for Software Research International, Carnegie Mellon University
NOSHIR S. CONTRACTOR, McCormick School of Engineering and Applied Science, School of Communications, and the Kellogg School of Management, Northwestern University
NANCY J. COOKE, The Polytechnic School, Ira A. Fulton Schools of Engineering, Arizona State University
BARBARA ANNE DOSHER (NAS), Department of Cognitive Science, University of California, Irvine
JEFFREY C. JOHNSON, Department of Anthropology, University of Florida
SALLIE KELLER, Social and Decision Analytics Division, Biocomplexity Institute, University of Virginia
DAVID MATSUMOTO, Department of Psychology, College of Science and Engineering, San Francisco State University
CARMEN MEDINA, MedinAnalytics, LLC
FRAN P. MOORE, The Financial Systemic Analysis and Resilience Center
JONATHAN D. MORENO (NAM), Perelman School of Medicine, Department of Medical Ethics and Health Policy, University of Pennsylvania
JOY ROHDE, Gerald R. Ford School of Public Policy, University of Michigan
JEFFREY W. TALIAFERRO, Department of Political Science, Tufts University
GREGORY F. TREVERTON, Dornsife College of Letters, Arts, and Sciences, School of International Relations, University of Southern California
JEREMY M. WOLFE, Departments of Ophthalmology and Radiology, Brigham and Women's Hospital, Harvard Medical School

SUJEETA BHATT, *Study Director*
ALEXANDRA BEATTY (*from March 2017*), *Senior Program Officer*
JULIE ANNE SCHUCK, *Program Officer*
ELIZABETH TOWNSEND (*until March 2018*), *Research Associate*
RENÉE L. WILSON GAINES (*until June 2018*), *Senior Program Assistant*
THELMA COX, *Program Coordinator*

BOARD ON BEHAVIORAL, COGNITIVE, AND SENSORY SCIENCES

Contents

Foreword

The Office of the Director of National Intelligence (ODNI), which oversees and directs the work of the agencies and organizations responsible for foreign, military, and domestic intelligence for the United States, has a strong interest in research from the social and behavioral sciences. The Intelligence Community (IC) turns to researchers from these fields for support with many challenges and currently has multiple mechanisms for engaging researchers and mining their understanding and expertise to support the work of the intelligence analyst.

But the ODNI has also recognized the need for a more systematic understanding of the potential benefits these disciplines offer for strengthening national security in the long term. It asked the National Academies of Sciences, Engineering, and Medicine to conduct a study that would identify a 10-year research agenda and also elaborate on possibilities for fostering collaboration between the IC and the SBS research community. The ODNI requested that the study take the form of a decadal survey of the potential contributions that research from the social and behavioral sciences (SBS) can make to national security. Decadal surveys are a means of engaging members of an academic community to identify lines of research with the greatest potential to be of use over a 10-year period in the pursuit of a particular goal. This approach was first developed by the National Academies in the 1960s but this was the first study of its kind to survey the social and behavioral sciences, and also the first application of the process to the needs of the IC.

The resulting report, *A Decadal Survey of the Social and Behavioral Sciences: A Research Agenda for Advancing Intelligence Analysis*, published

in early 2019, explored a wide range of research opportunities in detail and set them in the context of a thorough discussion of the IC and the SBS research community; their history of working together and challenges and values they share; the work of intelligence analysts; and the global risks they monitor. Reviewers who appreciated the comprehensiveness of that report also expressed a desire for a summary that would capture the most important ideas for the IC to consider in the coming decade but also be easier to digest.

The result is this volume, which provides an overview of the primary opportunities that research in the social and behavioral sciences offers for strengthening national security, specifically the work of the intelligence analyst, and the conclusions and recommendations of the Committee on a Decadal Survey of Social and Behavioral Sciences for Applications to National Survey. This digest version is a succinct roadmap to the critical contribution SBS research makes to national security; readers whose appetites may be whetted will find a wealth of detail in the original report.[1]

The original decadal survey and this digest volume were made possible by the generous sponsorship of ODNI as well as substantive core support for the Board on Behavioral, Cognitive, and Sensory Sciences received from the National Science Foundation's Social, Behavioral and Economic Sciences Directorate, which ensured necessary oversight on the project. I also want to acknowledge staff member Alix Beatty, who prepared this volume.

Susan Fiske, Chair
Board on Behavioral, Cognitive, and Sensory Sciences

[1]The original report can be downloaded for free at https://www.nap.edu/catalog/25335/a-decadal-survey-of-the-social-and-behavioral-sciences-a.

1

Introduction

Ten years from now the job of the intelligence analyst will have been transformed. Technological changes—both new technologies that can be used to conduct analysis and risks related to technologically based activities and communications around the world—are virtually inevitable. What is not inevitable is that the Intelligence Community (IC) will adapt to these changes in the most productive ways. Integrating the understanding of human beings and social processes that comes from social and behavioral science (SBS) research into the analyst's work as it evolves in the coming decade will be critical. It is this knowledge base that will enable the IC to navigate the emergence of new technologies and challenges in productive ways: to develop technological supports that are both proactive and interactive and can effectively augment the capacities of human analysts and, more broadly, to respond effectively to the security threats of the coming decades. The opportunities described in this report offer the potential for

- stronger intelligence assessments;
- tools and technologies optimally designed for human use and human–machine interaction; and
- strengthened readiness to confront evolving security threats.

Intelligence analysts already rely on SBS research, just as they already synthesize large volumes of data and information about fast-breaking developments to produce reliable and accurate assessments that can support urgent and consequential decisions. However, the influence of SBS research on intelligence analysis has been ad hoc: despite the value of many ongoing

Box 1
What Is a Decadal Survey?

A decadal survey is a method for engaging members of a scholarly community to identify lines of research with the greatest potential to be of use over a 10-year period in pursuit of a particular goal. The National Academies developed this type of survey to support the planning of future research for other government entities, including the National Aeronautics and Space Administration (NASA), the National Science Foundation, the Department of Energy, the National Oceanic and Atmospheric Administration, and the U.S. Geological Survey. Decadal studies have targeted many sorts of missions and have involved research disciplines within the space and earth sciences that use a range of methodologies. The process has not previously been used to survey SBS research or to support the IC's research planning.

efforts, the IC has not found ways to systematically integrate research and perspectives from the academic SBS community into its work. Capitalizing on the power of research that integrates the insights from SBS research with what technology makes possible will require a fundamental commitment by the IC.

Recognizing the crucial role of SBS research in supporting intelligence analysis and the need for further and systematic integration, the Office of the Director of National Intelligence (ODNI), which oversees and directs the work of the agencies and organizations responsible for foreign, military, and domestic intelligence for the United States, requested that the National Academies of Sciences, Engineering, and Medicine conduct a decadal survey of SBS research with applications to national security (see Box 1).

The Committee on a Decadal Survey of Social and Behavioral Sciences for Applications to National Security, made up of experts with decades of experience in intelligence, scholars in diverse SBS fields, and several individuals with extensive experience in both worlds, was appointed to conduct the study. The charge to the committee was to (1) develop understanding and direction regarding resources from SBS disciplines with the greatest potential to augment and support the intelligence analysis process and enhance national security, which the IC can use in determining its research priorities for the coming decade; and (2) identify lessons to be learned from the application of the decadal survey process in the national security context. The committee's consensus report, *A Decadal Survey of The Social and Behavioral Sciences: A Research Agenda for Advancing Intelligence Analysis*, provides a detailed discussion of opportunities in SBS research

Box 2
What Are the Social and Behavioral Sciences?

It is not simple to develop a comprehensive list of SBS fields, but they include areas as diverse as demography and social statistics, sociology, economics, linguistics, social anthropology, international relations, and psychology. Researchers in these fields use a wide range of scientific methods, research strategies, and tools, and rely on diverse theoretical approaches, but all contribute to understanding of people and what they do. They investigate questions about individuals, groups, communities, societies, and nations. They may examine, for example, individual mental processes that guide behavior, ways in which cultural practices and attitudes are shared and evolve across generations, or how water shortages are influencing political developments in a particular region. Within each SBS discipline, moreover, there are multiple subspecialties that have developed their own research approaches and methodologies.

and important context for considering a 10-year research agenda.[1] This digest version provides an overview of the main ideas in that report.

The essence of the task for the committee was to develop a process for understanding the needs of the IC analyst and culling SBS research that might be relevant to those challenges. Both aspects of this task were challenging. The IC, which is made up of 17 agencies, each with its own mission and resources, is varied (see Box 3). Much of its work is classified and not readily understood by outsiders. Similarly, the academic disciplines that are considered part of the SBS community are diverse and only connected by their shared focus on understanding the behavior and actions of people, organizations, and communities (see Box 2). Most researchers in these fields have no particular incentives to consider contributions their work could make to national security, or means of identifying possible opportunities to explore such applications.

[1] The complete report is available for free download at https://www.nap.edu/catalog/25335/a-decadal-survey-of-the-social-and-behavioral-sciences-a.

Box 3
What Is the Intelligence Community?

The government officials responsible for the nation's security rely on information collected by the IC. The 17 IC agencies each have a particular focus and mission, but together they provide support to decision makers in the executive and legislative branches of government, law enforcement, and the military. The structure of the IC has evolved in response to the nation's changing needs but its overall responsibility has not changed: it is collectively responsible for identifying issues that need to be investigated, collecting and analyzing relevant information of many kinds, and conveying the information and analysis in a timely manner to those who need them while also keeping the information secure and complying with laws regarding its collection and handling.

The 17 Entities That Make Up the Intelligence Community:

Department of Defense Entities:

1. Defense Intelligence Agency
2. National Geospatial-Intelligence Agency
3. National Reconnaissance Office
4. National Security Agency/Central Security Service
5. U.S. Air Force Intelligence
6. U.S. Army Intelligence
7. U.S. Marine Corps Intelligence
8. U.S. Navy Intelligence

Non–Defense Department Entities:

9. Office of the Director of National Intelligence
10. Central Intelligence Agency

Department of Energy

11. *Office of Intelligence and Counter-Intelligence*

Department of Justice

12. *Federal Bureau of Investigation - National Security Branch*
13. *Drug Enforcement Administration - Office of National Security Intelligence*

Department of Homeland Security

14. *Office of Intelligence and Analysis*
15. *U.S. Coast Guard Intelligence*

Department of State

16. *Bureau of Intelligence and Research*

Department of the Treasury

17. *Office of Intelligence and Analysis*

SOURCE FOR LIST: Adapted from Miles (2016).

2

Opportunities for the Intelligence Community

The committee explored both the needs of the IC and the areas of SBS research to identify key opportunities to strengthen intelligence analysis and national security (see Box 4 for a description of their process). They identified significant research opportunities in four key areas:

- sensemaking: emerging ways to answer intelligence questions;
- enhancing security in cyberspace;
- supporting the design of a human–machine ecosystem; and
- strengthening the analytic workforce for future challenges

For each of these areas the committee identified specific ways the IC could benefit from research developments that can be reasonably expected in the coming decade, if priority is placed on supporting this work. The committee did not claim that these are the only areas of opportunity, but was confident that they are "ripe" in the sense that they offer innovations in theory and/or application likely to bear fruit in concrete ways in the coming decade, and are responsive to significant goals and needs related to the analyst's work. The full report provides detailed discussion of possible applications and research directions to support progress in each area.

SENSEMAKING: EMERGING WAYS TO ANSWER INTELLIGENCE QUESTIONS

Understanding of human social processes—insights about the functioning of individuals, groups, and societies—is essential to the analysts'

Box 4
The Committee Process

The committee used numerous methods to solicit input from the IC and the SBS research community, including calls for white papers and public workshops, and to review research literature in salient areas. They examined global trends likely to affect the security risks the IC will be monitoring and considered the many functions of the IC analyst. The committee also identified IC needs that allowed them to focus their search through the vast domain of SBS research. These needs fell into two categories: support in taking advantage of developing research and technology to improve the skills and tools of intelligence analysts.

Members of the IC specifically expressed interest in improved ways to determine the usefulness of and analyze information and data; effectively communicate findings to decision makers; monitor and measure evolving events; model and understand complex, multiple-actor phenomena; and avoid errors and biases in decision making. The committee identified research that is on the cusp of supporting significant progress with those objectives, highlighting work that has high potential for impact on urgent national security priorities; has a strong supporting evidence base; is somewhere along the research continuum from basic research, to field testing and evaluation, to applied research; and offers the potential to use or develop emerging data sources, methods, or other technical advances.

ability to answer enduring intelligence questions. Analysts' primary function is sensemaking, drawing meaningful conclusions from the vast stream of information to which they have access about core phenomena related to national security, including the nature of power and influence; threats, opportunities, and social and organizational dynamics; complexity; and deception and gaps in information. Figure 1 suggests the complexity of the challenge of making sense of diverse kinds of information from varied sources that may be relevant to an analyst's primary area of responsibility.

Four areas of SBS research have the potential to be particularly fruitful in supporting analysts' sensemaking capacities.

The Study of Narrative

Understanding the content of communications and how and why they are conveyed—from the meaning of cultural traditions, to political themes in press coverage, to trends in social media communications—is fundamental for the intelligence analyst. Scholars in in the humanities and in such social sciences as anthropology and psychology have long studied the structure and content of narratives using many tools and methods. More recently, exponential growth in data created by social media such

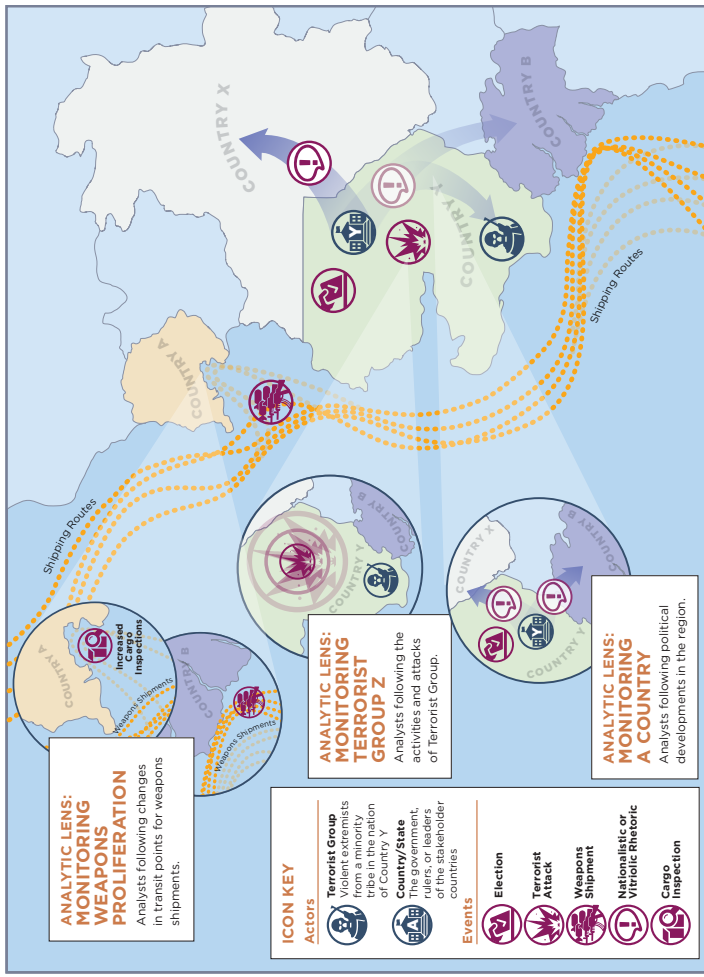

FIGURE 1 Illustration of how analysts with different sets of responsibilities associated with a particular region (in this case a hypothetical one) will regard the same set of circumstances through different lenses. The figure depicts several events that would be monitored by groups of analysts; each group would focus their information collection and analyses on some events and not others, according to their assigned responsibilities.
SOURCE: Generated by the Committee on a Decadal Survey of Social and Behavioral Sciences for Applications to National Security.

as Facebook and Twitter, and by the fact that vast amounts of content are now stored digitally, has made the study of narratives at a large scale much more practical. These capabilities offer new frontiers for applying the study of narratives to intelligence analysis.

Among the possibilities are decoding influential narratives such as those of Islamist extremism, interpreting new kinds of data such as digital video footage, and tracking the flow and influence of ideas or emotional states. Techniques for analyzing multiple aspects of communication and its context can yield insights into the comparative power and influence of political narratives and means of countering them. Machine learning techniques have opened up possibilities for developing effective indicators of growing extremism or potential for violence in narrative streams.

The Study of Social Networks

Social network analysis is a structural approach to understanding the world based on the interdependencies among actors and their influences on behavior. This type of analysis has played an important role in fields such as anthropology, communication, sociology, and political science. It entails representing a network in terms of nodes and relations that form an interdependent, holistic system, and identifying key actors, their group identifications, and other network features. Cutting-edge methods for social network analysis rest on technological advances, particularly improved capacity for application at very large scales. Many of these advances resulted from collaboration between researchers and the IC—but the utility of this research for intelligence analysis rests on interdisciplinary work with other SBS disciplines.

Social network analysis can yield understanding of such phenomena as the distribution and exchange of resources, the development of trust within a group or society, ideological contagion, diffusion of beliefs and attitude formation, the establishment of normative constraints, the development of group and individual social capital, group and organizational effectiveness, the evolution of organizational leadership, group and organizational resilience and robustness, and political stability, among many others.

The Study of Complex Systems

Subject matter experts in the IC face constant pressure, often within tightly compressed timeframes, to understand and develop forecasts about scenarios that are both complex and constantly changing. Many of the issues they follow have the features of complex systems. A good example is the role of China in the world, which is a key issue for the IC. Numerous factors—including economic performance, degree of social cohesion,

rural-urban migration, leadership dynamics in the Communist party, and environmental degradation, to name but a few—interact and shape developments in that country. Yet analysts are expected to communicate findings about China to policy and decision makers in clear terms.

Work in fields including both mathematics and philosophy has contributed to the development of an interdisciplinary approach to studying complexity (sometimes termed complexity science, strategy, or theory). Based in systems theory as well as developments in the natural sciences, this approach is used to study phenomena that are unpredictable and nonlinear, providing ways to identify and mitigate unintended consequences, as well as methods useful for considering a wide range of alternatives and thus supporting strategic analysis—all of which have clear utility of intelligence analysis. Scholars of complexity theory use computational and mathematical methods to assess such phenomena, and rely heavily on modeling and simulation.

The Affective Sciences

The affective sciences are fields of study that address emotions, feelings, affect, moods, sentiments, and affectively based personality traits and psychopathologies. The study of these kinds of phenomena, including the verbal and nonverbal signals of affective states, can provide insights into the mindsets, personalities, motivations, and intentions of the actors whom intelligence analysts seek to understand; help explain people's actions, judgments, and decisions; and support more nuanced and sophisticated understanding of communication. Research has provided strong support for the validity and reliability of interpretations of nonverbal expressions of specific emotional states and signals of other cognitive and emotional states. Such findings can support the analysis of phenomena including the content and power of narratives, the processes of judgments and decision-making, and the spread of attitudes and beliefs associated with terrorism and security threats.

Basic research in these four areas provides a theoretical and empirical foundation for the development of sophisticated methods that analysts can use in tackling core sensemaking challenges. For example, accurate computer modeling of complex, sophisticated sociopolitical systems rests on foundational understanding of the nature of status and power, socioemotional processes, and linguistic structures. The potential for advances in the development and application of such tools and approaches, in turn, rests on the marriage of technological advances and insights from SBS fields. Examples include the use of digital trace data to assess the importance of network nodes that pose potential security threats or to track the trajectory of political ideas, the use of understanding of how nonverbal cues can

enhance the power and influence of political messages to assess such messages, and the application of traditional techniques of narrative analysis to machine computational analysis of discourse among social media groups. See Boxes 5, 6, and 7 for more potential applications.

Box 5
Potential Application: Indicators of Actors' Intentions

Advances in research on judgment and decision making could allow analysts to carry out more sophisticated assessments of the likely intentions of actors they are following. For example, a reliable way to determine a leader's preferred decision-making style would allow analysts to anticipate how long a particular leader would take to make a decision or the likelihood that a leader would reverse a policy move. Research has shown that emotions can affect decision making (e.g., by modulating attention and/or memory), and has identified specific behavioral and physiological markers of emotion that can be applied in assessing the role of emotion in decision making. Such research could provide the basis for using signals of mental states or situational cues as indicators of potentially consequential emotional states or changes in those states among leaders or other powerful actors, or as indicators of their thinking. These methods could be applied to help analysts assess the inclinations of leaders involved in high-stakes encounters with the United States, such as Iraqi President Saddam Hussein during the two Gulf Wars and North Korean leader Kim Jong-un.

Box 6
Potential Application: Using Dynamic Network Analysis to Track Security-Related Developments

Dynamic network techniques can support understanding of, for example, how groups or regions transition from stability to instability and how factions form. These techniques may also provide indicators and metrics of reductions or increases in the power of key actors, help identify emergent groups, and aid in identifying anomalous network activity.

Box 7
Potential Application: Understanding How Networks and Persuasive Messages Together Influence Individuals

The integration of social network analysis with analysis of narrative content could be the basis for a robust analytic approach to assessing the influences of and on social networks. For instance, this combined approach could be used to test the cohesiveness of a network in which toxic narrative is spreading, identify how changes in power structure may affect narratives, or reveal how changes in leaders' narratives coincide with changes in their networks. Such an approach, for example, could have helped analysts track the rise of ISIS in the Middle East and the relative decline in the appeal of Al Qaeda.

Sophisticated methods such as computational analysis of large datasets would make little sense without theoretical frameworks to guide the development of algorithms, such as those for classification of narrative structures or analysis of the functioning of social networks. Similarly, insights from SBS research are important guides for the development of indicators that could be used to track, for example, significant emotional states or changes in leaders or other powerful actors, the developing strength of a minority group's message, or the cohesiveness of networks in which toxic narratives are spreading.

CONCLUSION 1: Developing research on narratives, social networks, complex systems, and affect and emotion can enhance understanding of primary targets of intelligence analysis, the potential impact of actions taken by the IC, and individual and social processes relevant to security threats. This research offers possibilities for new tools, including but not limited to

- **indicators for use in monitoring and detection of key security-related developments;**
- **algorithms for extracting meaning from large quantities of open-source information; and**
- **models for reasoning about the potential implications of various interventions or activities.**

There is considerable variation in how directly SBS research has been applied to questions of interest to the IC, in how close it is to providing the basis for practical application for analysts, and in the aspects of intelligence analysis it could potentially support. Tools for social network analysis, for example, are close to being operational, and simulation groups within the IC are using models to address complex situations. Research on other tools, such as those based on understanding of unconscious behavior and nonverbal cues, is still emerging.

Further progress in the development of applications that can serve the IC's needs will depend on interdisciplinary collaboration that takes advantage of developments in multiple fields. For example, the integration of recent advances in analysis of narratives, networks, and affect would provide a framework for supporting dramatic advances in the assessment of narratives and counternarratives, early detection of polarization, assessment of group vulnerability to disinformation, and detection and mitigation of diverse information maneuvers. Similarly, applying multidisciplinary, multimethods research to IC issues from a complexity perspective—using modeling and simulation, representation, and understanding of human factors—would yield significantly stronger methods of forecasting surprising events or developments.

Advances in the use of large-scale data are likely to be at the heart of significant developments for the IC in the coming decade, but new technologies will be only as strong as the understanding of the human phenomena they are used to model or explain. The committee expects that there will be progress in the development and validation of computational models, the reuse of simulation modes, and the integration of social networks with computational models. These advances have the potential to make near-real-time assessment of competing actors, messages, or groups and the interventions that influence them possible.

CONCLUSION 2: Interdisciplinary, multimethod approaches to integrating insights from SBS fields with sophisticated technological developments will be essential to support the development of new tools for the analysis and interpretation of data and intelligence. The IC would benefit from pursuing a portfolio of such research focused on the development of operational methods and tools.

INTEGRATING SOCIAL AND BEHAVIORAL SCIENCES (SBS) RESEARCH TO ENHANCE SECURITY IN CYBERSPACE

Cyber-related developments have both dramatically altered the nature of security threats and expanded the landscape of potential tools for countering those threats. Experts from multiple disciplines, including electrical engineering, software engineering, computer science, and computer engineering, have a laser focus on cybersecurity, but those efforts have primarily addressed technical or data challenges: protecting the integrity of networks, programs, and data. These techniques have undisputed value but they shed relatively little light on the human behaviors and motivations that shape cyber-based challenges.

The emerging field of social cybersecurity science has developed to fill the need to integrate understanding of constantly evolving technology with insights about fundamentally human phenomena. Researchers in this field build on foundational work in SBS fields to characterize cyber-mediated changes in individual, group, societal, and political behaviors and outcomes, and also to support the building of the cyber infrastructure needed to guard against cyber-mediated threats.

Designing ways to protect against cyber-based threats requires the ability to collect data on and analyze and visualize high-dimensional dynamic networks with both social network and knowledge network components. Twitter networks, for example, generate both social data on who replies, retweets, or mentions or which individuals are quoted, and knowledge data on hashtags or topics that co-occur. However, available machine learning techniques and standard computer science methods are of limited utility for answering nuanced questions about developing situations. Nor are traditional social science methods sufficient to address complex issues in today's information environment.

A promising next frontier is the combining of computer science techniques with deep theoretical understanding—from social and cognitive science research—of such phenomena as how the media and entertainment technology used to collect these data operate and the nature of the sociocultural phenomena being studied. Methods used in network science, coupled with language technologies, geospatial crowdsourced information, or machine learning and applied to large-scale data form the methodological cornerstone on which further advances social cybersecurity will be realized.

Empirical assessment of influence and manipulation in social cyberspace is yielding methods capable of processing large volumes of data, often from multiple media, and carrying out high-dimensional network analysis. Such methods have been successfully used to address a number of issues, such as the likelihood of retweeting, information diffusion, disaster planning, extremist recruiting, and political polarization. Furthermore, geo-

spatial assessments have shown great diversity in the ways in which social media are used by region, time, and political context. This work provides a starting point for the development of tools that could be used by the IC for efficiently identifying propaganda, false information, and other social cyberthreats.

CONCLUSION 3: A comprehensive multidisciplinary research strategy for identifying, monitoring, and countering social cyberattacks, predicated on computational social science, would provide significant support for the IC's efforts to address the social cybersecurity threat in the coming decade. The emerging field of social cybersecurity research can yield insights that would supplement the IC's training and technology acquisition in the area of social cybersecurity threats and foster an effective social cybersafety culture. These insights could support development of the capacity to, for example, detect bots and malicious online actors and track the impact of social cyberattacks.

CONCLUSION 4: The IC could strengthen its capacity to safeguard the nation against social cyber-mediated threats by supporting research with the objectives of developing

- **generally applicable scientific methods for assessing bias in online data, drawing conclusions based on missing data, and triangulating to interpolate missing or incorrect data using multiple data sources; and**
- **new computational social science methods that would simultaneously consider change in social networks and narratives within social media–based groups from a geotemporal social-cyber perspective; and operational computational social science theories of influence and manipulation in a cyber-mediated environment that simultaneously take into account the network structure of online communities, the types of actors in those communities, social cognition, emotion, cognitive biases, narratives and counternarratives, and exploitable features of the social media technology.**

INTEGRATING THE SOCIAL AND BEHAVIORAL SCIENCES (SBS) INTO THE DESIGN OF A HUMAN–MACHINE ECOSYSTEM

Technologies that become operational in the coming decade and beyond will be capable of augmenting the capacities of the human in vital ways, and these developments will necessarily change the ways human analysts use and interact with the technological resources available to them. Figure 2 illustrates the sort of human-machine ecosystem that could become a central component of intelligence analysis.

Insights from SBS fields are essential to the design and development of tools and technologies that

- take advantage of the strengths of both humans and machines;
- allow humans to collaborate productively with machine partners;
- support more rapid assessment and forecasting of human activity; and
- avoid serious unintended practical and ethical consequences.

SBS research offers insights on human capacities and limitations, how humans can interact effectively with machines, how humans and machines can collaborate as teams, and how machines can mimic and manipulate humans. These insights will be needed in the design of tools that use Artificial Intelligence (AI) and machine learning in conjunction with social network analysis, which is likely to be an increasingly important component of analysis. This work could also support the development of an ecosystem for intelligence analysis composed of human analysts and semiautonomous AI agents, operating on and through diverse social media and supported by other technologies. Such a team could, proactively and securely, reach across controlled-access networks and develop enhanced intelligence analyses by identifying patterns and associations in data more rapidly than humans alone could, doing so in real time and uncovering connections that previously would not have been detectable.

Whatever directions the IC takes in developing and procuring technologies to support intelligence analysis in the coming decade, it will surely rely on researchers and other experts, both those working within the IC and outside contractors; commercially available software programs; and other resources. The extent to which both basic and emerging SBS research is already being incorporated into the planning, design, and use of the tools and methods used and purchased by the IC is not publicly known. Emphasis on this aspect of design is critical, however, because the technology used for analysis is only as strong as the understanding of the human behavior it is being used to model or explain; insights from SBS fields will provide essential support for the procurement of valid and effective products from the private sector to support the analyst's work.

FIGURE 2 A human–machine ecosystem for intelligence analysis.
NOTE: This figure is a simple illustration of a human–machine ecosystem with analysts working in collaboration with and connected through AI systems. It shows three teams of analysts who have different sets of responsibilities working individually while remaining connected to the ecosystem. A variety of sensors (shown surrounding the ecosystem) provide information to the human and AI agents for a number of different purposes, from monitoring and analyzing data pertinent to intelligence analysis to collecting and processing data from interactions between analysts and AI to improve performance.
SOURCE: Generated by the Committee on a Decadal Survey of Social and Behavioral Sciences for Applications to National Security.

CONCLUSION 5: To develop a human–machine ecosystem that functions effectively for intelligence analysis, it will be necessary to integrate findings from SBS research into the design and development of AI and other technologies involved. A research program for this purpose would extend theory and findings from current research on human–machine interactions to new types of interactions involving multiple agents in a complex teaming environment.

CONCLUSION 6: An SBS research agenda to support the development of technologies and systems for effective human–machine teams for intelligence analysis should include, but not be limited to, the following goals:

- **Apply methodologies from the vision sciences, the behavioral sciences, and human factors to advances in data visualization to improve understanding of how people extract meaning from visualizations and the functionality of tools designed to present information from large datasets.**
- **Use techniques from social network analysis to better understand how information can be transmitted effectively, as well as filtered among distributed teams of humans and machines, and how the need to use AI to search and filter information can be balanced with the need to restrict access to certain information.**
- **Develop new modes of forecasting that incorporate human judgment with automated analyses by AI agents.**
- **Apply neuroscience-inspired strategies and tools to research on workload effects in a complex environment of networked human and AI agents.**
- **Examine the implications of ongoing system monitoring of work behaviors in terms of privacy issues, as well as potential interruptions to the intrinsic work habits of human analysts.**
- **Extend insights from the science of human teamwork to determine how to assemble and divide tasks among teams of humans and AI agents and measure performance in such teams.**
- **Identify guidelines for communication protocols for use in coordinating the sharing of information among multiple human and AI agents in ways that accommodate the needs and capabilities of human analysts and minimize disadvantages associated with interruption and multitasking in humans.**

For some, talk of machines and collaboration with AI agents can be somewhat chilling. Reasonable concerns include the prospect that, in restricted environments, there will be more opportunities for inadvertent disclosures of confidential information; that biases inherent in algorithms will negatively affect decision making; that machine-generated output may increase false positives and subsequent false alarms; and that too much trust may be placed in machines to find the emergent patterns and signals, perhaps usurping what should be functions of human analysts or occupying them with new oversight and management tasks that compete with their analytic work.

CONCLUSION 7: The design, development, and implementation of a system of human–technology teams, which would include autonomous agents, for use in intelligence analysis raise important ethical questions regarding access to certain types of data; authority to modify, store, or transmit data; and accountability and protections when systems fail. The IC could best ensure that such systems function in an ethical manner and prepare to address unforeseeable new ethical issues by

- **from the start, incorporating into the design and development process collaborative research, involving both members of the IC and the SBS community, on the application of ethical principles developed in other human–technology contexts to the IC context;**
- **ensuring that all research supported by the IC adheres to the standards for ethical conduct of research; and**
- **establishing a structure for ongoing review of ethical issues that may arise as the technology develops and new circumstances arise.**

STRENGTHENING THE ANALYTIC WORKFORCE FOR FUTURE CHALLENGES

The IC has always needed a workforce that is responsive, flexible, effective, and well equipped to learn and adapt to change, but technological developments are likely to bring fundamental changes in the way intelligence analysis is conducted. In a decade or less, for example, analysts may have the capacity to obtain sophisticated analysis of a months-long narrative stream on social media sites, compare it with activities from that period identified through geospatial imaging, and develop a graphical representation of the intersections between the two—as part of a day's work.

To take advantage of these opportunities, the analytic workforce will need new skills: developments in such areas as network science, complex systems models, statistics, and data analytics of all kinds will likely add new methods and tools to the analyst's toolbox. In areas in which intelligence analysts are expert—qualitative analysis of text and narrative, for example—new developments such as improved quantitative methods for text analysis, including methods for analyzing social media, offer possibilities that may not yet have been integrated into common practice within the IC.

The analytic workforce already reflects diverse and valuable technical and academic skills and experience, and analysts typically join the workforce with specific disciplinary subject matter knowledge. Analysts of the future will need to build on the skills they have always had, including technical skills, domain-specific knowledge, social intelligence, strong communication skills, and the capacity for continued learning—but they will also need to function in new ways.

As in any large organization, the agencies of the IC pay attention to means of identifying, recruiting, and selecting individuals likely to excel as intelligence analysts; providing training and using other means to develop their skills and abilities; obtaining the best possible performance from the workforce; and retaining effective employees. Researchers in the fields of industrial-organizational psychology and human resource development have produced a robust body of work on ways to pursue most of these objectives.

Translational research is needed, however, to identify specific ways the IC can take advantage of these opportunities. Moreover, the nature of analytic work is a moving target. In the next 10 years, new work challenges, new analytic technologies, and new work practices can be expected to emerge, and new collaborations will become necessary. Selection practices, training regimes, and teamwork requirements will need to be adapted to the new work requirements that will result.

CONCLUSION 8: A range of personal attributes—including skills in critical evaluation, writing and presentation, and teamwork; openness to feedback; and a continuous learning orientation—contribute to successful job performance as an intelligence analyst. To strengthen its capacity to select individuals well suited to work as an intelligence analyst, the IC would benefit from

- **regularly updating its assessment of the facets of the analyst's job performance that are of greatest value to the IC and the attributes most useful for selection of personnel for intelligence analysis roles;**
- **having the capacity to measure a broad range of attributes for use in selecting individuals who possess those attributes; and**
- **evaluating the predictive power and potential ethical implications of such assessment devices as digital games, gleaning information about candidates from social media, and using machine learning approaches to extract information from interviews and resumés and develop scoring algorithms.**

CONCLUSION 9: A large body of SBS research identifies individual and organizational factors linked to employee retention, including employees' attitudes and engagement, unit cohesiveness, and leader quality, but these factors have not been examined in the IC context. Translational work examining the role of these potential influencing factors could aid in managing retention in the IC.

CONCLUSION 10: A systematic review of the degree to which the organizational culture within the agencies of the IC supports both organizationally directing training and autonomous learning could provide valuable information that could be used to promote these means of enhancing the skills of the analytic workforce. This review could focus on practices that promote such a culture, including

- **opportunities for workers to receive feedback;**
- **tolerance for error as employees attempt to use new skills;**
- **support and encouragement from supervisors and peers; and**
- **allocation of time for autonomous learning.**

CONCLUSION 11: Emerging research indicates that developing tools and methods could be used to assess and mitigate issues related to the effects of work in the high-stress environment of intelligence analysis, including cognitive fatigue, reduced attention, impaired performance, and decreased efficiency. Possibilities include the application of neuroergonomics (e.g., cueing, visual or auditory warning signals, automation); neuroscience (e.g., noninvasive brain stimulation); and neuropharmacology. The development of effective and safe tools and methods ready for implementation would require (1) research on the utility and applicability of these methods in the IC environment, and (2) careful consideration of safety and ethical issues related to their use.

CONCLUSION 12: To fully benefit from research findings relevant to the development of an optimal analytic workforce, the IC would need to invest in research and evaluation to guide their application in the context of intelligence analysis. Translating key insights about selection, training, retention of, and support for the IC analytic workforce will in itself require a team approach in which members of the IC, SBS researchers, applied scientists, and others collaborate to help translate the approaches discussed here for the IC context and assess their effectiveness.

3

Capitalizing on Opportunities in Social and Behavioral Science Research: A 10-Year Vision

It is only through sustained attention to the integration of SBS research into its work that the IC can begin to more systematically take advantage of the opportunities described in this report. Indeed, technological and other developments in intelligence analysis that proceed without the benefit of SBS research are likely to be limited in their effectiveness, or worse, to result in misleading or distorted analysis.

CONCLUSION 13: SBS research offers a fundamental—indeed essential—contribution to the mission of the IC, a mission that requires understanding of what human beings do, how, and why. The research described in this report amply demonstrates the critical importance of

- **interdisciplinary research—both foundational and applied and domestic and international—designed to take advantage of and integrate theory, methodology, and data from across SBS fields to yield new insights into human behavioral and social processes with relevance to national security;**
- **the integration of basic science and developing research on human behavior and social processes, as well as advances in computational methods for large-scale data analysis, with the expertise of the IC on analytic methods and challenges;**

- **the incorporation of a deep understanding of the IC's challenges into the identification of research questions and hypotheses to be tested, as well as the design and execution of research;**
- **the integration of SBS insights into the design and engineering of technologically based analytic tools; and**
- **translational and applied work to establish the direct utility of SBS research findings for the IC.**

Taking full advantage of this essential contribution will require effective and consistent collaboration between the IC and the SBS research community. The study process revealed some of the obstacles to integration and collaboration and showed that coordination between the two communities is less prevalent than it could be. Moreover, awareness of the potential applications of SBS research to IC needs is highly uneven across relevant SBS fields: many researchers may be unaware of the potential applications of their work to national security or reluctant to pursue such applications because of negative impressions of past collaborations.

Realizing most of the opportunities identified in this report will depend on the integration of research from SBS fields with work from technical fields including engineering, computer science, and neuroscience. Technological developments occur in a social and economic context: SBS research is therefore essential to understanding the potential applications and benefits, risks, and long-term effects of sophisticated technology and to its sound application, despite significant differences in theory and method between these two cultures.

RECOMMENDATION: The leadership of the Intelligence Community should make sustained collaboration with researchers in the social and behavioral sciences a key priority as it develops research objectives for the coming decade. A multipronged effort to integrate the knowledge and perspectives of researchers from these fields into the planning and design of efforts to support intelligence analysis is most likely to reap the potential benefits described in this report.

As the key coordinator of the IC, the Office of the Director of National Intelligence (ODNI) can continue to play an important leadership role in fostering the critical ties between the IC and SBS researchers. The committee had no empirical foundation on which to base specific recommendations about institutional structures within the IC, and future efforts will need to be considered in light of particular efforts currently under way. Whatever structures are chosen, effective interchange is likely to involve four key ingredients:

- identifying and building on successful examples;
- strengthening bridges between the two communities;
- providing opportunities for analytic staff to build their knowledge of SBS research; and
- drawing on the principles of human–systems integration.

Although the objectives and perspectives of the SBS research community and the IC are not always aligned, the two communities have always had much to learn from one another. Researchers and members of the IC have differing objectives, face differing challenges and constraints, and operate in contexts that have very different norms and expectations. Nevertheless, collaborations between the two have for decades yielded important scientific and analytic insights.

CONCLUSION 14: Explicit attention to the respective intellectual goals, values, and perspectives of members of the IC and academic researchers is a prerequisite for productive collaboration. Collaborations between the two have yielded important scientific and analytic insights, and have functioned well when funding sources and agency goals have been transparent, when SBS research questions and agency missions and goals have been harmonized and clear, and when ethical and value-based concerns have been treated with sufficient care. Conversely, the relationship has fractured in the past when funding sources have been kept secret or misrepresented, researchers and government agencies have struggled to balance research and agency needs, and research has touched on broader ethical or value-based disagreements.

CONCLUSION 15: Ethical issues may arise at all steps of the research process, from planning, to dissemination of findings, to the operationalization of digital tools in analytic contexts. Because standards with respect to some ethical issues—particularly those concerning the use of large-scale digital datasets—are developing, and because these issues are context-sensitive, ethical assessments require careful attention throughout the research process.

CONCLUSION 16: Meticulous clarity and openness about the approaches taken to ensure the reproducibility and validity of the evidence generated in the course of research conducted by or with the support of the IC are critical to the utility of the research results. The IC can promote this standard by requiring researchers to identify project components that incorporate assessments of reproducibility, replication, and validity.

This report comes at a critical time in the nation's history. New threats, as well as complex new methods and tools analysts can use to understand trends and developments, identify immediate threats, and forecast future problems, are bringing profound changes. Without understanding of the human component of these developments, the IC analyst would be perilously hampered. However, capitalizing on the research opportunities discussed in this report will require the IC to abandon procedures and ways of doing business that have been in place for a long time. The continued strengthening of the IC workforce will depend on interdisciplinary approaches in which the insights and ideas of SBS researchers are fully integrated with the needs and objectives of the IC.