Future Directions in Social Science

A Workshop on the Emergence of Problem-based Interdisciplinarity

April 11-12, 2019
Arlington, VA
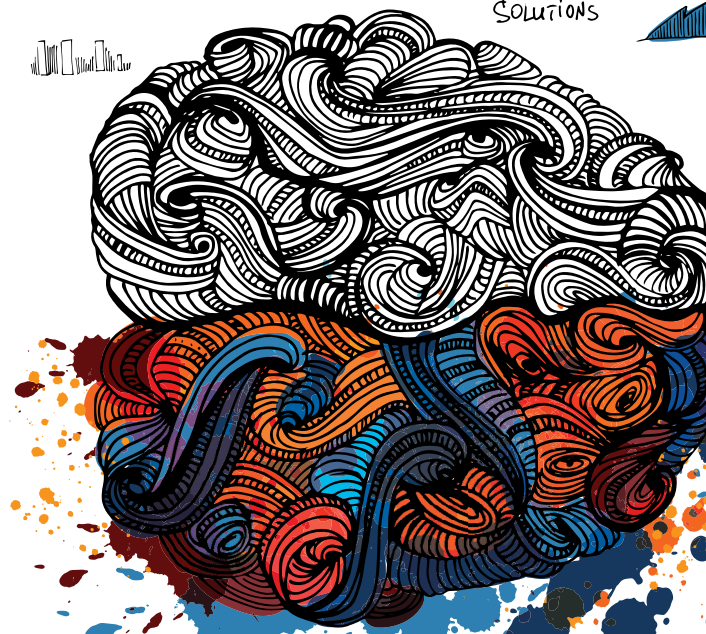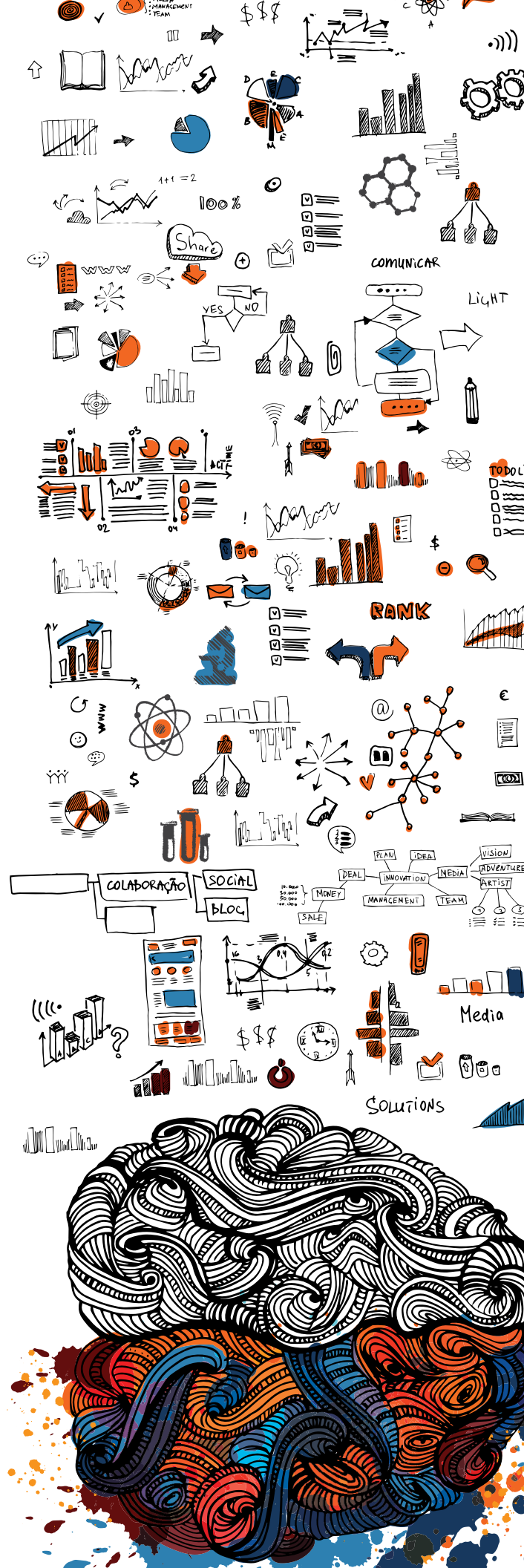
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> Innovation is the key to the future, but basic research is the key to future innovation.
> –Jerome Isaac Friedman,
> *Nobel Prize Recipient (1990)*

Director's Note

Over the past century, scientific advancement and technological development have brought remarkable new capabilities and insights that have had profound influence on social life. Ranging from telecommunications, energy, and electronics to medicine, transportation, and defense, technologies that were unimaginable decades ago—such as the internet and mobile devices—now shape the way we live, work, and interact with our environment. And as environments change, so do the social contexts in which people interact and see themselves being connected. Central to discussions around security, broadly defined, is the capacity of the global basic research community to understand the social implications of science, technology, and the wider context in which sociality plays out. Being aware of the trajectories of fundamental research, within the context of global challenges, empowers stakeholders to identify and seize potential opportunities.

The Future Directions Workshop series, sponsored by the Basic Research Office in the Office of the Under Secretary of Defense for Research and Engineering, seeks to examine emerging research areas that—in the natural and formal sciences—are most likely to transform future technology capabilities and—in the social sciences—innovatively inform about how the social world works. These workshops gather distinguished academic researchers from around the globe to engage in an interactive dialogue about the promises and challenges of each emerging basic research area and how they could impact future capabilities and understanding. Chaired by leaders in the field, these workshops encourage unfettered considerations of the prospects of fundamental science areas from the most talented minds in the research community.

Reports from the Future Direction Workshop series capture these discussions and therefore play a vital role in developing basic research priorities. In each report, participants are challenged to address the following important questions:

- How will the research impact science and technology capabilities of the future?
- What is the trajectory of scientific advancement over the next few decades?
- What are the most fundamental challenges to progress?

This report is the product of a workshop held on April 11-12, 2019 at the Basic Research Innovation Collaboration Center in Arlington, VA on the future of problem-based interdisciplinary social science research. It is intended as a resource to the Science and Technology community, including the broader federal funding community, federal laboratories, domestic industrial base, and academia.

Executive Summary

An in-depth understanding of the ways in which humans effect change and the impact of change on humans is critical to anticipating and shaping both the opportunities and challenges posed by a world in which the pace of change seems to be ceaselessly increasing. This understanding requires integration of conceptual and theoretical frameworks, approaches to data collection, and methods of analysis—long the role of the social sciences both as individual disciplines, and, most importantly, in concert with other social sciences, as well as the natural and biomedical sciences, and the humanities. The current complexity and pace of change intensifies the need for, and value of, developing new approaches to conduct and disseminate multidisciplinary social science research.

The Future Directions in Social Science Workshop was convened on April 11-12 in Arlington, VA, with the goal identifying opportunities for, and challenges to, conducting interdisciplinary research in the social sciences. Interdisciplinary research is defined as research that either occurs across multiple existing academic disciplines, or in the space between disciplines. It can be conducted by a single individual working across disciplines ("single scholar interdisciplinary research"), by teams of people from different disciplines working within their own disciplinary traditions but in collaborative projects ("multidisciplinary research"), or by teams working across disciplines ("interdisciplinary teams"). The workshop aimed to elucidate the potential benefits of interdisciplinary research, the existing barriers to conducting interdisciplinary research, opportunities for overcoming those barriers, and timelines for concrete steps to support the continued development of interdisciplinary social science research.

The workshop was divided into two parts. On the first day, participants were split into three smaller groups, each of which addressed the potential value of, as well as impediments to, interdisciplinary research by focusing on a particular problem: *technology and sociality; information and politics; and migration and stasis.* These three topics were chosen because they highlight subjects of inquiry where the potential benefits from interdisciplinary research appear large, and thus represented good case studies for thinking through the existing challenges to interdisciplinary research, as well as creative solutions for overcoming those challenges. The discussions of the individual research topics then formed the basis for plenary discussions on the second day to produce general assessments of the potential benefits of an expansion of interdisciplinary research, the challenges inherent in doing so, and opportunities for overcoming these challenges.

The workshop identified potential benefits from interdisciplinary research in the social sciences, most of which fell into one of the following three categories:

- **A more thorough research approach to pressing challenges:** There are large problem areas currently challenging society for which traditional disciplinary research approaches will at best be able to address only a part of the problem. The three topics addressed on the first day of the workshop are good examples of such research questions.

- **Cross-fertilization of research methodologies:** New developments in data availability—such as fMRI in economics or social media data in political science—require the adoption of new methodological techniques—such as the rise of lab experiments in economics and political science—from other fields (e.g., neuroscience and data science). Multidisciplinary research can greatly speed this process.

- **Establishment of new, unidentified fields:** Past examples of new fields growing out of interdisciplinary efforts—such as behavioral economics or neuroscience—show the tremendous possibilities for research development, including areas that cannot presently be envisioned.

The workshop also identified four general categories of challenges facing researchers interested in pursuing interdisciplinary research in the social sciences:

- **Culture challenges:** Different lexicons and methodological approaches are used and privileged across different disciplines.

- **Professional challenges:** There are more barriers to publication, promotion, and recognition for interdisciplinary social science research, especially as such efforts often generate publications with larger numbers of co-authors than is currently common in the social sciences and may be published outside of traditional disciplinary journals.

- **Training challenges:** Current scholarly training is dominated by disciplinary models, and the special administrative skills needed to manage larger team-based research projects.

- **Financial/Resource challenges:** Current funding pipelines are largely oriented along disciplinary lines, and, in some cases, there are mismatches between the level of funding traditionally needed to support disciplinary research and the significantly larger grants necessary to sustain interdisciplinary efforts. This is especially the case when establishing large scale research labs, which are not currently present in most of the social sciences but may be necessary to realize many of the interdisciplinary benefits identified in this report.

The workshop also identified several **potential solutions** for overcoming these challenges:

- Establishment of explicitly interdisciplinary (high profile) journals and funding opportunities, including funding to sustain research labs in the social sciences.
- New models of graduate—and post-graduate—training that bridges the disciplinary divides.
- Establishment of intellectual spaces (e.g., summer institutes) where scholars from different disciplines with common problem-based interests can learn from one another and break-down barriers to collaboration with the goal of initiating targeted research collaborations.
- New approaches to training scholars to review interdisciplinary research and grant proposals.
- New models for structuring research funding in the social sciences in ways that are more conducive to interdisciplinary research, such as support for lab-based research inquiry.

In the final section of the report, we provide timelines for implementing these proposals. Workshop participants mapped the research trajectory along three pathways:

1. Bridging the methodological divide, adopting disciplinary cross-training and diversity.
2. Creation of new career paths and approaches to assessing excellence.
3. Managing multidisciplinary knowledge and research structures.

The short-, medium-, and long-term goals for these three pathways are summarized as:

Short-term goals (up to 5 years)
- Promotion of cross training and dual degree programs for students in existing programs.
- Creation of on-site and online interdisciplinary workshops and seminars at local, regional, national, and global levels.
- Funding supporting diversity in research teams, as well as methods to audit the success of such efforts.
- Promotion of disciplinary, methodological, and social diversity training for peer reviewers, program officers, and administrative staff that can assist in the identification and appropriate evaluation of interdisciplinary and multidisciplinary research projects for funding.
- Development of reviewer pools for the fair assessment of interdisciplinary and multidisciplinary publications and grants within funding agencies and peer-reviewed journals.
- Establishment of a centralized online hub where researchers of different disciplines can network; find and post opportunities such as calls for post-doctoral fellows for multidisciplinary programs; and access support for researchers interested in interdisciplinary opportunities. Such a hub should also be used for publicizing funding opportunities for interdisciplinary research and to support research labs in the social sciences.
- Promotion of mechanisms for enhancing the ability of researchers to review and access broader literature reviews, such as administrative support to produce new literature reviews and guides that are intended for researchers not from that discipline.
- Modification of existing funding pipelines to better match the needs of larger research teams and laboratories in the social sciences.

Medium-term goals (5-10 years)
- Promotion of industry support for interdisciplinary/multidisciplinary training, especially for students aiming for a non-academic career.
- Increased interdisciplinary and multidisciplinary and methods training programs in universities.
- Promotion of cross-disciplinary post-doctoral training and fellowships.
- Creation of cross-disciplinary post-tenure sabbatical and other training opportunities.

- Promotion of structural changes in the organization of social science disciplines both in the training of new researchers and in the evaluation for promotion and tenure of faculty and mentors that reward interdisciplinary training and participation in interdisciplinary/multidisciplinary research.
- Incorporation of ways to evaluate the quality and impact of interdisciplinary/multidisciplinary research through soliciting of appropriate external reviewers for promotion.
- Creation of research and training positions inside academia and outside of the historical tenure system and revaluing those positions.
- Development of interdisciplinary, area/topic focused, and appropriately peer-reviewed journals.
- Establishment of information systems for archiving and sharing data and data archives.
- Addressing basic structural problems in the funding pipelines, including:
  » Establishment of rapid response small planning grants for developing interdisciplinary teams (one model could be the old USAID Collaborative Research Support Programs).
  » Promotion of staged funding approaches that provide small grants for the development of multidisciplinary teams, in anticipation of broader funding.
  » Creation of new funding pipelines that better match the needs of larger research teams and laboratories in the social sciences.

Long-term goals (10+ years)
- Realignment of social science training with the range of conceptual and methodological approaches critical for approaching contemporary issues.
- Promotion of "cultural" changes in the expectations and value of interdisciplinary/multidisciplinary research.
- Promotion of training in interdisciplinary social science approaches critical for industry and industry-based research organizations.

While there are clear benefits to conducting interdisciplinary research, participants also agreed there remains great value in the traditional disciplinary approach to conducting research. There are strong advantages in terms of efficiencies gained from shared understanding of the research process, the scientific rigor that comes from consensus around methods, and valuable existing infrastructure in the form of existing departments, scholarly associations and related conferences, disciplinary journals, and funding opportunities. Thus, the report should not be read as a recommendation to privilege interdisciplinary research at the expenses of traditional disciplinary approaches to research, but rather as a guide to supporting the parallel growth of interdisciplinary research in the social sciences, a vehicle for scientific advancement that is currently under-utilized relative to its potential benefits.

Introduction

Humanity, at present, faces what *The New York Times* columnist Thomas Friedman refers to as a "hugely plastic moment" characterized by "four climate changes at once." The most obvious of these is anthropomorphic changes to the physical environment. Globalization of the world economy, the rapid ascension of artificial intelligence, and changes in communication technology associated with the cloud and smart phones are the other three changes. Although largely technological in origin, these developments, occurring at unprecedented speed, are leading to disruptions of the world economy, mass migration (with diverse consequences), changes in social interactions, and political upheavals, with impacts that extend from the daily experiences of individuals to the planetary ecosphere.

A good portion of the scientific enterprise is devoted to developing technological solutions to these challenges (e.g., climate science and artificial intelligence approaches to detecting fake news). But, the processes that unleash these changes and mediate their consequences are inherently social, and their consequences unfold at a human scale. Among scholars, social scientists, uniquely, possess the expertise, theoretical perspectives, and research tools to make sense of these developments, as well as, potentially, to propose policies to manage them.

As a methodologically diverse grouping of academic disciplines, including anthropology, economics, political science, psychology, and sociology, the social sciences are broadly concerned with the scientific study of humans as individual agents, as well as with social, economic, and political interactions. They differ from one-another, however, on multiple dimensions: the research methods they employ; the types of questions they address; and the theoretical and conceptual lenses through which they view the world. While each discipline can illuminate dimensions of problems, no one social science can do justice to phenomena of the magnitude and complexity of those currently facing the world—hence, the need for interdisciplinary research.

"The Social Sciences differ from one-another on multiple dimensions: the research methods they employ; the types of questions they address; and the theoretical and conceptual lenses through which they view the world."

To define "interdisciplinary" research, a definition of a discipline is necessary. One way to do this is to focus on the "classic" disciplines of academic inquiry and put some sort of general consensus/longevity requirement on a field of inquiry to consider it an academic discipline. By such a definition, no one would doubt that biology, English, and economics would all be considered disciplines. A more functional approach would be to define disciplines in terms of the fields that are represented by academic departments in schools of arts and sciences in most major research universities and colleges. This might expand our definition to include fields that have shorter pedigrees, such

as neuroscience, environmental studies, or African-American studies. Either way, "disciplinary" research is best defined as research that is primarily located within a discipline: asking questions that grow from the literature in that discipline; using methods common to that discipline; often appearing in disciplinary journals; expected to be evaluated (for publication, funding, and promotion) by other members of that field; and largely carried out by people who have PhDs granted by departments in that discipline and/or have faculty appointments (or are being trained) in departments in that discipline.

Interdisciplinary research, therefore, crosses some of these boundaries. It can ask questions that are posed at the intersection of—or in between—different disciplines. It often draws upon methods from different disciplines, and, in some cases, it combines theories from one discipline with methods from another. Interdisciplinary research may be carried out by people with degrees from different disciplines, or by a researcher with a PhD from one field but who is publishing or working in another. Interdisciplinary research may be published in non-disciplinary "general" journals such as *Science* or the *Proceedings of the National Academy of Sciences*, in journals across a variety of different fields, or—in less fortunate circumstances—struggle to find an outlet in any traditional academic journals.

Like the proverbial elephant explored by blind men, practitioners from different disciplines see the same phenomena through dramatically different disciplinary lenses. Considering, as an example, the rise of political polarization and political extremism, psychologists are currently best equipped to shed light on individual-level phenomena such as the attraction that people feel for extreme perspectives and their abilities to discriminate between real and fake news. Economists, in contrast, would be more likely to focus on the economic forces that drive technological change and the interests of media in competing for attention. Sociologists might focus on the social networks through which much information-dissemination occurs (the nature of which has been transformed by social media). Anthropologists tend to privilege an understanding of the participants' experiences, meanings, strategies, and shared expectations, and, by immersing themselves in real or virtual political organizations, would tend to take a qualitative and critical approach that aims to understand the nature of the phenomenon from the point of view of the participants. Finally, political scientists would likely focus on the motivations of those who would share fake or hyperpartisan news for political purposes, as well as the impact of exposure to fake or hyperpartisan news on subsequent political behavior. Only by integrating these disparate perspectives can we hope to obtain a more complete pic-

ture of these developments that could inform public and private attempts to predict the course they take and—ultimately—provide policy makers with tools for addressing problems that arise in today's digital news environment.

Although interdisciplinary research can be conducted by individuals possessing expertise in multiple disciplines, multidisciplinary, team (or lab) based research, ubiquitous in the natural sciences, is a virtual imperative for applying it to phenomena of the scale characterized by current challenges.

The potential benefits of interdisciplinary research are illustrated by several success stories, which also document the different paths via which interdisciplinary research can arise. In some cases, such as behavioral economics, interdisciplinarity arises from the recognition of scholars in one discipline that insights from another could enrich their work. Behavioral economics is a subfield of economics that arose in the 1980s, drawing especially on a branch of psychology called behavioral decision research. Largely adhering to the conventional assumption that people are rational, self-interested decision makers, behavioral economics has enriched our understanding of the motives that underlie such decisions and identified commonly made mistakes that lead people to behave in irrational or self-destructive ways. Strengthening the behavioral underpinnings of economics with more realistic assumptions about human cognition and behavior has yielded diverse intellectual dividends and has spawned a wide range of offshoots such as behavioral finance, behavioral law and economics, and behavioral public finance. Behavioral economics has had an especially significant impact on public policy, largely as a result of the 'nudge' approach pioneered by Richard Thaler and Cass Sunstein (see figure).

Visual Feedback Given to Power Customers in San Marcos, California

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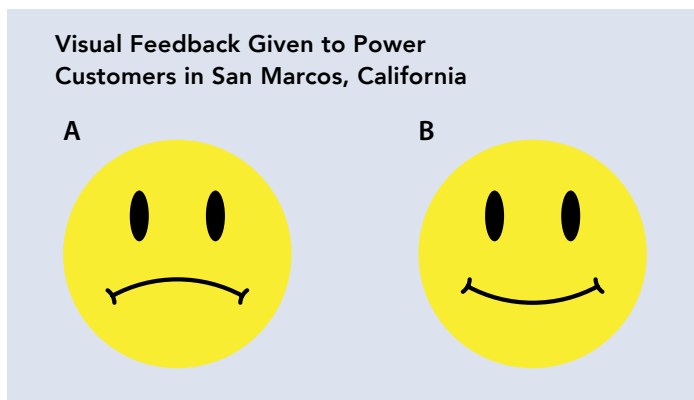
Caption: In their book *Nudge*, Thaler and Sunstein detail the use of an "emoticon" to signal to a subset of households in San Marcos, California whether they were increasing or decreasing energy use relative to their use over the previous weeks. The social 'nudge' was effective in getting the over-users to reduce energy use and the under-users to continue to use less energy than in previous weeks. *Source: Richard Thaler and Cass Sunstein, Nudge (London: Penguin Books, 2009), 70.*

In other cases, interdisciplinary interactions have been problem-focused, arising from the recognition that any one discipline cannot do justice to a problem. The imperative of quickly generating information to combat the HIV pandemic in the 1980s resulted in a dramatic increase in interdisciplinary and multidisciplinary research focused on understanding the different pathways of HIV transmission. As an example of the fruits of these developments, the study of stigmatized behavior and hidden populations at risk for HIV was one of the factors that resulted in the development of Respondent-Driven Sampling strategies. Research on HIV also contributed to the development of the syndemics approach in Public Health, an inherently interdisciplinary approach to understanding the ways in which diseases cluster and the socio-cultural conditions that explain clustering. A number of explicitly interdisciplinary and multidisciplinary research centers focused on HIV research were established throughout the world.

A third example of successful interdisciplinary research is found in the investigation of the role of new information technologies in politics, which represents an especially recent combination of the fields of data science, communications, and political science. While previously political scientists had studied media exposure either through self-reported survey questions regarding viewing or reading habits, or through macro-level analyses of, for example, television markets and aggregate level elections results, the explosion of social media usage presented an unprecedented opportunity to analyze objective measures of the effects of media exposure for hundreds of millions of people as well as political attitudes, activity, and ideology. To manage this influx of data, new methodological techniques were imported from the newly emerging field of data science. Ethnographic research on online communities and user-media interactions expanded researchers' understanding of how such communities are formed and experienced. At the same time, theoretical work from political science began to inform the study of these new sources of political data. Just a few years later, data science is ubiquitous in the study of social media and politics, and questions such as how social media impacts political polarization, the role of disinformation in elections, and the ways in which authoritarian regimes respond to online opposition can all be answered using techniques and data that were unknown to the politics research community a decade ago.

Given the potential benefits to interdisciplinary social science research—both within the social sciences and beyond—the Future Directions in Social Science workshop was convened to explore why there isn't more of it occurring and how to encourage such research in the future. In the following sections, we identify some of the most significant barriers that limit the degree to which the potential benefits of interdisciplinary research have so far been realized and then describe some solutions for overcoming these barriers.

Challenges to Conducting Interdisciplinary Social Science Research

During the workshop, participants identified numerous challenges to conducting interdisciplinary research in the social sciences. These challenges can be grouped together into four categories: language and culture; current models of training scholars within disciplines; professional incentives; and alignment of funding sources. We address each of these in turn.

Cultural Challenges

Fundamental differences in the conceptual vocabulary, models, and expectations for key methods employed in different disciplines constitute the simplest, yet at the same time potentially most vexing, barrier to collaborative interdisciplinary research. While not the same level of challenge as actually speaking different languages, at times it can feel this way when scholars from different disciplines attempt to discuss research. There are field-specific vocabularies, and indeed one of the purposes of graduate training is to teach new scholars how to use them to communicate effectively with other scholars in the field. While such lexicon serves a useful role within disciplines—complex ideas can be communicated efficiently with a high guarantee of shared understanding—they can prove problematic when scholars attempt to communicate across disciplines. Clearly, this is more serious when social scientists attempt to communicate

"Such differences in knowledge of, and preferences for, different methodologies can present challenges at even the earliest stages of research collaboration; teams may not share a common perspective on what data are necessary to address a common research question, or how to analyze that data."

with researchers in the humanities or the natural sciences, but the challenges are significant even in interdisciplinary work within the social sciences.

Closely related is the preference for different methodological approaches by different disciplines. Here, the challenge may not be lack of understanding one another, but rather the basic assumptions people in different disciplines hold about research protocols, appropriate methodological tools, the best means for communicating findings, and other fundamental attributes of the research process. Such differences in knowledge of, and preferences for, different methodologies can present challenges at even the earliest stages of research collaboration; teams may not share a common perspective on what data are necessary to address a common research question, or how to analyze that data. It can also lead to a lack of consensus about what the output of a project ought to be, both in terms of actual product (e.g., papers, a book, or conference proceedings) as well as more procedural questions such as whether to post working papers prior to submission or publication, and which data are appropriate to release publicly for replication purposes. These and other problems may prevent meaningful collaboration from even getting started or, if not adequately addressed in the early stages of the research process, may make continuing collaboration more difficult through divergent expectations about how the research process will unfold.

During the workshop, concern was also expressed that the team format inherent in many interdisciplinary projects could lead to some team members feeling alienated by power dynamics within these teams. While this is a potential problem for any collaborative research endeavor, participants expressed concern that in interdisciplinary research some research methodologies are viewed as more rigorous than others, thus leading to the team members from the supposed "less rigorous" methodological approach possibly being marginalized in group decision making.

Professional Challenges

There are a number of tangible professional challenges confronting those who seek to embark on interdisciplinary research projects, and especially those who seek to make a career out of interdisciplinary research.

First, when researching specific topics, it can be challenging for scholars to locate literature produced by researchers in other disciplines, and especially to identify the most relevant, rigorous, and important work, to which they should pay special attention. Despite the rise of Google Scholar—which should in theory go far toward addressing this concern—there are still many ways in which awareness of literature on topics of interest is driven by the discipline in which a scholar resides. This begins with graduate training, continues through disciplinary-specific conferences (even interdisciplinary conferences often feature panels orga-

nized according to discipline), and is enhanced by publications such as the Annual Reviews and Oxford Handbooks series, which feature reviews of literatures largely organized by disciplines. The topic of the impact of digital information on politics—discussed in one of our thematic groups at our workshop—provides a nice illustration of this tendency: there are serious concerns about whether computer and network scientists working in this area are aware of much of the literature coming out of the social sciences, and vice versa.

Second, the current model of reviewing grant proposals can make it difficult to identify appropriate reviewers for interdisciplinary grant proposals. This model generally involves soliciting independent reviews of proposals that are then adjudicated by a larger panel. Thus, the individual reviewer is expected to assess the project in toto. A truly interdisciplinary grant proposal is therefore likely to have large sections that a reviewer from one discipline may not feel, or in fact be, competent to evaluate.

Moreover, as projects progress, the reality that different disciplines measure publishing success differently may pose challenges to interdisciplinary teams. For example, in computer science a conference presentation—which will most likely have gone through a peer review process—is equivalent to a peer-reviewed journal publication in social science disciplines; in the social sciences, conference presentations do not have the weight of a journal article. Some disciplines—primarily in the humanities—weight books heavily, while many others are primarily concerned with peer-reviewed journal articles. Moreover, some fields greatly privilege what Andrew Gelman has called the academic tabloids—glossy general interest journals such as *Science* and *Nature*—while others do not.[1] Thus, the decision of where to publish may cause tensions within interdisciplinary research teams.

Finally, there was a strong consensus among workshop participants that the existing tenure and promotion structure is not conducive to interdisciplinary work. Tenure in the social sciences, with the possible exception of social scientists working in explicitly interdisciplinary departments or schools, such as information or policy schools, is a very disciplinary affair. The first vote in nearly any tenure case takes place within a disciplinary department. Given low existing levels of interdisciplinary work, the likelihood in most cases is that the departmental chair in charge of soliciting tenure letters will not know nearly as many letter writers working in fields outside of the discipline as within, and this only increases as the disciplinary distance increases (e.g. a political science chair might know economists to ask for letters, but is less likely to know anthropologists or computer scientists). Also—for exactly the reasons we have enumerated in this section—the number of scholars within the field who themselves are engaged in interdisciplinary research is likely to be low, thus making for a shallow pool of appropriate tenure letter writers. Moreover, just because an individual is engaged in interdisciplinary research does not mean that the individual will be familiar with the same fields as the junior scholar approaching promotion.

Training Challenges

There are also serious impediments to training scholars for interdisciplinary work. To begin with, one's original research training will almost invariably be a PhD program that is largely housed within a discipline. Therefore, the first stage of any training is almost always going to be heavily influenced by one particular field. However, even if a PhD student is enrolled in some form of interdisciplinary PhD program or is inclined toward interdisciplinary work, acquiring the skills necessary to conduct research in multiple disciplines is time consuming. There is a reason it takes 4-6 years to complete a traditional PhD within a social science discipline; mastering the skills to successfully move between disciplines may take much longer than normally considered appropriate for a PhD program.

For those who choose not to acquire interdisciplinary training themselves but instead to attempt to work within multidisciplinary teams, there is a critical set of administrative skills that may not come naturally to many social scientists. As we noted in the introduction, the typical social science research project might come from a single author, a single faculty member working with graduate students, or from small collaborative teams, but typically consists of researchers who are all from the same discipline. Learning to manage larger teams—and especially interdisciplinary teams that may need to face the types of challenges laid out in the preceding two subsections—is a skill that will need to be acquired by social scientists, and not something in which many (at least for now) are likely to have observed earlier in their careers.

Finally, some participants in the workshop believed there was a tension between the type of critical thinking that disciplinary training encourages—is this particular theoretical/methodological/empirical approach being implemented in the way that is currently considered state of the art?—and the type of more open-minded, outside the box thinking that is needed to set interdisciplinary research trajectories along paths that may not have previously been well trodden.

Financial/Resource Challenges

Participants identified multiple concerns regarding the suitability of current funding models for sustaining interdisciplinary research more broadly in the social sciences.

At the highest level, there is a mismatch between the current provision of social science funding, which is largely distributed through smaller grants aimed at providing financial support for individual researchers, and larger research labs of the types that may be necessary for interdisciplinary research, complete with post-docs, research scientists (e.g., software engineers, data scientists), and scalable data infrastructure to facilitate collaboration across a larger number of actors who may not be in geographically contiguous areas. A typical biologist starting her career might expect to receive hundreds of thousands of dollars in start-up funds[2] with an expectation that within a few years she will be

1. Andrew Gelman, "The Natural Selection of Bad Science," 1 June 2016. Available: https://statmodeling.stat.columbia.edu/2016/06/01/the-natural-selection-of-bad-science/

bringing in at least that much annually in government grants to run her lab. By comparison, a political scientist or anthropologist would be fortunate to get in the thousands of dollars annually in research support with the hope that they might eventually win a National Science Foundation grant that would provide a few hundred thousand dollars over multiple years—and that will only happen to a few individuals. Even though higher levels of funding may be necessary for natural science labs to pay for expensive items like microscopes, the funds necessary for a larger multidisciplinary social science research lab are generally not available at the present time in the standard funding pipelines.

More logistically, most funding in the social sciences—especially federal funding—flows through disciplinary funding pipelines. This raises the challenge of where to look for funding when trying to embark on interdisciplinary work. The National Institutes for Health have long provided funding for interdisciplinary pre- and post-doctoral training programs in the social sciences related to health and medicine. Outside of the health sciences, though, there have been fewer opportunities that support interdisciplinary training.

2. Hannah Hoag, "Lab budgets: A numbers game," Nature, vol. 524, 127-128, 2015. Available: https://www.nature.com/naturejobs/science/articles/10.1038/nj7563-127a

Opportunities for Interdisciplinary Social Science Research

Workshop participants also considered opportunities for advancing interdisciplinary social science research. To understand the opportunities, it is worth identifying different possible approaches to the interdisciplinary endeavor.

Interdisciplinary research approaches:

- A single individual can pursue a course of interdisciplinary research.
- Researchers in one discipline may consciously attempt to produce interdisciplinary research themselves by asking questions and using methods or approaches drawn from other disciplines.
- Groups of individuals from different disciplines can conduct research on a common topic, but in a manner in which each participant conducts disciplinary research individually; the collective effort therefore makes contributions in multiple disciplines.
- Groups of individuals may work in teams to produce interdisciplinary outputs, where the teams combine researchers from different disciplines.
- Groups of interdisciplinary researchers may work in teams to conduct explicitly interdisciplinary research and produce interdisciplinary outputs.

To the extent that research is conducted in groups, such groups could be housed at a single location (most typically, a university) or across multiple locations. In addition to universities, interdisciplinary research can occur at not-for-profit institutions, such as the Social Science Research Council (SSRC) or at 'think-tanks' like RAND and the Brookings Institution, and increasingly at research units created by firms in the private sector, such as Microsoft Research. These new types of research entities are garnering expanded funding and gaining increasing public prominence but also pose special challenges, such as ensuring research independence that is not biased by the interest of funders.

Interdisciplinary research projects can also occur at each of the three levels defined earlier: (1) the methods they employ, (2) the types of research questions they address, and (3) the theoretical lens through which they view the world. Cross-pollination of research methods is by far the easiest of these hurdles to surmount, and, indeed, has already advanced tremendously. For example, economists have made huge strides by importing and refining methods, such as field experimentation and quasi-experiments, that were pioneered by other disciplines, most prominently psychology. The study of the political implications of the digital information age is now infused with methods from data-, computer-, and network-science. Importation of research questions is also often possible, and again can be illustrated by

the case of economics, which has recently been investigating questions, such as the consequences of media bias, that would have traditionally been considered the purview of psychologists or political scientists. Integrating the implicit theoretical perspectives of social science disciplines poses more significant challenges and attempts to bridge their diverse cultures often founder on disagreements occurring at this level.

Finally, efforts to foster interdisciplinary research can take a more 'bottom-up' or 'top-down' approach. Behavioral economics, as previously discussed, provides a kind of bottom-up example of how interdisciplinary scholarship can be done. Behavioral economics began with a recognition by scholars (most notably Richard Thaler, who won the Nobel Prize in economics in 2017 for his pioneering of the approach)[3] that the behavioral foundations of economics could be strengthened by inputs from psychology, and specifically the work in behavioral decision research that was at the time being done by Daniel Kahneman and Amos Tversky. Many of the formative years for behavioral economics occurred when different key figures were able to spend extended periods of time interacting in-person, at the University of British Columbia, the Center for Advanced Study in the Behavioral Sciences, and the Russell Sage Foundation (which also provided generous funding for a wide range of field-building endeavors).

The cases of interdisciplinary HIV research on the role of information technologies provide examples that better represent a top-down approach. In each of these cases, an urgent societal problem—in one case a public health epidemic and in the other case the emergence of trends that threatened the health of democratic institutions—was identified that appeared to be too large in scale, and multifaceted, to be addressed by the limited methods and perspectives of a single discipline.

What types of institutions and practices can be put into place to encourage the emergence of, and to nurture, successful interdisciplinary efforts of these types? In addressing this question, it is useful to consider how some of the previously discussed challenges that impede interdisciplinary work could be overcome.

Professional Opportunities

Professional challenges to interdisciplinary research could be addressed in several ways. For example, given the importance of publishing and securing research funding for professional advancement in academia, one of the most urgent imperatives is the establishment of journals and granting opportunities that are open to interdisciplinary work. Currently, there are journals, such as *Science* and *Proceedings of the National Academy of Sciences*, that publish papers from different disciplines, and granting agencies such as the National Science Foundation that accept

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3. Peter E. Earl, "Richard H. Thaler: A Nobel Prize for Behavioural Economics," Review of Political Economy, vol. 30, issue 2, 107-125, 2018. Available: https://www.tandfonline.com/doi/full/10.1080/09538259.2018.1513236

"...social scientists should be offered training in methods that are in common use, and have been refined, by scholars in other disciplines."

submissions from different disciplines. But when it comes to both journals and grants, individual submissions tend to be authored by single researchers or teams of researchers from a single discipline. Interdisciplinary research could thus be fostered by the creation of high-profile journals publishing papers that do not fit cleanly into a single discipline and requests for proposals from granting agencies that specifically target interdisciplinary teams. Finding reviewers for such submissions, however, will be challenging. To deal with this problem, perhaps a new model of reviewing—whereby individuals are assigned to only review portions of papers and proposals, and reviewers are selected from a range of disciplines—could be pioneered. Of course, such a solution would simply push the challenge up a level: program officers will need to have an increasingly wide roster of known potential reviewers (although this is a problem that perhaps technology could help solve).

Training and Cultural Opportunities

The dearth of scholars equipped to evaluate papers that do not fit neatly within disciplinary bounds points to the need for new types of training. Such training could, and to some extent already does, take several forms. Most obviously, social scientists should be offered training in methods that are in common use, and have been refined, by scholars in other disciplines. For example, a cadre of economists have for about a decade been receiving training in neuroscience methods, such as fMRI, and more recently in machine learning analysis techniques. Political scientists now routinely are exposed to machine learning methods in advanced methods courses. And, returning to the success story of behavioral economics, one of the early activities funded by the Russell Sage Foundation was a biennial summer institute, begun in 1994, at which the founders of the field introduced a select group of PhD students and junior faculty members to the latest thinking and research in the field. Not only has the roster of students who came through 'behavioral economic summer camp' become a virtual who's who for behavioral economics, but the friendships and professional collaborations initiated in these two-week sessions have proved enduring. In the decades since the first such summer institute began, a variety of other summer-camps with overlapping focuses have sprung up (see figure), but the original one continues to draw top students every other year. Such efforts

may—over time—provide an important means to address the cultural challenges noted in the previous section.

Summer-institutes in Behavioral Economics for PhD students, 2018–2019

> Russell Sage Foundation Summer Institute in Behavioral Economics (2018)

> Prague Summer School on Behavioral Economics and Psychology (June-July 2019)

> BRIQ (Institute on Behavior and Inequality) Summer School (July 2019)

> Summer School on the Cognitive Foundations of Economic Behavior (June-July 2019)

> Norwegian School of Economics, Behavioral Economics PhD course (August 2018)

> Yale Summer School in Behavioral Finance (June 2019)

> Paris School of Economics Summer School in Bounded Rationality and Behavioral Economics (June 2019)

Dual-degree programs, also currently in place at a small scale (e.g., at Carnegie Mellon University between the Decision Sciences and Psychology, Economics, Medicine, and Marketing, and nationwide at a number of MD/PhD and PhD/MPH programs), could be radically expanded to manage training challenges. However, given the difficulty of achieving mastery of even a single discipline during the limited time available for graduate training, a different approach would be to support mid-career training that gave researchers, perhaps with the job security provided by recent tenure, the opportunity to learn about a different discipline, which could ultimately help enlarge the currently small collection of scholars capable of doing successful interdisciplinary research.

Overcoming the barriers that arise from different disciplines' measures of publishing success could be promoted through ef-

forts to publicize the different norms prevailing in different disciplines. In the same way that visitors to countries with dramatically different social norms (e.g., American and European visitors to Japan) are sometimes given 'cheat-sheets' to help them avoid social gaffes, perhaps a simple document could be composed to alert those in a position to evaluate interdisciplinary scholars to norms prevailing in different fields. For example, in economics it is customary to list authors of publications alphabetically, in psychology by order of their contribution, and in medicine in order of contribution but with the last author position also conferring special contribution, often of a financial nature or conferring status as the senior member of a research team. Individuals who are in a position to evaluate scholars publishing in other disciplines—e.g., on tenure and promotion committees, evaluating applicants for research positions, or evaluating the strengths of researchers listed in a grant—need to be made aware of these different conventions, so they can appropriately evaluate the relative contributions of the authors of publications.

Financial/Resource Opportunities

Financial challenges could likewise be addressed in several different ways. For example, diverse forms of funding, including small-scale grants to explore the feasibility of interdisciplinary projects, could be specifically earmarked for interdisciplinary research. Programs could also establish interdisciplinary centers at the intersection of departments. Finally, given the growth and ever-increasing affluence of technology companies, mechanisms should be put into place for such companies to share the vast quantities of data they collect and fund independent scholarly research making use of such data. Great care would need to be taken to ensure the independence of research in these cases, but efforts like the nascent Social Science One initiative—which combines support from foundations, peer-reviewed research proposals, and data from Facebook—suggest that creative new solutions can be found.[4] Even so, increasing interdisciplinary and multidisciplinary research will require larger collaborative teams and research labs, which means not just new funding pipelines, but also increases in the financial resources available for social science research.

Successful efforts to promote interdisciplinary research are likely to involve a mix of light-touch approaches, such as educating scholars about publication norms in other disciplines, and more heavy-handed approaches, such as programs with earmarks for interdisciplinary teams. In addition, they are likely to involve a mix of bottom-up approaches, such as providing diverse types of support to spontaneously emerging interdisciplinary initiatives, as well as top-down approaches, such as providing support for, or even assembling, interdisciplinary teams focused on addressing specific urgent social, economic, and political problems.

"Successful efforts to promote interdisciplinary research are likely to involve a mix of light-touch approaches, such as educating scholars about publication norms in other disciplines, and more heavy-handed approaches, such as programs with earmarks for interdisciplinary teams."

4. Social Science One. Available: https://socialscience.one/

Trajectory For Interdisciplinary Social Science Research

Workshop participants proposed a series of steps that could be taken to overcome the challenges to conducting interdisciplinary social science research and advance the goal of expanding the amount and quality of such research. These include:

Steps to expand research:

- The establishment of new opportunities for cross disciplinary training whereby researchers at several career stages can acquire the skills required to conduct interdisciplinary/multidisciplinary research.
- The creation and support of non-traditional forms of employment in the academy, including non-tenure stream researchers and a reorientation of the tools used to evaluate excellence in tenure stream appointments such that interdisciplinary and multidisciplinary research is fairly evaluated and excellence rewarded;
- The creation of fair methods for evaluating interdisciplinary/multidisciplinary research and the dissemination of the results of it.
- The development of funding pipelines—and resources—that match the evolving needs of large-scale social science research enterprises.

When considering timelines for addressing the challenges, workshop participants were in consensus regarding the easier and more difficult challenges, as well as the most promising approaches to overcoming them. In the remainder of this section, we identify a number of possible next steps to address existing challenges to interdisciplinary/multidisciplinary research and training. While some of these approaches are not new, even these have not been fully realized, having often been applied only to limited topical areas of research. The section is organized by addressing three different components of the path forward—bridging the methodological divide; creation of new career paths; and managing multidisciplinary institutions—and then providing short-, medium-, and long-term steps that can be taken in each area.

Bridging the Methodological Divide,
Adopting Disciplinary Cross-training and Diversity

One of the key themes of the discussions in the workshop was the ways in which researchers from different disciplines address research questions. To communicate effectively in multidisciplinary settings requires the ability to identify the intersections in project design where shifts in concepts, qualitative and quantitative approaches, units of analysis, and analytic techniques address different aspects of the question in a way that reinforce each other. This requires some training in the diversity of approaches and appreciation for the ways in which disciplines and methodologies address different aspects of phenomena.

Likewise, broader diversity issues also need to be addressed. Gender, class, race/ethnicity all have an impact on the point of view researchers. Attention to diversity in interdisciplinary approaches implies a diverse set of researchers.

Broadening students' and experienced researchers' exposure to diverse methods in training may require a shift in the way methods of data collection and analysis are presented to researchers in training. Like cultural diversity training, the goal of methodological diversity training is not to train individual researchers to be experts in all types of social science methods—but to be aware of the very different points of view among the disciplines, and to appreciate that there are many things to know, and different ways to know them.

Workshop participants deemed it important that there be several entry-points for social science researchers to develop the skills critical to performing interdisciplinary research and work in multidisciplinary teams at different stages in their careers. These include the promotion of cross disciplinary training at the graduate and post-doctoral level, as well as post-tenure and sabbatical training; and the creation of on-site and online topically oriented interdisciplinary/multidisciplinary workshops.

Similarly, critical funding agencies need to assess current, often disciplinary-based, approaches to evaluating research funding requests and should consider the training of program officers and grant administrators in identifying and evaluating appropriate interdisciplinary/multidisciplinary research approaches.

Cross-training and "discipline diversity" training can be accomplished in a number of ways, and workshop participants endorsed the desirability of addressing these concerns across several fronts.

Short-term approaches (up to 5 years)
- Promotion of cross training and dual degree programs for students in existing programs.
- Creation of on-site and online interdisciplinary workshops and seminars at local, regional, national, and global levels.
- Funding supporting diversity in research teams, as well as methods to audit the success of such efforts.
- Promotion of disciplinary, methodological, and social diversity training for peer reviewers, program officers, and administrative staff that can assist in the identification and appropriate evaluation of interdisciplinary and multidisciplinary research projects for funding.

Medium-term approaches (5-10 years)
- Promotion of industry support for interdisciplinary/multidisciplinary training, especially for students aiming for a non-academic career.
- Increased interdisciplinary and multidisciplinary and methods training programs in universities.
- Promotion of cross-disciplinary post-doctoral training and fellowships.
- Creation of cross-disciplinary post-tenure sabbatical and other training opportunities.

Long-term approaches (10+ years)
- Realignment of social science training with the range of conceptual and methodological approaches critical for approaching contemporary issues.

Creation of New Career Paths and Approaches to Assessing Excellence

Career paths for social science researchers have historically moved through academia and, to some extent, through non-academic research institutes and government. Academic, disciplinary, department-based positions have posed challenges to the promotion and tenure of researchers pursuing interdisciplinary/multidisciplinary research trajectories. This is due in part to challenges posed by the ways in which departments and schools assess the quality of research work through external peer evaluations and peer-reviewed publications that are not well suited to judging interdisciplinary work.

To address these challenges, workshop participants discussed the feasibility of increasing the number of non-tenure stream research positions. The natural and biomedical sciences have long provided non-tenure stream research positions for post-doctoral fellows and in part for non-tenure stream research faculty. Social science has historically been less invested in the laboratory structure for research, although the forces pushing toward greater frequency of interdisciplinary research will likewise also be fueling the growth of social science research labs in the coming years. Identifying research positions, not in the tenure stream, that allow greater latitude in the research questions being pursued, and the range of approaches and analytic strategies being applied is a goal that requires shifts in expectations. Similarly, the growth of multidisciplinary laboratory approaches to social science research would require a shift in the structure of funding for research, as discussed previously.

There was disagreement among participants at the workshop as to the value of this type of development for PhD training. Some participants felt that designing PhD programs with an eye toward non-academic employment would help students by providing more employment options. They would benefit the field by attracting a wider range of applicants for PhD programs because of the greater job security in the long run. However, others felt that professional training should be the providence of professional schools that charge tuition for such training, as opposed to acting as another demand on the limited resources of universities. From this vantage point, PhDs should remain funded by universities precisely because they are needed to train the next generation of university faculty.

Academically trained and employed faculty tend to underestimate the availability of existing research positions in the social sciences in non-academic, multidisciplinary settings. One of the consequences is diminished interest in the kind of interdisciplinary training appropriate for the research settings that already exist. Redesigning research training for the kinds of positions that already exist in industry and research organizations is a long-term goal.

A more explicit conversation on the value of interdisciplinary/multidisciplinary research could shift expectations for training. Approaches could include an approach to training at both the master's and PhD levels that focus on interdisciplinary/multidisciplinary research as a professional degree.

Industry could, and should, be encouraged to contribute further to training.

Short-term approaches (up to 5 years)
- Development of reviewer pools for the fair assessment of interdisciplinary and multidisciplinary publications and grants within funding agencies and peer-reviewed journals.

Medium-term approaches (5-10 years)
- Promotion of structural changes in the organization of social science disciplines both in the training of new researchers and in the evaluation for promotion and tenure of faculty and mentors that reward interdisciplinary training and participation in interdisciplinary/multidisciplinary research.
- Incorporation of ways to evaluate the quality and impact of interdisciplinary/multidisciplinary research through soliciting of appropriate external reviewers for promotion.
- Creation of research and training positions inside academia and outside of the historical tenure system and revaluing those positions.

Long-term approaches (10+ years)
- Promotion of "cultural" changes in the expectations and value of interdisciplinary/multidisciplinary research.
- Promotion of training in interdisciplinary social science approaches critical for industry and industry-based research organizations.

Managing Multidisciplinary Knowledge and Research Structures

There was broad consensus among workshop participants that current structures for the accessing of information, evaluation of funding requests, dissemination of research results, and identification of colleagues with overlapping interests are not adequate for the promotion of interdisciplinary/multidisciplinary research approaches.

The ability to access a broad range of theoretical and empirical literature in order to plan, design, conduct, and appropriately analyze research is critical to interdisciplinary/multidisciplinary research approaches. The areas identified by workshop participants as critical include the creation of approaches to accessing information across disciplinary and methodological platforms in literature searches such as a user manual reference for key language by discipline that can be used by other researchers not from that discipline.

Likewise, workshop participants believed it is important to develop and promote new structures for the dissemination of interdisciplinary/multidisciplinary research, such as appropriately peer–reviewed interdisciplinary journals, area and topical studies journals, and centers and institutes (e.g. the Social Science Research Council).[5] Structures for data archiving and sharing with attention to the conceptual and methodological differences among disciplines should also be enhanced.

Workshop participants also agreed that improving funding opportunities to form interdisciplinary teams will be key to the development of interdisciplinary research and ultimately knowledge, particularly because in larger projects a team of researchers from multiple disciplines can take time to integrate fully.

Short-term approaches (up to 5 years)
- Establishment of a centralized online hub where researchers of different disciplines can network; find and post opportunities such as calls for post-doctoral fellows for multidisciplinary programs; and access support for researchers interested in interdisciplinary opportunities. Such a hub should also be used for publicizing funding opportunities for interdisciplinary research and to support research labs in the social sciences.
- Promotion of mechanisms for enhancing the ability of researchers to review and access broader literature reviews, such as administrative support to produce new literature reviews and guides that are intended to be used by other researchers not from that discipline.
- Modification of existing funding pipelines to better match the needs of larger research teams and laboratories in the social sciences.

Medium-term approaches (5-10 years)
- Development of interdisciplinary, area/topic focused, and appropriately peer–reviewed journals.
- Establishment of information systems for archiving and sharing data and data archives.
- Addressing basic structural problems in the funding pipelines, including:
  » Establishment of rapid response small planning grants for developing interdisciplinary teams (one model could be the old USAID Collaborative Research Support Programs).
  » Promotion of staged funding approaches that provide small grants for the development of multidisciplinary teams, in anticipation of broader funding.
  » Creation of new funding pipelines that better match the needs of larger research teams and laboratories in the social sciences.

5. Social Science Research Council. Available: https://www.ssrc.org/

Conclusion

In this report, we have sought to highlight the tremendous gains that can be realized by blurring the boundaries between disciplines, by expanded cross-disciplinary exchanges of ideas and collaborations, and by larger laboratory-style approaches to research in the social sciences. Such initiatives already exist and are expanding, their growth driven both by bottom-up approaches by scholars who see opportunities for gaining insight and research methods from other disciplines, and by top-down approaches motivated by the recognition that some of the greatest problems currently facing society demand more multifaceted approaches and larger teams of researchers. Workshop participants were optimistic that deliberate steps of the type identified in the meeting and detailed in this report can accelerate the development of approaches that lead to more complex and comprehensive research agendas.

"Only by integrating these disparate Social Science perspectives can we hope to obtain a more complete picture of these developments that could inform public and private attempts to predict the course they take and—ultimately—provide policy makers with tools for addressing problems that arise in today's digital news environment."

Appendix A: Trajectory for Interdisciplinary Social Science Research

Bridging the Methodological Divide, Adopting Disciplinary Cross-training and Diversity

Short-term approaches (up to 5 years)
- Promotion of cross training and dual degree programs for students in existing programs.
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- Funding supporting diversity in research teams, as well as methods to audit the success of such efforts.
- Promotion of disciplinary, methodological, and social diversity training for peer reviewers, program officers, and administrative staff that can assist in the identification and appropriate evaluation of inter-disciplinary and multidisciplinary research projects for funding.

Medium-term approaches (5-10 years)
- Promotion of industry support for interdisciplinary/multidisciplinary training, especially for students aiming for a non-academic career.
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Long-term approaches (10+ years)
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Short-term approaches (up to 5 years)
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- Establishment of a centralized online hub where researchers of different disciplines can network; find and post opportunities such as calls for post-doctoral fellows for multidisciplinary programs; and access support for researchers interested in interdisciplinary opportunities. Such a hub should also be used for publicizing funding opportunities for interdisciplinary research and to support research labs in the social sciences.
- Promotion of mechanisms for enhancing the ability of researchers to review and access broader literature reviews, such as administrative support to produce new literature reviews and guides that are intended to be used by other researchers not from that discipline.
- Modification of existing funding pipelines to better match the needs of larger research teams and laboratories in the social sciences.

Medium-term approaches (5-10 years)
- Development of interdisciplinary, area/topic focused, and appropriately peer-reviewed journals.
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    - » Establishment of rapid response small planning grants for developing interdisciplinary teams (one model could be the old USAID Collaborative Research Support Programs).
    - » Promotion of staged funding approaches that provide small grants for the development of multidisciplinary teams, in anticipation of broader funding.
    - » Creation of new funding pipelines that better match the needs of larger research teams and laboratories in the social sciences.

Appendix B: Workshop Attendees

Workshop Co-Chairs

George Loewenstein, Professor
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George Loewenstein is the Herbert A. Simon University Professor of Economics and Psychology at Carnegie Mellon University, and also currently holds positions at the BRIQ Institute in Bonn Germany and the Arctic University of Norway in Tromsø. He received his PhD from Yale University in 1985 and since then has held academic positions at The University of Chicago and Carnegie Mellon University, and fellowships at Center for Advanced Study in the Behavioral Sciences, The Institute for Advanced Study in Princeton, The Russell Sage Foundation, The Institute for Advanced Study (Wissenschaftskolleg) in Berlin, and the London School of Economics. He is one of the founders of the fields of behavioral economics and neuroeconomics. His research focuses on applications of psychology to economics, and his specific interests include decision making over time, bargaining and negotiations, psychology and health, privacy, curiosity, boredom, information avoidance, privacy, adaptation, the role of emotion in decision making, conflicts of interest, and diverse aspects of public policy.

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Kathleen Musante is a Professor of Anthropology and Public Health at the University of Pittsburgh. She is the Past-President of the Society for Applied Anthropology. She is a medical anthropologist with specialization in the health and nutrition of indigenous peoples of Latin America, food security in economically marginal rural communities, and the anthropology of food policy. She has conducted qualitative and quantitative research in Mexico, Brazil, Honduras, Ecuador, and rural US.

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Joshua A. Tucker is Professor of Politics, affiliated Professor of Russian and Slavic Studies, and affiliated Professor of Data Science at New York University. He is the Director of NYU's Jordan Center for Advanced Study of Russia, a co-Director of the NYU Social Media and Political Participation (SMaPP) laboratory, and a co-author/editor of the award-winning politics and policy blog *The Monkey Cage* at *The Washington Post*. His original research was on mass political behavior in post-communist countries, including voting and elections, partisanship, public opinion formation, and protest participation. More recently, he has focused his research efforts on the newly emerging field of study of the relationship between social media and politics. His research in this area has included studies on the effects of network diversity on tolerance, partisan echo chambers, online hate speech, the effects of exposure to social media on political knowledge, online networks and protest, disinformation and fake news, how authoritarian regimes respond to online opposition, and Russian bots and trolls. His research has appeared in over two-dozen scholarly journals, has been supported by half a dozen philanthropic foundations and the National Science Foundation, and his most recent book is the co-authored *Communism's Shadow: Historical Legacies and Contemporary Political Attitudes* (Princeton University Press, 2017).

Workshop Participants

Alex Bentley, Professor
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Professor Alex Bentley is the Head of Anthropology at University of Tennessee, Knoxville (UTK), since Fall of 2017. His background is inter-disciplinary, starting from a B.A. in physics (Bowdoin College) to Masters in Earth Sciences (Cornell University) to a PhD in Anthropology (U. Wisconsin). Bentley spent 14 years at universities in the UK, where he was Deputy Director of the $2M interdisciplinary "Tipping Points" project at Durham University in 2011, and Professor and Department Head at University of Bristol until 2015. His research uses large aggregated data sets to explore popular cultural evolution, social influence, and decision-making, at time scales ranging from decades to days. With these interests, Bentley has served as a consultant in the UK to a range of organizations including the UK Department of Health, Unilever, Sony Europe, Sanofi Pasteur, and others. Bentley is co-author on about a hundred scholarly articles and chapters, including co-authoring a series of three short books with M.I.T. Press: *I'll Have What She's Having: Mapping Social Change* (2011), *The Acceleration of Cultural Change* (2017), and *The Importance of Small Decisions* (2019).

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Eli Berman is IGCC Research Director for International Security Studies and professor of economics at UC San Diego. He co-directs the Economics of National Security group at the National Bureau of Economic Research and helps lead the Empirical Studies of Conflict Project and the Economics of National Security Association. Publications include *Small Wars, Big Data: The Information Revolution in Modern Conflict* (with Jacob N. Shapiro and Joseph H. Felter, 2018) and *Radical, Religious and Violent: The New Economics of Terrorism* (2009). Recent grants supporting his research have come from the Minerva Research Initiative and the National Science Foundation. Berman received his PhD in economics from Harvard University.

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Tom Boellstorff is Professor in the Department of Anthropology at the University of California, Irvine. A Fellow of the American Association for the Advancement of Science, he is the author of *The Gay Archipelago* (Princeton University Press), *A Coincidence of Desires* (Duke University Press), and *Coming of Age in Second Life* (Princeton University Press). He is also coauthor of *Ethnography and Virtual Worlds: A Handbook of Method* (Princeton University Press) and coeditor of *Data, Now Bigger and Better!* (Prickly Paradigm Press). Former Editor-in-Chief of American Anthropologist, the flagship journal of the American Anthropological Association, he currently coedits the Princeton University Press book series "Princeton Studies in Culture and Technology." He has conducted research in Indonesia since 1992 and online since 2003. His published articles have appeared in top journals including American Anthropologist, American Ethnologist (twice), Cultural Anthropology (twice), Current Anthropology, Annual Review of Anthropology, Games and Culture, International Journal of Communication, Journal of Asian Studies, Journal of Linguistic Anthropology, Journal of Virtual Worlds Research (twice), Ethnos, GLQ: A Journal of Lesbian and Gay Studies (thrice), and Media, Culture, and Society.

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Keith Brown is Director of ASU's Melikian Center for Russian, Eurasian, and East European Studies, and Professor in the School of Politics and Global Studies. Trained as an anthropologist, he has conducted research on insurgent organizations, democratic activism, and labor migration in the Western Balkans, and contributed to U.S. military cultural awareness training.

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Ethan Bueno de Mesquita is the Sydney Stein Professor and Deputy Dean at the Harris School of Public Policy at the University of Chicago. His research focuses on applications of game theoretic models to a variety of political phenomena including conflict, political violence, and electoral accountability. His research has been supported by the National Science Foundation, the Office of Naval Research, and the United States Institute of Peace.

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Heath Cabot (PhD, University of California, Santa Cruz 2010) is a political and legal anthropologist whose research examines citizenship, ethics, and rights in Europe, with a focus on Greece. Research interests and areas of expertise: political and legal anthropology; anthropology of ethics and morality; migration, citizenship, and asylum; human and social rights; care and humanitarian governance; economies of redistribution; cultures of neoliberalism; ethnography of the state; Europe, Italy, Greece; epistemology, and aesthetics.

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Kathleen Carley is a professor in the School of Computer Science at Carnegie Mellon University and the director of the Center for Computational Analysis of Social and Organizational Systems (CASOS), a university wide interdisciplinary center that brings together network analysis, computer science, and organization science (www.casos.ece.cmu.edu). Kathleen M. Carley's research combines cognitive science, social networks, and computer science to address complex social and organizational problems. Her specific research areas are dynamic network analysis, computational social and organization theory, adaptation and evolution, text mining, and the impact of telecommunication technologies and policy on communication, information diffusion, disease contagion, and response within and among groups particularly in disaster or crisis situations. She and her lab have developed infrastructure tools for analyzing large scale dynamic networks and various multi-agent simulation systems. Her simulation models meld multi-agent technology with network

dynamics and empirical data. She is the founding co-editor of the journal Computational and Mathematical Organization Theory which she now co-edits with Dr. Terrill Frantz. She has co-edited several books in the computational organizations and dynamic network area

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Justine Cassell is Associate Dean of Technology Strategy and Impact in the School of Computer Science at Carnegie Mellon University, and Director Emerita of the Human Computer Interaction Institute. She co-directs the Yahoo-CMU InMind partnership on the future of personal assistants, and was a founding co-director of the Simon Initiative on Technology-Enhanced Learning. Previously Cassell was faculty at Northwestern University where she founded the Technology and Social Behavior Doctoral Program and Research Center. Before that she was a tenured professor at the MIT Media Lab. Cassell has received the MIT Edgerton Prize, and Anita Borg Institute Women of Vision award, in 2011 was named to the World Economic Forum Global Agenda Council on AI and Robotics, which she chaired for 2 years before moving to chair the World Economic Future Council on the Future of Computing. In 2012 Cassell was named a AAAS fellow, in 2016 made a Fellow of the Royal Academy of Scotland, and in 2017 made a Fellow of the ACM. In 2017-2018 Cassell held the Chaire Blaise Pascal in Paris, where she was a visiting researcher at the Sorbonne. Cassell has spoken at the World Economic Forum in Davos for the past 8 years on topics concerning the impact of AI and Robotics on society.

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Rosta Farzan is an Associate Professor at the School of Computing and Information. She earned her PhD in Intelligent Systems from the University of Pittsburgh. Dr. Farzan studies socio-technical systems that empower individuals and groups to contribute to knowledge production and community building, such as Wikipedia, online discussion forums, and hyper-local online communities. Her research focuses on understanding what contributes to the sustainability of socio-technical systems; how to encourage participation of under-represented groups in socio-technical systems; and, what the value of these systems are for their users and beyond. She studies how these systems can play a role in addressing important societal problems, such as increasing civic engagement, empowering non-profit organizations, fighting cyber-bullying, supporting individual's privacy in face of high presence of sensors, and increasing reliability and neutrality of user-generated information in social media. Her research has been supported by a variety of federal, academic, and industry sources such as the National Science Foundation, AT&T, and Google.

Erik Gartzke, Professor

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Erik Gartzke is the Professor of Political Science and Director of the Center for Peace and Security Studies (cPASS) at the University of California, San Diego, where he has been a member of the research faculty since 2007. Previous permanent faculty positions include Columbia University in the City of New York (2000 to 2007) and the Pennsylvania State University (1997 to 2000). He has held temporary positions at Dartmouth University, the Ecole des Affaires Internationales (Sciences Po), the Naval Postgraduate School, UC Santa Barbara, and at the University of Essex. Dr. Gartzke received a PhD in Political Science from the University of Iowa in 1997.

Professor Gartzke's research focuses on war, peace, and international institutions. His interests include nuclear security, the liberal peace, alliances, uncertainty and war, deterrence theory, and the evolving technological nature of interstate conflict. He has written on cyberwar, trade and conflict, and the effects of economic development, system structure, and climate change on war. Dr. Gartzke's research has been published in numerous academic journals and edited volumes.

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Molly Roberts is an Associate Professor at UC San Diego. Her research interests lie in the intersection of political methodology and the politics of information, with a specific focus on methods of automated content analysis and the politics of censorship in China. Currently, she's working on a variety of additional projects that span censorship, propaganda, topic models, and other methods of text analysis. Some of this work has appeared or is forthcoming in the American Journal of Political Science, American Political Science Review, Science, and Political Analysis. Her book, *Censored: Distraction and Diversion Inside China's Great Firewall* was published by Princeton University Press in 2018.

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Dawn T. Robinson is Professor of Sociology and Owens Institute of Behavioral Research Fellow at the University of Georgia where she co-directs the Laboratory for the Study of Social Interaction and the Computational Social Science Work Group. Dr. Robinson received her Ph.D. from Cornell University and held a NIMH postdoctoral fellowship at Stanford University. She was elected as a 2009 Kavli Frontiers of Science Fellow by the National Academy of Sciences. She is past Chair of three Sections of the American Sociological Association—the Altruism, Morality, and Social Solidarity Section, the Social Psychology Section, the Sociology of Emotion Section. She also has held elected offices in the International Society for Research on Emotion and the Southern Sociological Society. She served on the Committee of Visitors for the National Science Foundation program on Human and Social Dynamics. Her recent research includes a multi-national study on affective-linguistic culture, developing new mathematical models of cross-cultural interactions, developing non-reactive emotion measures of emotion, studying emotional responses to injustice, and a series of papers on gender in networks and task groups. Her research has been funded by National Science Foundation, U.S. Department of the Interior, Office of Naval Research, and Army Research Office.

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Appendix C: Workshop Prospectus

We live in a socially complex world where challenges to security and stability rapidly emerge and continuously evolve. A good portion of the scientific enterprise is devoted to developing technological solutions to these challenges, but an overly technological focus can obscure efforts to understand the underlying dynamics of security and stability that are inherently social. Social scientists have many tools available to help us understand the complexities of the social world. The focus of this workshop is on exploring opportunities to move beyond existing methodologies to develop new, more interdisciplinary ways of understanding the social context inherent to security.

As a methodologically diverse grouping of academic disciplines, social science includes a methodologically diverse grouping of academic disciplines that are broadly concerned with the scientific study of human society and social relationships. Its constituent disciplines—including anthropology, economics, political science, psychology, and sociology—have well-established approaches to investigating the social world. While these are useful to engaging ongoing disciplinary questions, the explanatory contribution of a single discipline's approach can prove limited to the operationalization of knowledge. There is some multidisciplinary work across social science, including some involving non-social science approaches, but such research presents its own unique challenges for researchers. The goal of this Future Directions workshop is to look at the contributions of—and explore ways of supporting—multidisciplinary research as a fundamental approach to basic social science research that more fully elucidates the underlying social issues of problems. We are particularly interested in complex problems that may demand multi-disciplinary efforts to fully understand and address them, as well as existing barriers to such approaches and how they can best be addressed moving forward.

This two-day workshop will convene a diverse group of leading scholars from a variety of social science disciplines—and some non-social science disciplines—with two overarching goals: 1) explore problem-based social science interdisciplinarity that utilizes multi-method approaches; and 2) to be prescriptive about the future directions of research, asking how we can think broadly and holistically about addressing the myriad problems societies face. Collectively, these discussions are vital to forge methodologically innovative research approaches that are generalizable, in the sense of shaping future research approaches to similar problems.

The workshop will be structured around small-group breakout sessions and whole-group discussions, rather than a standard conference format, to consider new directions in problem-based interdisciplinary social science research. In order to provide some structure, discussions will be focused around three thematic heuristic problem sets:

- Information and Politics
- Migration and Stasis
- Technology and Sociality

Workshop participants will represent a wide-range of social science disciplines and many—though not all—will have demonstrated expertise in researching issues inherent to the thematic problem sets.

While problem-based approaches can lead to applied solutions, it is worth reiterating that the underlying question is a fundamental, basic science question about innovative methodological approaches that could influence how problems are researched in the future. Participants will aim to frame innovative research approaches to the individual problem sets, but also use those heuristics to get at the meta-level question of how a future social science might address social problems across a myriad of disciplines, including insights on overarching questions:

- How might problem-based interdisciplinary research impact future capabilities of addressing social problems?
- What is the possible trajectory of social scientific achievement over the next 10–15 years?
- What are the most fundamental challenges to social progress and security (broadly defined)?
- How could funding organizations help alleviate these challenges?

The discussions and ensuing distributed report will provide valuable long-term guidance to the Department of Defense community, as well as the broader federal funding community, federal

labs, and other stakeholders. Workshop attendees will emerge with a better ability to identify and seize potential opportunities at the intersection between the fields of study. This workshop is sponsored by the Basic Research Office within the Office of the Under Secretary of Defense for Research and Engineering.

Agenda

Day One: The workshop will begin with comments welcoming participants to the workshop and logistics information on the workshop and the site. A short, introductory lecture will follow to frame the event and provide a platform for small group discussion. The majority of the first day will be spent in breakout sessions on fundamental challenges and opportunities in problem-based social science research.

Framing: Problem-based Interdisciplinarity
What are the disciplinary challenges to interdisciplinary research and what opportunities can emerge from more holistic, problem-based social science research?

Thematic Problem Set Breakout Session
The Breakout Session aims to clearly elucidate and discuss the fundamental research challenges implicit to the thematic problem sets.

Thematic Problem Sets:
- **Information and Politics:** How has the conduct of politics changed in the digital information era? What are the key threats to open, democratic societies from digitized information?
- **Migration and Stasis:** How do we research the implications of different types of population movements—economic, environmental, conflict, etc.—and those who stay behind?
- **Technology and Sociality:** How do we research the implications of technology on sociality—including artificial intelligence and human relations; cyber and virtuality; and social media and communality?

This will facilitate discussions on areas where social science could make an impact in a way inaccessible to current methods, where each group will discuss:

- What are the primary challenge areas in this space and what are researchers working on to address them?
- What are the unique challenges in this space that would impact our understanding of the problem?
- What are the technical obstacles for implementing current and future social science research approaches, and what advances are needed to overcome these obstacles?
- What are the structural obstacles (i.e., incentive structures, funding) for implementing current and future social science research approaches, and what advances are needed to overcome these obstacles?

Day Two: The second day of the workshop will consist of whitespace, whole group discussions on topics from Day 1, as well as especially ambitious and/or high-risk approaches. Participants will also discuss areas that require more growth, as well as the trajectory of this intersectional area over time. At the end of the day, the whole group will discuss the overarching themes of the workshop that should be included in the final workshop report.

Appendix D: Workshop Agenda

DAY 1—Thursday, April 11, 2019

Time	Title
8:00–8:30	Check-in and Continental Breakfast
8:30–9:00	**Welcome, Overview, Introductions and Expectations** David Montgomery, Office of Basic Research Tim Olsen, Virginia Tech Applied Research Corporation Kathleen Musante, University of Pittsburgh
9:00–9:20	Workshop Framing: Joshua A. Tucker, New York University
9:20–9:35	**BREAK** (move to breakout rooms)
9:35–11:00	Working Group I: Defining the problem *Small group discussion to identify a) how various disciplines think about the problem set; b) a problem that when addressed would highlight the importance of interdisciplinary research; c) challenges presented by the problem; and d) opportunities presented by the problem.* *Group A: Information and Politics* *Group B: Migration and Stasis* *Group C: Technology and Sociality*
11:00–11:15	**BREAK** (move to breakout rooms)
11:15–12:00	Working Group I Outbriefing
12:00–1:00	**LUNCH** (provided for participants)
1:00–3:45	Working Group II: Challenges and opportunities of interdisciplinary problem-based social science research (with breaks as needed) *Small group discussion to identify a) research questions needed to be asked; b) data needed to be considered; c) methods needed to analyze the data; d) opportunities/challenges from using an interdisciplinary approach to this problem; and e) what might help mediate the challenges to doing interdisciplinary research?* *Group A: Information and Politics* *Group B: Migration and Stasis* *Group C: Technology and Sociality*
3:45–4:00	**BREAK** (move to main room)
4:00–4:45	Working Group II Outbriefing
4:45–5:00	Summary of the Day: George Lowenstein, Carnegie Mellon University
5:00	**MEETING ADJOURNED FOR THE DAY**

DAY 2—Friday, April 12, 2019

Time	Title
8:00–8:30	Check-in and Continental Breakfast
8:30–9:00	**Welcome and Discussion on topics that were missed on Day 1** Kathleen Musante, University of Pittsburgh
9:00–9:45	Discussion on motivations of interdisciplinary research George Lowenstein, Carnegie Mellon University
9:45–10:00	**BREAK**
10:00–11:00	Discussion on challenges and opportunities presented by interdisciplinary research Joshua A. Tucker, New York University
11:00–12:00	Discussion of timeline for mitigating challenges and taking opportunities presented by interdisciplinary research Kathleen Musante, University of Pittsburgh
12:00	**MEETING ADJOURNED**