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An Exploratory Examination of Agent-Based Modeling for the Study of Social Movements



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About This Report

This report explores the suitability of employing agent-based modeling as a method for studying social movements. Social movement research is becoming increasingly important, as technological change, most notably regarding information and communications technologies, has altered the ways movements form, organize, mobilize, and act, as well as the ways in which they are surveilled and disrupted. We argue that, as a methodology, agent-based modeling is especially well-suited to integrate multiple lines of theoretical research with increasingly large and micro-level data, which can provide important social scientific and policy-relevant findings.

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Summary

Social movements are organized groups of people that work largely outside existing institutions to resist or defend existing authorities. The purpose of the research reported here was to explore the effects of information and communications technologies (ICTs) on the formation, maintenance, and dissolution of these movements over time.

This report begins with a review of selected research on recent technologies and social movements. Next, we review three case studies on these movements, focusing on the role of technologies in these events. The case studies are on the Arab Spring protests in Egypt in 2010, the civil uprising in Syria in 2010, and the Hong Kong protests in 2019. The Syrian case study is unique in that protesters lacked a high degree of access to social media, and this may explain in part why that protest movement was not successful. A common conclusion from these cases is that access to communication technologies enabled people to connect with each other in ways that, in turn, supported the expansion of social movements over time. However, it is also clear that those opposing these movements have also sought to develop and use ICTs to monitor, target, and disrupt movements, and that the technological affordances that have benefited social movements may increasingly be employed against them.

Based on the analysis from the case studies, we present an agent-based model (ABM) that tests the role of technology on two key features of social movements: (1) homophily—the tendency for people to interact with others who are similar to them¹—and (2) social influence—the capacity for one person to get what they want by convincing others they also want the same thing.² The results from this simulation model shows how communication technologies may increase the spontaneous interactions that lead to collective action during social movements.

We present three conclusions from this exploratory research. First, in each of our three case studies, we reached similar conclusions about the role of technology as a means for individuals to interact with each other, find common ground, and organize collective action. Second, recent advances in technology shaped the dynamics of the formation of collective action in our case studies. Third, ABMs are a useful tool for studying the role of technology in shaping the underlying characteristics that define a social movement. We conclude the report with an examination of how to better employ ABMs as a tool for understanding the dynamics of social movements, particularly under changing technological conditions, most notably ICTs that affect how individuals understand their environments and interests and how individuals organize and mobilize for collective action.

¹ Miller McPherson, Lynn Smith-Lovin, and James M. Cook, “Birds of a Feather: Homophily in Social Networks,” *Annual Review of Sociology*, Vol. 27, August 2001.

² David Willer, Michael J. Lovaglia, and Barry Markovsky, “Power and Influence: A Theoretical Bridge,” *Social Forces*, Vol. 76, No. 2, December 1997.

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Introduction

The purpose of the research reported here was to explore reasons and ways to investigate social movements using agent-based models (ABMs). We begin by examining the role of technology using three case studies: (1) the Arab Spring protests in Egypt in 2010 (Chapter Two), (2) the civil uprising in Syria in 2010 (Chapter Three), and (3) the Hong Kong Protests in 2019 (Chapter Four). Our conclusion from these case studies is that new technologies—most notably information communications technologies (ICTs) that enable people to understand their environments and interests and to connect with one another, such as through social media—play an increasingly important role in how movements evolve over time. Based on this conclusion, we review some of the relevant theories and models of social movements (Chapter Five).

Drawing from this literature, in Chapter Six we focus on some of the structural features of social movements using an ABM. Specifically, we explore the conditions under which people (agents) may find each other, connect, and form enduring networks that evolve into collective action. We also explore the role of authorities (e.g., a government's internal security service) in surveilling these movements. This model serves as one example for exploring a wide range of applications for ABMs in the study of social movements for social science and policy research. These opportunities include the ability to integrate multiple levels of analysis and theories and facilitate the introduction of new variables—such as ICTs—into the study of social movements. In Chapter Seven, we discuss these opportunities and build on the case studies and modeling to present several perspectives on the scientific and policy benefits of developing more robust efforts to apply ABMs to the study of social movements. We conclude in Chapter Seven by summarizing the lessons learned and opportunities to advance social movement research and related policy.

What Is a Social Movement?

There is no shortage of research on how to define what constitutes a social movement. The study of these movements spans various disciplines, each providing their own definition of *social movement* that is tailored toward specific lines of inquiry. This report starts with the following definition of *social movements*:

collectives acting with some degree of organization and continuity outside of institutional or organizational channels for the purpose of challenging or defending extant authority, whether it is institutionally or culturally based in the group, organization, society, culture, or world order of which they are a part.¹

The above definition contains three key components.² First, social movements are a form of collective action whereby two or more individuals work together to achieve some common goal. Thus, a social movement is a form of organized behavior by groups of people. On this point, degrees of organization are continuous, and the visible manifestation of social movements may mask multiple and complex layers of interaction within and between organizations, their members, and nonmembers. For example, large, well-organized peaceful protests may attract small groups specifically committed to performing acts of violence, while small, organized groups may not directly participate in violent acts yet may intentionally incite spontaneous action, such as riots or looting. According to our definition, organization is central to determining the presence and effectiveness of social movements,³ though the overt participants in collective action itself may run the gamut from deeply committed to unwitting. Indeed, a fundamental question regarding large-scale collective action, whether the Arab Spring protests or the January 6 insurrection at the U.S. Capitol, is the extent to which the behavior of participants was planned, coordinated, or organized in some way and the extent to which social mobilization leading to collective action is itself a technology enabled and enhanced by ICTs that well-organized groups are learning to wield.⁴

Second, social movements exist outside established institutional and organizational channels. Such established channels act as enduring contexts that define the expected patterns of behaviors for how people interact with each other. For example, the military clearly defines a chain of command that prescribes how junior enlisted personnel interact with senior leaders. In corporations, there are procedures that define how employees interact with human resources, other work units, and their managers. Within one's community, there are ways to voice concerns at city council meetings, file petitions with elected officials, and run for elected office.

Organized collective action that constitutes a social movement operates outside these existing institutions and established pathways. This is in contrast to, for example, organized interest groups, which tend to operate within existing structures for some common goal (e.g.,

¹ David A Snow, Sarah A. Soule, and Hanspeter Kriesi, "Mapping the Terrain," in David A. Snow, Sarah A. Soule, and Hanspeter Kriesi, eds., *The Blackwell Companion to Social Movements*, 1st ed., Malden, Mass.: John Wiley & Sons, 2007, p. 11.

² Snow, Soule, and Kriesi, 2007.

³ Carmi Schooler, "A Working Conceptualization of Social Structure: Mertonian Roots and Psychological and Sociocultural Relationships," *Social Psychology Quarterly*, Vol. 57, No. 3, 1994.

⁴ Joseph B. Bak-Coleman, Mark Alfano, Wolfram Barfuss, Carl T. Bergstrom, Miguel A. Centeno, Iain D. Couzin, Jonathan F. Donges, Mirta Galesic, Andrew S. Gersick, Jennifer Jacquet, et al., "Stewardship of Global Collective Behavior," *Proceedings of the National Academy of Sciences*, Vol. 118, No. 27, July 6, 2021.

influence public policy). Similarly, campaigns for elected office are not in and of themselves social movements, since the act of running for office occurs within existing political structures. A social movement may, however, influence an elected official or a politician's candidacy, or even align or fuse itself with a political party,⁵ and a traditional political campaign may give rise to a movement that exists outside traditional political channels.

Third, the purpose of these organized collectives of people is to challenge or defend existing institutions. Despite operating outside these institutions, these movements are focused on the abolishment, transformation, or protection of existing institutions. For example, a group of people may protest a police department to advocate for a reduction in funding for its operations. Another group may protest these protesters to ensure sustained or increased funding for the police. Regardless of the issue, both groups are organized, exist outside existing social structures, and have a common goal focused on existing institutional structures. Using these key features as a starting point, we now highlight some research that relates to the role of information technology in these movements.

Background

During 2010 and 2011, a series of mass protests swept through the Middle East. The self-immolation of Mohamed Bouazizi on December 17, 2010, in Tunisia set off protests and demonstrations in Tunisia, Libya, Egypt, Syria, Bahrain, Morocco, Iraq, Algeria, Iranian Khuzestan, Lebanon, Jordan, Kuwait, Oman, Sudan, Djibouti, Mauritania, the Palestinian National Authority, Saudi Arabia, and Moroccan-occupied Western Sahara.⁶ While many governments were able to weather the storm, several regimes were overthrown, including the governments of Tunisia, Libya, Egypt, and Yemen. Bahrain was pushed to its limits, and its regime would likely have collapsed had its Saudi patrons not provided military aid, while Syria was plunged into a civil war that persists to this day.

For many observers, the political success of the Arab Spring led to two interrelated conclusions. First, the rapid diffusion of protests within and across national boundaries highlighted the interconnected nature of the global system. This interdependence was further highlighted as the search for causes in regional political, economic, and social systems highlighted events far removed from the Middle East, such as sudden changes in Chinese wheat

⁵ Daniel Schlozman, *When Movements Anchor Parties: Electoral Alignments in American History*, Princeton, N.J.: Princeton University Press, 2015.

⁶ Kenneth M. Pollack Daniel L. Byman, Akram Al-Turk, Pavel K. Baev, Michael S. Doran, Khaled Elgindy, Stephen R. Grand, Shadi Hamid, Bruce D. Jones, Suzanne Maloney, et al. *The Arab Awakening: America and the Transformation of the Middle East*, Washington, D.C.: Brookings Institution Press, 2011; Joel Beinin and Frédéric Vairel, eds., *Social Movements, Mobilization, and Contestation in the Middle East and North Africa*, 2nd ed., Stanford, Calif.: Stanford University Press, 2; "Arab Spring," Wikipedia, June 8, 2020; "Mohamed Bouazizi," Wikipedia, June 9, 2020.

prices.⁷ Second, the Arab Spring was seen by some as related to the Cold War's conclusion and subsequent "color revolutions" or "flower revolutions" in former Soviet Bloc countries.⁸ In this view, emerging digital communications technologies, such as Facebook and Twitter, were construed as the modern equivalent of the facsimile machine, satellite television, and radio that enabled the organization and mobilization of human rights and dissident movements during the Cold War.⁹ In certain cases, the internet emerged as a key factor in the promotion of democracy and the development and strengthening of civil society.¹⁰

More recently, there have been examples where subgroups within civil society have mobilized in conflict with autocratic governments. However, the exuberance inspired by the Arab Spring has given way to more cautious assessments regarding the future of democracy, particularly as vulnerable regimes have developed a larger interest in—and capabilities for—*countering* internet-enabled resistance to their rule. In some cases, countermeasures have emerged in the form of new controls over the internet, public surveillance, and an encroachment into the economic and social lives of citizens, perhaps the most ambitious of which is the emerging system of social credit in China and the rise of "surveillance cities."¹¹ In other cases, governments have become more sophisticated in competing with social movements on online platforms, employing trolls, bots, and propaganda to discredit and counter the narratives of rivals while mobilizing their own constituencies.¹² Indeed, Russia has reportedly made defeating uprisings via both force and information operations a key capability in its suite of hybrid warfare tactics.¹³

⁷ News Desk, "Did Food Prices Spur the Arab Spring?" *PBS NewsHour*, September 7, 2011; Rami Zurayk, "Use Your Loaf: Why Food Prices Were Crucial in the Arab Spring," *The Guardian*, July 16, 2011; Ines Perez, "Climate Change and Rising Food Prices Heightened Arab Spring," *Scientific American*, March 4, 2013; Willeke Veninga Rico Ihle, "Import Vulnerability in the Middle East: Effects of the Arab Spring on Egyptian Wheat Trade," *Food Security*, Vol. 10, No. 1, February 5, 2018.

⁸ Stephen R. Grand, *Understanding Tahrir Square: What Transitions Elsewhere Can Teach Us About the Prospects for Arab Democracy*, Washington, D.C.: Brookings Institution Press, 2014.

⁹ Michael Nelson, *War of the Black Heavens: The Battles of Western Broadcasting in the Cold War*, Syracuse, N.Y.: Syracuse University Press, 1997; Alvin Snyder, *Warriors of Disinformation: American Propaganda, Soviet Lies, and the Winning of the Cold War*, New York: Arcade Publishing, 1997; Matthew Evangelista, *Unarmed Forces*, Ithaca, N.Y.: Cornell University Press, 2002; Nicholas J. Cull, *The Cold War and the United States Information Agency: American Propaganda and Public Diplomacy, 1945–1989*, New York: Cambridge University Press, 2009.

¹⁰ Olesya Tkacheva, Lowell H. Schwartz, Martin C. Libicki, Julie E. Taylor, Jeffrey Martini, and Caroline Baxter, *Internet Freedom and Political Space*, Santa Monica, Calif.: RAND Corporation, RR-295-DOS, 201.

¹¹ Bill Drexel, "A Totalitarian Surveillance City in China Should Be a Warning to Us All," *Washington Post*, June 22, 2020.

¹² Luke Tress, "Twitter Removes over 8,000 Fake Accounts Tied to Saudi, Egyptian Governments," *Times of Israel*, April 5, 2020.

¹³ Patrick Tucker, "Russia Is Perfecting the Art of Crushing Uprisings Against Authoritarian Regimes," *Defense One*, July 12, 2019.

One important development regarding computing and social movements, however, is that the same capabilities that were viewed as essential for building civil societies in nondemocratic countries have had dramatic effects on democracies as well. Specifically, the same networking technologies that enabled online public spaces and the public exposure of autocratic regimes' oppressive and corrupt conduct have in some cases allowed groups of people to self-segregate. The result has been the formation of echo chambers wherein a small number of people reinforce their own extreme beliefs, leading to violence.¹⁴ Likewise, whereas internet penetration into society was initially seen as promoting democracy and the enablement of civil society, it has now become the infrastructure through which surveillance states are being built, extending regimes' abilities to police and control populations and reach into public spaces beyond their borders to pursue their national interests.¹⁵

Understanding these changes requires a nuanced view of new ICTs and their relationships with democracy and autocracy. Events over the past decade reveal that vulnerable governments have made concerted efforts to shore up vulnerabilities exposed during the Arab Spring. At the same time, the emergence of sustained protests in Hong Kong over its diminishing autonomy vis-à-vis China, as well as protests in Belarus, indicate that authoritarian vulnerabilities remain. Thus, modern ICTs alone cannot provide governments or their rebellious populations a decisive victory when governance is contested.

Analytic Approach and Progression

We examined the effects of ICTs on social movements and protests using multiple methods. By exploring relationships between technology and social movements using theory, case studies, and formal modeling, this project moves toward the development of an operationalizable research infrastructure—a type of Social Behavioral Modeling Laboratory (SBML)¹⁶—upon which more rigorous, generalizable, and case-specific research can proceed.

ICTs—defined as a broad collection of computational technologies that enable digital communication, data storage, and data processing—enhance the coordination capacity of individuals and groups seeking to challenge (or occasionally enhance) governmental author-

¹⁴ Marc Fisher, John Woodrow Cox, and Peter Hermann. “Pizzagate: From Rumor, to Hashtag, to Gunfire in D.C.” *Washington Post*, December 7, 2016; Cecilia Kang and Sheera Frenkel, “‘PizzaGate’ Conspiracy Theory Thrives Anew in the TikTok Era,” *New York Times*, June 27, 2020; Joshua Partlow, Isaac Stanley-Becker, and Mark Guarino, “After Online Warnings, Armed Civilians Bring Threat of Violence to Protests in Kenosha and Elsewhere,” *Washington Post*, August 26, 2020.

¹⁵ Aaron Friedberg, “An Answer to Aggression: How to Push Back Against Beijing,” *Foreign Affairs* September/October 2020; Jane Perlez, “One Country, Two Systems, No Future: The End of Hong Kong as We Know It,” *Foreign Affairs*, September/October 2020.

¹⁶ Paul K. Davis, Angela O’Mahony, Timothy R. Gulden, Osonde A. Osoba, and Katharine Sieck, *Priority Challenges for Social and Behavioral Research and Its Modeling*, Santa Monica, Calif.: RAND Corporation, RR-2208-DARPA, 2018.

ity outside established institutional channels. Meanwhile, these technologies also provide governmental and nongovernmental authorities with new tools and opportunities for surveillance and coercion. ICTs also affect more deep-seated strategic issues that may make citizens more—or less—aware of their political, economic, and social circumstances, thus shaping the pool of people willing to mobilize against, or in defense of, the regime. Given the centrality of technology in these dynamics, each of the three methodological approaches used in this study makes important contributions toward understanding how social movements and technology may coevolve.

Theoretical foundations have drawn from the existing literature on social movements and the broader field of study referred to as “contentious politics.” This field seeks to understand the emergence and dynamics of collective political struggle in which at least one party is the existing government.¹⁷ In doing so, it seeks to identify and characterize common mechanisms of political mobilization and contestation that occur in a variety of alternative forms—social movements, strikes, nationalism, democratization, terrorism, insurgency, civil war, and more.¹⁸ This broad framing increases the aperture through which social movements and ICTs may be assessed, and it raises the possibilities that future social movements may be enabled or constrained by new technologies and that the process of making and resisting claims to power and status may shift to alternative modes of conflict.

Figure 1.1 provides a simple model of a polity in which the many modes of contentious politics may occur. The polity is itself a complex organization, as the identities of actors, depicted as cubes, confer differentiated roles and status within political, economic, and social life.¹⁹ Actors include (1) the government and its agents, (2) polity members that enjoy routine access to government agents and resources, (3) challengers that lack routine access to government agents and resources, (4) subjects that are not constituted or formally organized political actors, and (5) outside political actors that exist beyond the reach of government power and authority.²⁰ Though simple, this model allows for power struggles to be viewed through multiple perspectives and at multiple scales. For example, disorganized subjects may organize to challenge the government; external actors may provide moral, financial, technical, and even military support to challengers or the government; and coalitions may form between challengers and members of the polity. Moreover, each box may itself be decomposed

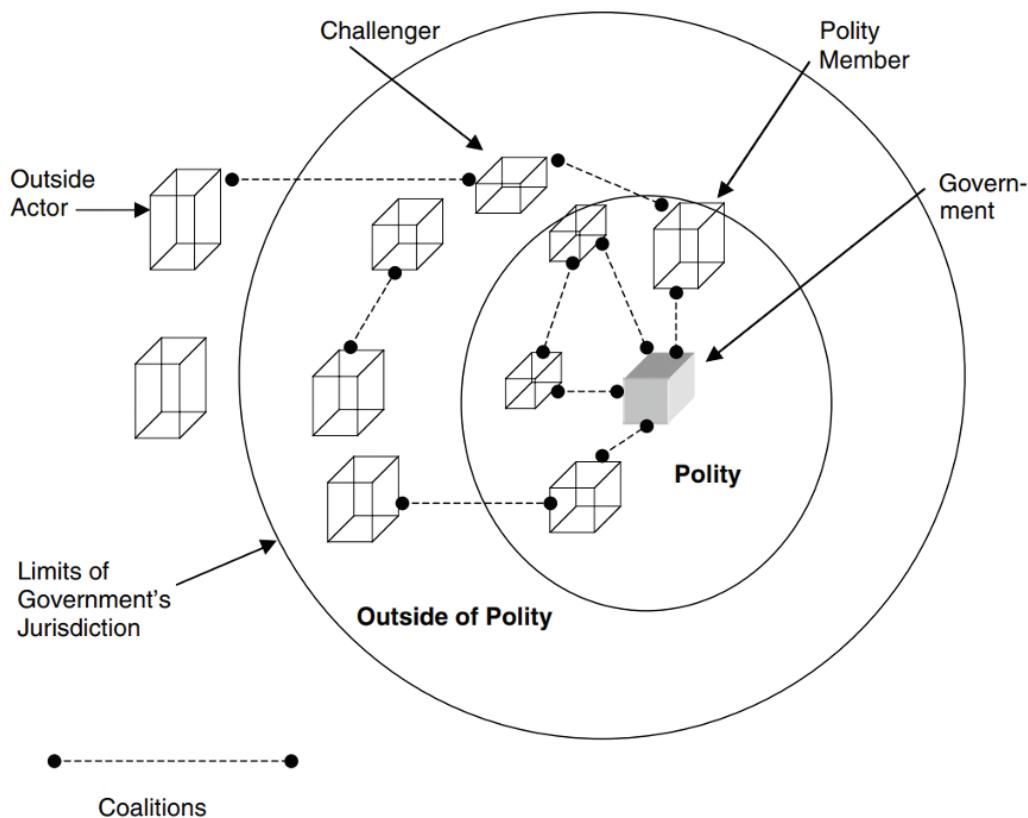
¹⁷ Doug McAdam, Sidney Tarrow, and Charles Tilly, *Dynamics of Contention*, New York: Cambridge University Press, 2001, p. 5.

¹⁸ McAdam, Tarrow, and Tilly, p. 4; Sidney Tarrow, “Contentious Politics,” in Donatella Della Porta and Mario Diani, eds., *The Oxford Handbook of Social Movements*, New York: Oxford University Press, 2015.

¹⁹ For a more comprehensive discussion of societies as complex systems that are characterized by identity roles and status see Paula L.W. Sabloff and Skyler Cragg, “Status, Role, and Behavior in Premodern States: A Comparative Analysis,” in Paula L. W. Sabloff and Jeremy A. Sabloff, eds., *The Emergence of Premodern States: New Perspectives on the Development of Complex Societies*, Santa Fe, N.M.: Santa Fe Institute Press, 2018.

²⁰ McAdam, Tarrow, and Tilly, 2001, pp. 11–12.

FIGURE 1.1
Simple Polity Model



SOURCE: Doug McAdam, Sidney Tarrow, and Charles Tilly, *Dynamics of Contention*, New York, Cambridge University Press, 2001, p. 11. Used with permission.

into individuals, organizations, and networks. Finally, while the polity structure allows us to characterize power struggles, it is ecumenical as to the means and methods through which these struggles occur.

Importantly, both the flexibility of the simple polity model and the diversity of perspectives on contentious politics (especially those focused on social movements) reveal important strengths and weaknesses of our project. A weakness is that resolving theoretical disputes within the field of social movements and contentious politics is infeasible, as any effort to do so would be a massive interdisciplinary undertaking with no guarantee that findings would be robust to definitional and operational changes—as well as the effects of nonstationary relationships among actors and variables, including technology itself.²¹ The model’s

²¹ Karl Popper, *The Poverty of Historicism*, New York: Routledge, 2002; Nancy and Rosa Runhardt, “Measurement,” in Nancy Cartwright and Eleonora Montuschi, eds., *Philosophy of Social Science: A New Introduction*.

strength, however, is that by accepting the legitimacy of a diverse range of frameworks under the umbrella of contentious politics, it provides an initial view of what a prospective “laboratory for social movements” might look like to enable robust theoretical research and case specific applied investigations.²²

Report Outline

In the next three chapters (Chapters Two through Four), we present brief case studies on social movements that generated large-scale public protests. These chapters cover two cases during the Arab Spring protests that emerged in late 2010 and 2011 (in Egypt and Syria), and a third on the 2019 protests in Hong Kong prior to the outbreak of the coronavirus disease 2019 (COVID-19) pandemic. These three cases are presented to examine how ICTs were used by movements and the governments they opposed. They provide examples of technological use—predominantly in the domains of recruitment, mobilization, and coordination of protests—as well as snapshots examples of countermeasures employed by regimes. While these case studies address the paths taken by real-world movements, they are unable to reveal the full range of what could have happened, or what is possible.²³

In Chapter Five, we review some of the relevant literature on social movements to interpret results from these case studies. We then present arguments for creating a modeling infrastructure specifically devoted for the study of social movements and contentious politics more broadly. A research infrastructure of this type would allow for the rigorous analysis of social movements, integrating multiple theoretical approaches to how movements form,

duction, New York: Oxford University Press, 2014; Drew Bowlsby, Erica Chenoweth, Cullen Hendrix, and Jonathan D. Moyer, “The Future Is a Moving Target: Predicting Political Instability” *British Journal of Political Science*, Vol. 50, No. 4, October 2020.

²² In several ways, questions about how ICTs may affect the future of social movements returns to early RAND theorization about methods for exploring the social consequences of information technology and the emergence of information societies through the development of artificial societies that proved foundational in the development of ABM and social and policy research. See Carl H. Builder and Steven C. Banks, *Artificial Societies: A Concept for Basic Research on the Societal Impacts of Information Technology*, Santa Monica, Calif.: RAND Corporation, P-7740, 1991; Nigel Gilbert, and Rosaria Conte, eds., *Artificial Societies: The Computer Simulation of Social Life*, New York: Routledge, 1995; Joshua M. Epstein and Robert L. Axtell, *Growing Artificial Societies: Social Science from the Bottom Up*, Washington, D.C.: Brookings Institution Press and MIT Press, 1996.

²³ François Jacob, *The Possible and the Actual*, Seattle, Wash.: University of Washington Press, 1982; Philip E. Tetlock and Aaron Belkin, eds., *Counterfactual Thought Experiments in World Politics*, Princeton, N.J.: Princeton University Press, 1996; Simon A. Levin, “Complex Adaptive Systems: Exploring the Known, the Unknown, and the Unknowable,” *Bulletin (New Series) of the American Mathematical Society*, Vol. 40, No. 1, 2002; Mary S. Morgan, “Case Studies,” in Nancy Cartwright and Eleonora Montuschi, eds., *Philosophy of Social Science: A New Introduction*, edited by, New York: Oxford University Press, 2014; Stuart A. Kauffman, *A World Beyond Physics: The Emergence and Evolution of Life*, 1st ed., New York: Oxford University Press, 2019.

mobilize, and evolve or dissolve over time. Indeed, an ABM-based laboratory has the potential to test some of the robustness and conditionality of fundamental dynamics that occur during social movements (e.g., formation of social networks). This echoes the initial motivations behind the applications of ABMs to studying how ICTs affect how individuals in society interact.²⁴

In Chapter Six, we provide a short presentation of an ABM of protester network formation and its surveillance by government security forces.²⁵ The employment of a simulation in Chapter Six provides two opportunities. First, it offers a detailed articulation of specific variables that are theoretically important, but rarely captured empirically. These suggest new ways of framing social processes and the need to operationalize the measurement of features that are not currently captured. Second, simulations offer an opportunity to discover behaviors and dynamics that are possible, yet not evident in the small number of available case histories and contemporary events.

Finally, in Chapter Seven we summarize findings and opportunities from prior chapters.

²⁴ Builder and Bankes, 1991.

²⁵ An in-depth discussion of this model and analysis of its dynamics is presented in a companion paper currently under peer review.

Case Study: Egypt and the Arab Spring Protests

The Arab Spring protest movement began when a Tunisian vegetable seller named Mohamed Bouazizi set himself on fire on December 17, 2010.¹ Ensuing protests quickly engulfed the country of Tunisia, and the country's leader, Ben Ali, was ousted on January 14, 2011. These events, and the protests' success, quickly led to follow-on protests throughout the Middle East and North Africa. In addition to Tunisia, the established and reigning governments in Egypt, Yemen, and Libya were overthrown, and protests led to various governmental changes in such countries as Jordan, Oman, Kuwait, Morocco, and Lebanon. In Syria and Libya, protests led to sustained civil wars.

Scholars have lent considerable attention to understanding the factors that led to the Arab Spring in general and predicted the success of some protest movements over others.² Among the most commonly addressed factors are access to the internet and the rise of social media. For example, several macroeconomic studies have argued that differential access to technology may have predicted protest success. Hussain and Howard for example, weighed various political, economic, demographic, and cultural conditions in the Middle East and found that information infrastructure—especially mobile phone use—consistently predicted successful protest movements during the Arab Spring.³ Massoud, Doces, and Magee measured protest data and assessed the relationship between political, economic, and social factors in determining protest size in 19 Arab League states between 1990 and 2011. They found that protests

¹ Thessa Lageman, "Remembering Mohamed Bouazizi: The Man Who Sparked the Arab Spring," *Al Jazeera*, December 17, 2020.

² See for example, Angela Joya, "Syria and the Arab Spring: The Evolution of the Conflict and the Role of the Domestic and External Factors," *Ortadoğu Etütleri*, Vol. 4, No. 1, July 2012; Andrey V. Korotayev, Leonid M. Issaev, Sergey Yu. Malkov, and Alisa R. Shishkina, "The Arab Spring: A Quantitative Analysis," *Arab Studies Quarterly*, Vol. 36, No. 2, 2014.

³ Muzammil M. Hussain and Philip N. Howard, "What Best Explains Successful Protest Cascades? ICTs and the Fuzzy Causes of the Arab Spring," *International Studies Review*, Vol. 15, No. 1, March 1, 2013.

were stronger in countries with higher inflation, higher levels of corruption, lower levels of freedom, and more use of the internet and cell phones.⁴

Even taking such studies at face value, a key question is *how* social media may have helped protesters in countries to successfully counter the government. In addition, it is critical to understand how the government sought to counter the protest movement.

In an effort to shed some light on these questions, this chapter offers a case study on the Arab Spring protest that led to the downfall of President Hosni Mubarak. By many accounts, social media played a critical role in supporting these successful protests. In contrast, the following chapter examines the Syrian protest movement that not only failed to dislodge the local government but also led to a civil war that affected the entire region. The story of the Syrian protest movement reflects less on protester activities and more on successful government efforts to stymie protester access to technology.

For these case studies, we conducted a systematic search for literature in a host of academic and policy-related databases.⁵ For each database, we conducted a title, abstract, and keyword search using the following search query [(*Arab Spring* and *protest*) and (*Egypt* or *Syria*)]. This query resulted in a total of 722 papers. We then reviewed the titles and abstracts and selected a subset of papers that appeared most pertinent to this report. In particular, we looked for reports that offered original scholarship and employed rigorous research methods. We then supplemented this list with additional and targeted literature searches.⁶

In this chapter, we first assess the Egyptian protest movement, and this assessment highlights the ways that the internet and social media helped facilitate recruitment, planning and organization, and live updating of protests. We then highlight Egypt's response to these protests, and we conclude the chapter by detailing an influence diagram that summarizes the role of social media in the Egyptian uprising. This diagram specifically highlights that social media helped the Egyptian protesters acquire international support for the protests, recruit new protesters into the movement, organize specific protest activities, and communicate live updates to the protesters.

The Egyptian Protest Movement

Eleven days following the January 14, 2011, downfall of the Ben Ali regime in Tunisia, Egyptians followed suit in a “day of rage” protest against Hosni Mubarak. Ten thousand Egyptians

⁴ Tansa George Massoud, John A. Doces, and Christopher Magee, “Protests and the Arab Spring: An Empirical Investigation,” *Polity*, Vol. 51, No. 3, July 201.

⁵ The databases we searched included Academic Search Complete, ACM Digital Library (captures tech/social media), Business Source Complete (prelim results captured some legal/social media articles but most were eliminated in duplication removal), IEEE (tech/social media), Military Database, PAIS Index, Policy-File (search results from the previous week), PSYCHINFO, SCOPUS, Social Sciences Index, Sociological Abstracts, and Web of Science.

⁶ For example, we conducted additional targeted searches to identify opinion poll surveys in the region.

participated in this protest in Cairo, with thousands more protesting in other cities across Egypt. Three days later, on January 28, an estimated 100,000 Egyptians protested at Cairo's Tahrir Square. These protests continued up until February 11, when Mubarak resigned and a military caretaker government was formed.

Numerous factors helped facilitate the success of the Egyptian protests. First, the success of the Tunisian protests against Ben Ali was surely pivotal in sparking and inspiring the movement in Egypt. Mubarak's government laid the groundwork with policies that produced political oppression and economic stagnation.⁷ And various events during the protests themselves appeared pivotal. The Egyptian military, which could have turned against the protesters, ultimately proved critical in forcing Mubarak's resignation. President Barak Obama signaled U.S. support for the protesters. Al Jazeera's live and continuous coverage of the protests helped galvanize broader international support.⁸

Ranking high among these potential factors is the role of social media, especially Facebook and Twitter. At the start of the Arab Spring, 26.7 percent of Egyptians had access to the internet (according to 2010 data), and 5.5 and 0.15 percent had access to Facebook and Twitter, respectively. In contrast, 87.1 percent had access to a cell phone.⁹ Some writers, including Malcolm Gladwell, have argued that the "weak social ties" of Facebook and Twitter are more likely to produce sympathetic onlookers than key players in high-stake games of government protests.¹⁰ However, others point to social media's ability to connect aggrieved audiences in Egypt and marshal them with news and information on protest plans.¹¹

Egyptian Protesters

To understand the role of social media in fostering the protest movement in Egypt, we draw on a framework articulated by Clarke and Kocak in their 2018 paper on social media and the

⁷ Nahed Eltantawy and Julie B. Wiest, "Social Media in the Egyptian Revolution: Reconsidering Resource Mobilization Theory," *International Journal of Communication*, Vol. 5, September 2, 2011.

⁸ Mohamed Nanabhay and Roxane Farmanfarmaian, "From Spectacle to Spectacular: How Physical Space, Social Media and Mainstream Broadcast Amplified the Public Sphere in Egypt's 'Revolution,'" *Journal of North African Studies*, Vol. 16, No. 4, December 1, 2011.

⁹ See International Bank for Reconstruction and Development, "The World Bank: Data by Country," 2010, and International Telecommunications Union, "World Telecommunications/ICT Indicators," 2010, both as referenced in Andrea Kavanaugh, Steven D. Sheetz, Riham Hassan, Seungwon Yang, Hicham G. Elmongui, Edward A. Fox, Mohamed Magdy, and Donald J. Shoemaker, "Between a Rock and a Cell Phone: Communication and Information Technology Use During the 2011 Uprisings in Tunisia and Egypt," *International Journal of Information Systems for Crisis Response and Management*, Vol. 5, No. 1, 2013.

¹⁰ Malcolm Gladwell, "Small Change: Why the Revolution Will Not Be Tweeted," *New Yorker*, September 27, 2010.

¹¹ Clay Shirky, "The Political Power of Social Media," *Foreign Affairs*, January/February 2011.

Egyptian Arab Spring protests.¹² Clarke and Kocak argue that social media helped by promoting recruitment, planning and organization, and live updating of protests. We also reference additional research that highlights other potential pathways for social media's impact on the protests.

Recruitment

Numerous lines of evidence suggest that social media was critical to recruiting participants for the January 25 rally. The most significant of this evidence can be found in case studies of the “We are all Khaled Said” Facebook group and April 6 Youth Movement.

“We Are All Khaled Said” Facebook Group and April 6 Youth Movement

On June 6, 2010, a young Egyptian blogger and businessman named Khaled Said was dragged out of an internet café in Alexandria by police and brutally beaten to death, on the seemingly falsified grounds that he tried to swallow a packet of Hashish.¹³ Photos of his bloodied corpse, juxtaposed with photos of when he was alive, were soon circulated and widely shared on the social media.

Wael Ghonim, a regional executive for Google, and Abdel Rahman Mansour, an Egyptian blogger, soon started the “We are all Khaled Said” Facebook page, which sought to memorialize Said. It prominently displayed the gruesome photos of his body and denounced police brutality. It featured “short, simple posts about justice, fairness” and about police brutality.¹⁴ The site grew considerably over the course of 2010. On the eve of the revolution, the site had as many as 400,000 members, a figure higher than any other activist group or political party in Egypt.¹⁵

The April 6 Youth Movement also ran a popular antigovernment Facebook page. The name of this movement came from a protest organized on April 6, 2008, that sought to show solidarity with a labor strike slated to take place in the working-class city of Mahalla al-Kubra.¹⁶ The protest was ultimately unsuccessful, as few protesters showed up and they were quickly shut down by security forces. However, the organizers continued to maintain and expand the Facebook page. According to one account, the April 6 Youth Movement maintained numerous Facebook pages, with separate pages for Arabic and English for the national movement and Arabic pages for each governorate and individual districts. Some pages were

¹² Killian Clark and Korhan Kocak, “Launching Revolution: Social Media and the Egyptian Uprising’s First Mover,” *British Journal of Political Science*, Vol. 50, No. 3, July 2020.

¹³ John Ehab, “Journalists Protest State Media Coverage of Alexandria Police Killing,” *Egypt Independent*, June 30, 2010.

¹⁴ Nivien Saleh, “Egypt’s Digital Activism and the Dictator’s Dilemma: An Evaluation,” *Telecommunications Policy, Global Internet Governance Research and Public Policy Challenges for the Next Decade*, Vol. 36, No. 6, July 2012.

¹⁵ Clark and Kocak, 2020, p. 1033.

¹⁶ Clark and Kocak, 2020.

also focused on gaining new members and others on allowing activists to discuss “strategic nuts and bolts.”¹⁷ The main page had 53,000 members.¹⁸

At the end of December and as the protests in Tunisia were in full swing, Ghonim, the organizer of “We are all Khaled Said” and leader from the April 6 Youth, agreed to plan a protest for January 25, 2011, a day to coincide with official Egyptian holiday Police Day. Invitations were posted on the Facebook pages of “We are all Khaled Said,” the April 6 Youth Movement, and the Facebook page for Mohamed El-Baradei, a recipient of the Nobel Peace Prize, former diplomat and retired director general of the International Atomic Energy Agency.¹⁹ More than 100,000 Egyptian citizens confirmed their attendance in the forthcoming protest, with approximately 10,000 ultimately gathering in Tahrir Square on the afternoon of January 25.

In addition, on January 18, an Egyptian founder of the April 6 Youth Movement, Aasma Mahfouz, posted a video to Facebook that called for Egyptians to join her in protest on January 25 in Tahrir Square. The message, which received accolades because of Aasma’s willingness to speak directly to the camera and identify herself, went viral and complemented the promotions fostered by the two main Facebook groups.²⁰

Numerous commentators suggest that these Facebook pages, particularly “We are all Khaled Said,” were essential to recruiting a critical mass of participants for the ensuing demonstrations. These pages helped protest planners overcome barriers that had stymied past liberal activists. Olesya Tkacheva and colleagues note:

The site presented a space where Egyptians angry with the regime could “congregate” and interact, while the case for collective action was slowly rolled out in a manner that was accessible and meaningful to a larger segment of Egyptian society. In other words, only through social media were organizers able to make and maintain contact with such a large group of people. Text messages, telephone conversations, and word of mouth all played roles in mobilizing individuals to join the demonstration, but these “tools” could not manage contact among a large group of people for a sustained period of time.²¹

Furthermore, Clark and Kocak observe:

Facebook’s properties—“likes”, “walls” and “friends”—were well suited to these activities. They allowed activists to identify and “friend” potentially sympathetic strangers, chat with them through a private chat portal, and then extend an invitation to “like” a “wall”

¹⁷ Saleh, 2012.

¹⁸ Mohammed M. Aman and Tina J. Jayroe, “ICT, Social Media, and the Arab Transition to Democracy: From Venting to Acting,” *Digest of Middle East Studies*, Vol. 22, No. 2, Fall 2013.

¹⁹ Caroline S. Sheedy, “Social Media for Social Change: A Case Study of Social Media Use in the 2011 Egyptian Revolution,” Capstone Project, Washington, D.C.: American University, 2011.

²⁰ Sheedy, 2011.

²¹ Tkacheva et al., 2012, p. 62.

that could easily be used as a message board for disseminating information about protest logistics. Facebook therefore mitigated the significant challenge that activists everywhere face—of recruiting thousands of followers and sympathizers, and disseminating information to them about the details of planned protest events so that they may act in unison.²²

Additional Supporting Studies

Quantitative studies appear to confirm social media's role in recruitment. First, Tufekci and Wilson surveyed nearly 1,050 Egyptian protesters less than two weeks after the resignation of Mubarak.²³ They found that, controlling for other factors, social media use greatly increased the odds that a respondent attended protests on the first day. In addition, while half of participants heard about the demonstrations through face-to-face communication, one-third of respondents stated that Facebook was their first source of information.²⁴

A Facebook survey conducted in March of 2011 by the Dubai School of Government came to a similar conclusion.²⁵ Albeit from a relatively small sample size (126 respondents from Egypt and 105 from Tunisia), 31 percent of participants reported that they believe Facebook had been used to raise awareness within their countries about ongoing civil movements. However, the authors caution that other factors, such as level of aggrievement, ties to civic associations, and being an unmarried and urbanized male were statistically more important than new media in motivating individuals to take part in the protests.²⁶

One study offers insights into the mechanism by which Facebook helped spread the word on impending protests. Hasan, Yim, and Lucas analyzed the relationship between sentiment of posts to public Facebook “fan” pages during the Egyptian protests and the number or comments attached to each post.²⁷ They found that negative sentiments were associated with more comment participation. They suggest that Facebook can contribute to collective action in two key ways. First, they argue, it is a way to show graphic events that generate negative sentiments. A picture, such as Said’s bloodied corpse, graphically portrays what is happening in a way that a text report cannot. Second, Facebook contributes to the rapid spread of negative sentiment because pictures and posts are available to thousands of individuals almost instantly.

²² Clark and Kocak, 2020, p. 1029.

²³ Zeynep Tufekci and Christopher Wilson. “Social Media and the Decision to Participate in Political Protest: Observations from Tahrir Square,” *Journal of Communication*, Vol. 62, No. 2, April 2012.

²⁴ In addition, half of the survey participants reported that they “produced and disseminated” visual content from the demonstrations, mainly through Facebook (Tufekci and Wilson, 2012).

²⁵ Fadi Salem and Racha Mourtada, “Civil Movements: The Impact of Facebook and Twitter,” *Arab Social Media Report*, Dubai School of Government, Vol. 1, No. 2, May 2011.

²⁶ Robert Brym, Melissa Godbout, Andreas Hoffbauer, Gabe Menard, and Tony Huiquan Zhang, “Social Media in the 2011 Egyptian Uprising,” *British Journal of Sociology*, Vol. 65, No. 2, June 2014.

²⁷ Abrar Al-Hasan, Dobin Yim, and Henry C. Lucas, “A Tale of Two Movements: Egypt During the Arab Spring and Occupy Wall Street,” *IEEE Transactions on Engineering Management*, Vol. 66, No. 1, February 2019.

Recruiting the International Audience

Social media tools that promoted recruitment and engagement in the protests also helped galvanize international support for the protest movement. Wilson and Dunn analyzed tweets that used the “#jan25” hashtag and noted that Twitter was used actively and successfully to engage an international audience of the revolution.²⁸ They particularly note that this discourse was dominated by a relatively small group of what they call “power users” who operated within a larger group of more passive users who offered “expressions of support, shared related content, and retweeted power user content.” They further note that a third of the power users were based in Egypt and that the content and streams from this group, together with the international-based influencers, helped propel “significant transnational discourse and support network.” They also suggest that this seemed to have impacted international coverage, which in turn helped motivate the protest movement even further.

The Egyptians took advantage of other tools to reach beyond their country’s borders. The impact of Al Jazeera’s 24-hour news coverage likely cannot be understated. From January 28 to 31, Al Jazeera’s website experienced a 2,500 percent increase in traffic and experienced 4 million views. Approximately 1.6 million viewers hailed from the United States, with 70 percent of this traffic coming from links posted to Twitter or Facebook.²⁹ Key influencers also played a role. It has been suggested that the Twitter account of Ghonim, the local Google executive who started and moderated the “We are all Khaled Said” Facebook group, helped link the Arabic-speaking social networks with the mostly English-speaking network overseas.³⁰ In addition, Tamer Shaaban, an Egyptian and member of “We are all Khaled Said” Facebook group, posted what became the most-watched YouTube video about the protests on January 27. His video, viewed more than 2 million times, depicted a montage of the first two days of the protests, drawing on footage from Western and local news sources. He was reportedly aiming his message at an English-speaking audience.

Planning and Organization

Social media also appeared to have a role in efforts to plan and organize the protests. Drawing on a review of the literature as well as key informant interviews, Clarke and Kocak offer a detailed description of how the leaders of the April 6 Youth Movement and “We are all Khaled Said” organized and planned for the event.³¹ In particular, these leaders formed a 30-member planning committee that was constituted by leaders of each group. “We are all

²⁸ Christopher Wilson and Alexandra Dunn, “Digital Media in the Egyptian Revolution: Descriptive Analysis from the Tahrir Data Set,” *International Journal of Communication*, Vol. 5, September 2, 2011.

²⁹ Genevieve Barrons, “Suleiman: Mubarak Decided to Step Down #egypt #jan25 OH MY GOD’: Examining the Use of Social Media in the 2011 Egyptian Revolution,” *Contemporary Arab Affairs*, Vol. 5, No. 1, January–March 2012.

³⁰ Peter J. Schraeder and Hamadi Redissi, “The Upheavals in Egypt and Tunisia: Ben Ali’s Fall,” *Journal of Democracy*, Vol. 22, No. 3, July 2011.

³¹ Clark and Kocak, 2020.

Khaled Said” administrators used Facebook and Google Chat to maintain their anonymity. They created subcommittees for planning activities, such as collaborating with other organizations, developing slogans, and picking protest locations. Ultimately, leaders determined that protests would begin at 2:00 p.m. at four locations around Cairo and in six cities where activists believed they had a strong presence. They also planned to begin “secret protests” two hours ahead of the planned start time to build momentum before the formal kick off. They further set up a control room at a local nongovernmental organization office to enable leaders to answer phone calls from prospective demonstrators and post updates to Twitter and Facebook.³² In addition, it has been reported that participants in both Facebook groups actively debated on which hashtags they would use to promote the impending protests. They agreed on #egypt and #jan25.³³

At 2:53 p.m. on January 24, the activists published specific protest plans on a Facebook event page titled “Details for January 25 Protest.” The page offered an introduction to the activists and reasons for protest, the locations of the protests, general principles for how to protest and remain safe during the event, and information on various chants and slogans to be used during the protests. It also offered phone numbers for lawyers and contacts in each city.³⁴

Social media also helped organizers limit the security risks attendant in planning the protests. Administrators, for example, used Facebook and Twitter to deceive state security about meeting locations. As more Egyptians accepted invitations to attend the protest, the administrators assumed that state security officials were monitoring Facebook for plan details. To counter this threat, organizers used protected communication channels to contact select participants and changed arrangements for planned gathering locations. The use of the secret locations allowed the first groups of demonstrators to circumvent state security and enter Tahrir Square from unexpected directions. Tkacheva argues that such tactics were critical to a successful protest:

These diversion tactics significantly reduced the perceived risks of demonstrating. During past political protests, cordons of security personnel scared Egyptians from supporting activists. On January 25, the absence of security forces at many of the starting points encouraged observers to set their fears aside and get caught up in the excitement. By the time they marched closer to Tahrir Square and encountered the police, they were already part of—and likely invested in—their group.³⁵

³² Clark and Kocak, 2020.

³³ Barrons, 2012.

³⁴ Clark and Kocak, 2020.

³⁵ Tkacheva et al., 2013, p. 63.

Live Updating

Clarke and Kocak argue that social media, particularly Twitter, played a critical role in offering status updates of the protests. They argue, for example, that various properties of Twitter—including instantaneous updating, the ability to forward posts via retweeting, and the use of hashtags—were critical to disseminating real-time information about the timing and location of protests, location of security forces, and the direction of marchers.³⁶ They argue that Twitter contributed to a “seemingly leaderless coordination of protester movements.” They continue, “Although the activists who planned the protests had put in place a general framework for the day—the start time, where protesters should meet and the types of slogans that would be used—after the demonstrations began, they evolved organically, without the guidance of activist leaders or organizations.”

Clarke and Kocak offer a number of examples from interviews conducted as part of their study.³⁷ They describe one activist who missed the start of protests and used Twitter to learn of particularly strong protests in the Bulaq neighborhood and so joined them. They describe another activist who used Twitter to learn of violent reactions from security services to protests in peripheral cities such as Suez. They also note that live updating helped different groups of marchers around Cairo converge on Tahrir Square at the end of the day, which was not part of the original protest plan.

To gain a more systematic perspective on Twitter’s role, Clark and Kocak analyzed tweets and retweets from Egypt-based users associated with the #jan25 hashtag from January 14 to March 16. They coded the tweets according to the different categories of opinions and slogans, coordination, news and updates, referrals, documentation and other. They found that while opinions, slogans, and coordination were dominant topics in the run-up to the protests on January 25, there was also a significant uptick in the number of news and update tweets, with three out of five tweets focusing on this content. From January 26 to 28, the rate of tweets focusing on news and updates remained high, comprising two out of five tweets. They conclude that Twitter was used on first day of protests to disseminate live information about the protests.

Live updating may have also served to facilitate protester motivation. Kharroub and Bas analyzed Twitter and Facebook images disseminated during the protests and found that the disseminated images contained more pictures of what they call efficacy-eliciting content.³⁸ This includes images of crowds, protest activities, and national and religious symbols. Lower in the count were emotionally arousing content, such as violent images. The researchers took this to suggest that users in Egypt may have been intentionally posting more efficacy-eliciting

³⁶ Clark and Kocak, 2020.

³⁷ Clark and Kocak, 2020.

³⁸ Tamara Kharroub and Ozen Bas, “Social Media and Protests: An Examination of Twitter Images of the 2011 Egyptian Revolution,” *New Media & Society*, Vol. 18, No. 9, October 1, 2016.

content to encourage others to join the protests and less violent content that might have discouraged it.

Finally, one question that has been raised is how Twitter could have been used to live-update and promote the protests given what was a very low penetration rate in Egypt (estimated at 0.015 percent). Kavanaugh and colleagues used both surveys and analysis of Twitter data to address this question.³⁹ Their survey of Egyptian college students revealed that the small collective that used Twitter had the consistent communication behavior of opinion leaders. They then analyzed Twitter data and confirmed the heavy participation of elites on the network. They suggest that these influential Twitter users may have helped multiply the impact of Twitter content by spreading information further via family and other offline networks.

Egyptian Government Response

The Egyptian government used a mix of concessions and repression to quell the growing protest movement. Mubarak appointed a new vice president, the chief of Egypt's intelligence service, Omar Suleiman, and ceded some powers to him.⁴⁰ He also confirmed that he would not seek reelection and instead designated his son to be his successor. His allies also engaged in talks with the protest movement. Use of repressive tactics was widespread. Police routinely assaulted protesters. On February 2, Mubarak supporters, on camel and horseback, rode through the protest ranks and attacked protesters. Mubarak also increased the military presence, though the military ultimately refused to fire on protesters.⁴¹

To counter the ability of protesters to plan and coordinate on social media, on January 28, three days after the January 25 "Day of Rage," Mubarak shuttered the country's internet and cellular service for five days.⁴² Some protesters had anticipated the move and set up backup satellite phones and dial-up connections to Israel and Europe and were thus able to maintain social links with the rest of the world.⁴³ In addition, immediately after the shutdown, Google teamed up with Twitter and launched a service that allowed Egyptians to tweet via voice-

³⁹ Kavanaugh et al., 2013.

⁴⁰ Huma Khan, Alexander Marquardt, and Kirit Radia, "Egypt's Hosni Mubarak Names Vice President, Chaos Descends in Cairo," *ABC News*, January 29, 2011.

⁴¹ Martin Asser, "Q&A: Egyptian Protests Against Hosni Mubarak," *BBC News*, February 11, 2011.

⁴² Egyptian security services also arrested Wael Ghonim, the Google Executive and moderator of "We are all Khaled Said" Facebook group on January 27, and he was held for 12 days.

⁴³ Schraeder and Redissi, 2011.

mail.⁴⁴ It has been reported that in the following 24 hours, the service racked up 8,660 followers, who posted nearly 900 tweets.⁴⁵

However, at this point the damage may have been done. Online protest movements in Egypt that were already well underway by the start of the Arab Spring were well positioned to seize on the success of protests in Tunisia and kickstart the first phase of protests.⁴⁶ In fact, the blackout may have only increased public resistance to the Mubarak regime and spurred participation in protests. It may have also had the effect of limiting the state's ability to communicate threats to protesters.

Assessment of the Role of Social Media in the Egyptian Arab Spring Uprising

Figure 2.1 presents a notional model or factor tree that attempts to explain how the factors cited in this review interacted with one another to help contribute to the significance and success of the Egyptian uprising. This type of influence diagram comes from previous work by Davis and Cragin.⁴⁷ As they observe, the goal of an influence diagram is to include “all potentially relevant factors” that in this case contribute to the outcome of a successful Arab Spring protest in Egypt. They further highlight a distinction between root-cause factors that are permissive and those that are precipitant. The permissive root-cause factors, which are highlighted by solid-line boxes in the figure, set the stage, whereas precipitant factors, shown without boxes in the figure, serve as the key “trigger” that leads to the model’s outcome.

The primary precipitant factors in the group, highlighted in red text, are international support, recruitment, event organization, and organic updates. Both Twitter and Al Jazeera’s satellite and web broadcasts contributed to international support by helping to publicize the

⁴⁴ Ujjwal Singh, “Some Weekend Work That Will (Hopefully) Enable More Egyptians to Be Heard,” *Official Google Blog*, January 31, 2011.

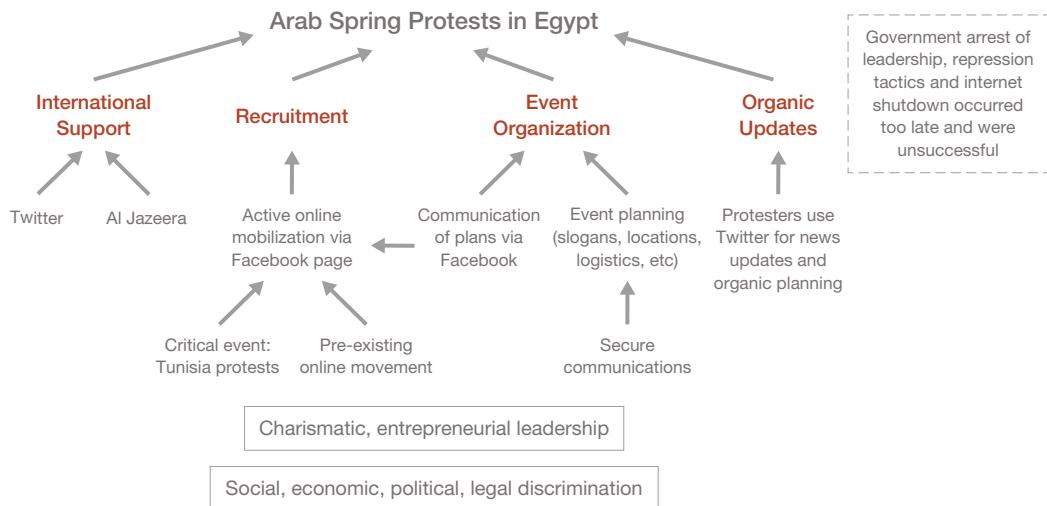
⁴⁵ Essam A. H. Mansour, “The Role of Social Networking Sites (SNSs) in the January 25th Revolution in Egypt,” *Library Review*, Vol. 61, No. 2, 2012.

⁴⁶ Sheedy, 2011; Van Niekerk, Pillay, and Maharaj, 2011. Sheedy, for example argues that the internet blackout occurred to late and that the protesters were already well organized by the time the internet was shut down Sheedy, “Social Media for Social Change.” And as Van Niekerk and colleagues note: “Once the uprisings had gained momentum, the need for social media involvement was reduced. This suggests that the reacting actor is at a disadvantage while the initiating actor has the opportunity to shape the perspectives of the target audience,” see Brett van Niekerk, Kiru Kiru Pillay, and Manoj Maharaj, “Analyzing the Role of ICTs in the Tunisian and Egyptian Unrest from an Information Warfare Perspective,” *International Journal of Communication*, Vol. 5, September 2, 2011, p. 1412.

⁴⁷ Paul K. Davis, *Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation*, Santa Monica, Calif.: RAND Corporation, MR-1513-OSD, 2002; Paul K. Davis and Kim Cragin, eds., *Social Science for Counterterrorism: Putting the Pieces Together*, Santa Monica, Calif.: RAND Corporation, MG-849-OSD, 2009.

FIGURE 2.1

Influence Diagram: How Social Media Contributed to the Success of the Egyptian Arab Spring Protests



NOTES: Unboxed text indicates a precipitant root cause factor, and red text indicates a primary precipitant root cause factor. The two solid-line boxes at the bottom of the figure indicate permissive root cause factors, and the broken-line box at the upper right indicates the failed government responses to the protest.

Egyptian protests to the rest of the world, who in turn offered both sympathy and support to the protest movement.

Recruitment was in turn significantly influenced by the active online mobilization engendered by Facebook. “We are all Said” and the April 6 Youth Movement served as preexisting online networks that were quickly mobilized following the successful protests in Tunisia. These networks helped to recruit new members, and the sharing of content among network members likely helped to solidify and enhance the motivation of network members to participate in the protests.

Those same networks also facilitated the organization and planning of the protests, particularly the January 25 Day of Rage event. Leaders, together with network members, helped to create event slogans, identify hashtags, plot protest locations, and address other key logistical tasks. Once those plans were created, they were quickly disseminated via Facebook to thousands, who in turn pledged their support to attend the protests.

Organic updates also played a role. Twitter helped to disseminate key logistics information, such as changes in protest locations and the locations of regime forces. It is further likely that such information was available to non-Twitter users, as influential Twitter users likely spread Twitter content through word-of-mouth networks.

Finally, all of this was made possible by the permissive root-cause factors of charismatic and entrepreneurial leadership as well as social, economic, political, and legal discrimination inherent to the Mubarak regime. Wael Ghonim, the Google Executive and moderator

of “We are all Khaled Said” Facebook group, played an instrumental role in seizing upon the killing of Khaled Said to mobilize thousands in opposition to the regime. Likewise, the Egyptian protests were built in part on networks of the failed April 6 Movement. Leaders of both Facebook groups and others, then systematically worked to foment continued unrest against the government and plot the intricacies of the January 25 protest march. And the social, economic, political, and legal discrimination that most Egyptians had experienced for many previous years provided the tinder for unrest that was ultimately lit by the success of the Tunisian protesters.

The top-right corner of Figure 2.1 shows a broken line text box that notes the inability of the Egyptian government to stop the protest movement. The government sought to shut down access to the internet, engaged in repressive tactics, and arrested key protest movement leaders, but these actions ultimately failed to quell the protest movement.

CHAPTER THREE

Case Study: Syria and the Arab Spring Protests

The Syrian civil uprising of 2011 presents a case of organized protests against one of the most authoritarian regimes in the world. The protests did not achieve their goals, and eventually turned into civil war, during which hundreds of thousands of people died and millions fled the country. The purpose of this case is to illuminate factors that contributed to the failure of the civil protests. In particular, we discuss the use of ICTs by an authoritarian regime to its benefit.

For these case studies, we conducted a systematic search for literature in a host of academic and policy-related databases.¹ For each database, we conducted a title, abstract, and keyword search using the following search query [(*Arab Spring* and *protest*) and (*Egypt* or *Syria*)]. This query resulted in a total of 722 papers. We then reviewed the titles and abstracts and selected a subset of papers that appeared most pertinent to this report. In particular, we looked for reports that offered original scholarship and employed rigorous research methods. We then supplemented this list with additional and targeted literature searches.²

In this chapter, we first detail the state of “pre-protest Syria,” then we detail the use of technology by the protest movement, and finally we consider the response of the Syrian regime and its use of technology. We conclude the chapter by detailing an influence diagram that summarizes the technology factors that contributed to the failed uprising. This diagram specifically highlights that limited baseline access to the internet and social media, Syrian government efforts to further curtail technology access, and efforts to discredit the protest movement played key roles in suppressing Syrian protesters. The search and analytical strategy that underlies this chapter is reviewed in the introduction to Chapter Two.

¹ The databases we searched included Academic Search Complete, ACM Digital Library (captures tech/social media), Business Source Complete (prelim results captured some legal/social media articles, but most were eliminated in duplication removal), IEEE (tech/social media), Military Database, PAIS Index, Policy-File (search results from last week), PSYCHINFO, SCOPUS, Social Sciences Index, Sociological Abstracts, and Web of Science.

² For example, we conducted additional targeted searches to identify opinion poll surveys in the region.

Pre-Protest Syria

According to Freedom House, Syria is, and historically has been, one of the least free countries in the world.³ Autocratic one-party rule was established in 1963. Hafez al-Assad took power over the Ba'ath Party in 1970 and transformed the country into a one-party state with a strong presidency and government function distributed along sectarian divisions—the Alawites (religious minority, to which the Assad family belongs) led the military, intelligence, and security forces, while the Sunnis (the religious majority) took over the political institutions.⁴ Hafez al-Assad ruled until his death in 2000 and was succeeded by his son, Bashar al-Assad, who had prepared for that role for six years, since his older brother and natural successor to their father, Bassel, died in a car accident in 1994. Bashar was a London-educated ophthalmologist, known for his fascination with information technologies. When he took over the country, there was a widespread expectation that he would liberalize it, following his Western experience.⁵ And indeed, in the initial period of his presidency, some political prisoners were released, and exiled dissidents could return to the country. As the president of the Syrian Computer Society, Bashar al-Assad helped to bring the internet to Syria. However, this liberal course was reversed soon after.

At the outbreak of the Arab Spring in Tunisia and Egypt, Syria continued repression against government opponents, including arrests of representatives of Islamic groups, Kurds, journalists, and intellectuals. The arrests were often attributed to these individuals publishing news “that may weaken national sentiment” or undermine “national unity.” Discussing the political and economic situation in groups larger than four people was forbidden. Defamation of the president and other officials was a criminal offense. Enforcement of these repressive rules solidified fear and self-censorship among the Syrian population.

Protests

Encouraged by the success of protests in Tunisia and Egypt, Syrian opposition started to call for protests on Facebook and Twitter in early February—February 3 and 4 were announced as Syria's “Days of Rage.” However, these first attempts were unsuccessful, and Syria was believed to be the least likely country in the region to revolt.⁶ Nevertheless, in March protests spread throughout the country after security forces in Daraa arrested 15 youths for

³ Freedom House, *Freedom in the World 2012: The Arab Uprisings and Their Global Repercussions*, Washington, D.C.: Freedom House, 2012a, p. 5.

⁴ Steven Heydemann, “Pity the Nation: Assessing a Half-Century of Assadist Rule,” *Brookings* (blog), Brookings Institution, December 14, 2020.

⁵ David W. Lesch, *The New Lion of Damascus: Bashar al-Asad and Modern Syria*, New Haven, Conn.: Yale University Press, 2005.

⁶ Cajsa Wikstrom, “Syria: ‘A Kingdom of Silence,’” *Al Jazeera*, February 9, 2011.

anti-regime graffiti. While their families protested locally, political opposition organized demonstrations in Damascus, Aleppo, and Hama, among others. Soon a pattern of protest developed: People gathered for Friday prayers continued to the streets with anti-regime slogans, then security forces excessive use of force led to the death of protesters, whose funerals turned into anti-regime demonstrations again. Initially, the protesters demanded democratic reforms, the release of political prisoners, the abolition of the emergency law, and the end to corruption. Over time, however, as security forces used more violence, including against minors, the demands shifted toward government change. That led to even more resolve on the regime's side, including the use of the military against civilians. This spiral of violence caused a series of defections in the army, which laid the ground for the creation of insurgent Free Syrian Army in July 2011, marking the transition of the civil uprising into an armed insurgency. By that time, more than 1,900 civilians had been killed and thousands detained by the regime forces.⁷

Use of Social Media and Information Technologies by the Protesters

As mentioned above, the first social media calls for protests were unsuccessful, which at the time was attributed mostly to fear of repression.⁸ While it might have been indeed the decisive factor, it's also worth noting that at the wake of the Arab Spring social media use in Syria was very low, relative to other countries of the region. According to Salem and Mourtada, Facebook penetration at the beginning of April 2011, after the protests started, was 1.55 percent and Twitter penetration was 0.17 percent,⁹ which stemmed from the government's four-year block on Facebook, Twitter, and YouTube, as well as from generally limited access to fast internet connections (see Table 3.1). According to International Telecommunication Union data, by the end of 2010, about 20 percent of the Syrian population used the internet, but less than 1 percent had a fixed-broadband subscription, which is needed to view multimedia content.¹⁰ Despite the widespread use of mobile phones, access to the 3G network was even less prevalent than broadband subscriptions.¹¹ Consequently, most internet users connected via a dial-up connection, where the speed of data transfer is restricted to 256 Kbps.¹²

⁷ Human Rights Council, *Report of the United Nations High Commissioner for Human Rights on the Situation of Human Rights in the Syrian Arab Republic (A/HRC/18/53)*, New York: United Nations General Assembly, September 15, 2011.

⁸ Wikstrom, 2011.

⁹ Salem and Mourtada, 2011.

¹⁰ United Nations, International Telecommunication Union, website, undated.

¹¹ Freedom House, "Freedom on the Net 2012—Syria," Refworld, website, September 25, 2012b.

¹² Freedom House, 2012b.

TABLE 3.1
Infrastructure Constraints

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Population (millions)	21.4	21.1	20.4	19.6	18.7	18.0	17.5	17.1	16.9
Internet penetration (%)	20.70	22.50	24.30	26.20	28.09	29.98	31.87	34.25	
Fixed-broadband subscriptions per 100 inhabitants	0.33	0.58	1.18	1.77	2.68	4.05	5.78	8.32	7.84
Fixed-telephone subscriptions per 100 inhabitants	19.05	20.34	20.81	22.62	19.40	19.67	19.84	15.95	16.17
Mobile phone subscriptions per 100 inhabitants	54.75	61.27	63.51	62.78	75.04	79.52	76.44	90.00	98.37

SOURCE: United Nations, International Telecommunication Union, website, undated.

In contrast to governments of other countries of the region, the Syrian regime lifted the ban on social media in the wake of the Arab Spring, on February 8, 2011. As Harkin asserts, this decision was motivated not by a readiness to make any concessions to the opposition, but rather by the desire to monitor the moods of the population through internet surveillance.¹³ Even before lifting the ban, in January 2011, Fidaaldin Al-Sayed Issa, a Syrian activist living in Sweden, established a Facebook page supporting anti-regime protests called “Syrian Revolution 2011,” which was used to call for demonstrations, especially in bigger cities, such as Damascus and Aleppo.¹⁴ By February 2011, the page had 16,000 followers, and by May 2011 more than 170,000; however, as the founder of the page estimated, only 35 percent of followers resided in Syria at the time. On that note, researchers recognize that a big part of organizing, planning, and recruitment was conducted offline. Tkacheva et al. note:

Put in terms of Western social science, mosques and funeral processions are natural “focal points” for dissent in Syria. For Syrians seeking to join demonstrations, the focal point is even more obvious—the mosque after Friday afternoon prayers. While some action is coordinated online, ordinary Syrians do not need Facebook to know how to join an uprising.¹⁵

¹³ Juliette Harkin, “Is It Possible to Understand the Syrian Revolution Through the Prism of Social Media?” *Westminster Papers in Communication and Culture*, Vol. 9, No. 2, June 13, 2017.

¹⁴ Adam Almkvist, Syrian Revolution 2011 Facebook Page Administrator, Fidaaldin Al-Sayed Issa, Interviewed by Adam Almkvist, “Syria Comment,” May 11, 2011. Al-Saleh, Asaad, *Dissecting an Evolving Conflict*, Loren White, ed., Clinton Township, Mich.: Institute for Social Policy and Understanding and the New America Foundation, June 2013.

¹⁵ Tkacheva et al., 2013, p. 80.

Over time, Syrians established a three-level coordination and planning structure: at the village and neighborhood level, Local Coordinating Councils; at the city and district level, Revolutionary Councils; and, eventually, at the national level, the Syrian Revolution General Commission.¹⁶ Online communication played a supporting role in their activities.

Social media was, however, extensively used for disseminating information—both inside and outside the country—about the repressions and government’s crackdown. Widespread use of mobile phones allowed “citizen journalists” to document protests and regime brutality in the form of short videos shot with their phone cameras. Importantly, these eyewitness accounts spread from websites such as Bambuser and YouTube to international TV outlets.¹⁷ This way, protesters were able to reach foreign audiences with their narrative, and to build cohesion and solidarity among protesters in different regions of the country. In that sense, social media, in particular YouTube and Facebook pages devoted to protests in general and cases of extreme atrocities in particular, helped to recruit protesters and maintain their support for the cause.

Use of Social Media and Information Technologies by the Syrian Regime

The Syrian government has a long history of restricting free access to the internet and using information technologies for surveillance purposes. During the Syrian uprising of 2011, the regime used multiple tools to limit the flow of information, track and target opposition activists, and, promote its own narrative about the events.

On the infrastructural level, the Syrian Telecommunication Establishment (STE) played the leading role. The STE is a government body under the Ministry of Communications and Technology in charge of the entire fixed-line telecommunications infrastructure, as well as an internet service provider and a regulator of telecommunications.¹⁸ Additionally, one of Syria’s two main mobile phone services providers, Syriatel, is owned by Rami Makhlouf, a cousin of Bashar al-Assad. In 2011, Syria had 14 internet service providers, but all of them, as well as all mobile phone internet providers, connected via gateways controlled by another government body—the Syrian Information Organization (SIO)—and operated under a license from the Ministry of Communications and Technology and approval from the security services. Finally, a popular remedy in Syria for poor infrastructure and weak internet connection at homes—cybercafes—are also potentially a tool of control. Their owners are vetted by the

¹⁶ Asaad Al-Saleh and Loren White (developmental editor), *Dissecting an Evolving Conflict: The Syrian Uprising and the Future of the Country*, Institute for Social Policy and Understanding and the New America Foundation, June 2013.

¹⁷ Tkacheva et al., 2013.

¹⁸ OpenNet Initiative, *Internet Filtering in Syria*, Cambridge, Mass., 2009.

Ministry of Interior¹⁹ and required to monitor activities of their clients as well as to record their names, identification cards, and the times they use cybercafes.²⁰

This infrastructure monopoly was heavily utilized during 2011 protests. As Freedom House (2012) notes:

Since early 2011, the Syrian government has repeatedly used its centralized control over the internet infrastructure to obstruct connectivity, at times shutting down the internet and mobile phone networks entirely (either nationwide or at particularly sites of unrest). A nationwide shut down was imposed in June 2011 and lasted one day. . . . According to activists, every time pro-regime forces begin to besiege a city, the broadband bandwidth is simultaneously reduced to a crawl and 3G services are shut off. . . . The government's deliberate use of such measures was evident from a leaked document issued by the General Head of the National Security Office in May 2011 explicitly ordering that "the internet is to be completely disconnected in Daraa, Homs, and the eastern provinces starting on Wednesday at 14:00." It was widely believed that such steps aimed at preventing citizen journalists from charging communication devices or transmitting updates to the outside world.²¹

On the software level, the regime has also been heavily invested in content censorship and monitoring. Even before the protests of 2011, it was a well-known fact that the government was using ThunderCache software for filtering websites by keywords. Allegedly, the software allows "monitoring and controlling a user's dynamic web-based activities as well as conducting deep packet inspection."²² Bigger scrutiny over Syrian surveillance practices during the civil uprising revealed information about other systems used by the regime:

- In 2008, Syriatel bought a filtering system from Ireland-based company Cellusys. The system was delivered with a purpose to deal with viruses and spam. However, according to documents obtained by Bloomberg, between November 2010 and December 2011 the system was used to block text messages with political content, such as the terms *revolution* or *demonstration*.²³
- Between October 2010 and May 2011, the Syrian government illegally purchased surveillance systems produced by U.S. firm Blue Coat Systems Inc. Hardware, and this software was sold to a Dubai-based distributor, which reported shipping the products to Iraq and Afghanistan. These systems allowed STE to "monitor the Web activities of individual internet users and prevent users from navigating around censorship"

¹⁹ Freedom House, 2012b.

²⁰ OpenNet Initiative, 2009.

²¹ Freedom House, 2012b.

²² OpenNet Initiative, 2009.

²³ Ben Elgin and Vernon Silver, and Vernon Silver, "Syria Bars Protesters' Text Messages with Dublin-Made Equipment," Bloomberg, February 15, 2012.

controls.”²⁴ According to “hacktivist” group Telecomix, based on the logs from Blue Coat devices, the regime was blocking websites in multiple categories, including advertising, social networking, software/technologies, video sharing, chat, forums/message boards, and instant messaging.²⁵ The *Wall Street Journal* reported that the first Blue Coat devices were used in Syria as early as 2005.²⁶

- According to Bloomberg reporting, in 2009 the Syrian government signed a contract with Italian company Area SpA for a delivery of a system that would allow the regime “to intercept, scan and catalog virtually every e-mail that flows through the country” and “to follow targets on flat-screen workstations that display communications and Web use in near-real time alongside graphics that map citizens’ networks of electronic contacts.”²⁷ According to the documents obtained by Bloomberg, the project included deep-packet inspection probes to scan Syria’s communications network, hardware and software for archiving emails, and a system connecting monitored telecom lines to Area SpA’s computer center. The system was being installed already during the government crackdown. When the uprising occurred, Area SpA was in the final stages of installation; afterward, it was unclear whether the system eventually became operational or the company pulled out of the deal.²⁸
- A few months after the February uprising, in the insurgency phase, Syrian activists reported phishing campaigns and malware attacks, which were believed at the time to be conducted by the Syrian government. Darkcomet RAT Trojan and Xtreme RAT have been found on activists’ computers. This malware allows to take screenshots, capture webcam activity, record keystrokes, steal passwords, and disable some antivirus notification.²⁹

Consequently, at the wake of the Arab Spring, the regime was blocking more than 160 websites with content related to political issues, ethnic and religious groups, and human rights groups. After the beginning of the civil uprising, the Syrian government intensified surveillance efforts, including “the extensive and unprecedented blocking of circumvention tools, internet security software, and applications that enable anonymous communications.”³⁰

²⁴ Steve Stecklow, “UPDATE 1-Dubai Firm Fined \$2.8 Million for Shipping Blue Coat Monitoring Gear to Syria,” Reuters, April 25, 2013.

²⁵ Arturo Filasto, “Syria Censorship – Bluecoat Log Analysis,” graphic, undated.

²⁶ Jennifer Valentino-DeVries, Paul Sonne, and Nour Malas, “U.S. Firm Acknowledges Syria Used Its Gear-to Block Web,” *Wall Street Journal*, October 29, 2011.

²⁷ Ben Elgin and Vernon Silver, “Syria Crackdown Gets Italy Firm’s Aid with U.S.-Europe Spy Gear,” Bloomberg, November 3, 2011.

²⁸ Freedom House, 2012b.

²⁹ Eva Galperin and Morgan Marquis-Boire, “How to Find and Protect Yourself Against the Pro-Syrian-Government Malware on Your Computer,” Electronic Frontier Foundation, March 5, 2012.

³⁰ Freedom House, 2012b.

Freedom House reported in 2012 that after the outbreak of protests, security services detained, often without trial, hundreds of internet users, “including several well-known bloggers and citizen journalists,” many of whom suffered torture and some subsequently died. There were instances when security forces were able to track the locations of activists based on the signal from their satellite phones.³¹ As one activist recalls:

I noticed that those prisoners who had taken photos and videos and sent them to the TV stations were treated harshly and tortured more than others.

The Syrian regime targeted people who photographed the protests and killed them; we saw so many videos in which the cameraman was killed or injured while shooting. One of them was the martyr Ahmad, who was shooting the tanks shelling the houses in Rastan, Homs, and who we saw dying while covering with his final words the crimes of the Syrian regime against the Syrian population. He was shot by soldiers from within a tank.³²

The regime’s efforts to promote its own narrative were twofold: producing their own content and discrediting protesters reporting. These activities were often conducted by proxies, and consequently not easily attributable to the regime. However, the alignment of goals and the scale of resources needed for continued activities led to a widespread belief that they were at least strongly supported by the government.

With regard to producing pro-regime content, the most active role was played by the Syrian Electronic Army (SEA), a pro-government hacktivist group established in April 2011 praised by Bashar al-Assad. SEA engaged in distributed denial-of-service (DDoS) attacks and spamming the Facebook pages of celebrities (including President Barack Obama) with pro-regime comments and phishing campaigns. Additionally,

The SEA’s key activities include hacking and defacing Syrian opposition websites and Facebook accounts, as well as targeting Western or other news websites perceived as hostile to the regime. . . . In other instances, the SEA has endangered anti-government activists by making public their phone numbers and addresses.³³

The attempts to discredit opposition activists included creating fake social media accounts and sharing content that “combined plausible criticism of the Assad regime with comments seeming to incite sectarian hatred or ask for Israeli intervention.”³⁴ As Ghrer (2013) recalls,

the activists faced suspicions regarding the photos they posted of protests, and the eyewitness testimonies of the events, because there was no way to validate those photos by a spe-

³¹ Freedom House, 2012b.

³² Hussein Ghrer, “Social Media and the Syrian Revolution,” *Westminster Papers in Communication and Culture*, Vol. 9, No. 2, June 13, 2017.

³³ Freedom House, 2012b.

³⁴ Freedom House, 2012b.

cial independent media body, since the regime deliberately broadcast fabricated videos, uploaded them and sent them to news stations, then revealed their falsehood in order to accuse the activists of lies and fraud. But this did not deter activists who continued uploading a huge amount of videos, which helped convey a much clearer picture of the reality in Syria.

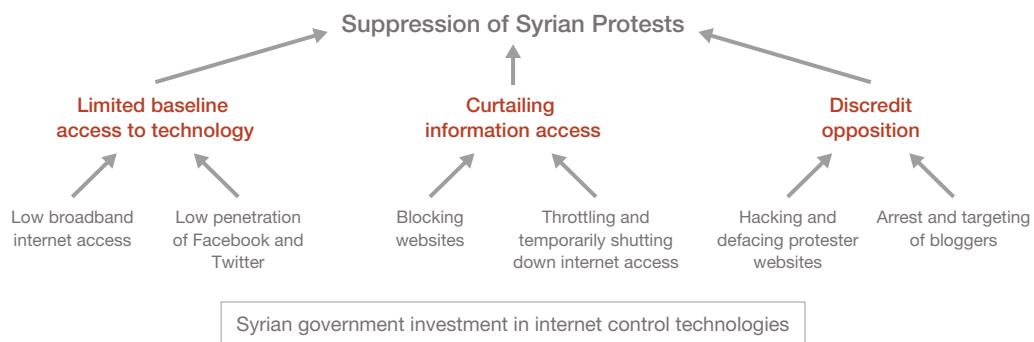
The constant doubt regarding photos of protests forced Syrians to develop their own tools to prove the credibility of what they broadcast by holding signs that specified the date and place, in addition to taking photos of obvious locations to conclusively show the sites of protest. They also used local newspapers for the first time in Banias in late April, when one of the activists started the video with a shot of a local newspaper to show the protest's date, so that the regime's media couldn't claim that the activists repeated broadcasts of the same protests on different days.³⁵

Assessment of the Role of Social Media in the Syrian Arab Spring Protests

Figure 3.1 presents a notional model or factor tree that attempts to explain the outcomes of the Syrian Arab Spring protests. The protests were obviously not successful in achieving the democratic aims of the protesters, and the country's ensuing civil war led to an unmitigated humanitarian disaster. Thus, the model highlights some of the key factors that may have contributed to the protest movement's failure.

The primary precipitant factors, indicated in red text, are limited baseline access to technology, curtailed information access, and discredited opposition. More than most countries

FIGURE 3.1
Influence Diagram of the Role of Technology in Suppressing Syrian Protests



NOTES: Unboxed text indicates a precipitant root cause factor, and red text indicates a primary precipitant root cause factor. A permissive root cause factors is highlighted in boxed text.

³⁵ Ghrer, 2017.

that partook in the Arab spring protests, Syria suffered from low baseline access to the internet and social media. Less than 2 percent of the population had access to Facebook or Twitter, only 20 percent had access to the internet, and only 1 percent had sufficient broadband access to view multimedia content.

The Syrian government undertook steps to further limit access to technology. It attempted to throttle down and at times shut off internet access, and it benefited from investment in censorship technologies to block websites that could further fuel the protest movement.

Finally, the regime sought to discredit and intimidate the opposition. The government not only engaged in mass arrests of protesters, it especially targeted bloggers and potentially other influencers with arrest. It also sought to hack and deface some protester web content.

Case Study: 2019 Hong Kong Protests

On April 3, 2019, the government of Hong Kong introduced the Fugitive Offenders amendment bill, which would have allowed the extradition of its citizens to China.¹ Later that month, fearing that Hong Kong residents would be subjected to China's criminal justice system and concerned about the infringement on Hong Kong's autonomy, tens of thousands protested the proposed amendment by marching at Hong Kong's Legislative Council.² The protest movement would soon prove an all-consuming feature of Hong Kong's landscape.

The government responded with offers of concessions over the next several months. On June 15, the extradition bill was delayed; on July 9, Hong Kong's leader, Carrie Lam, announced that it was "dead" and a "total failure" and then on September 4 announced that it would be withdrawn. At each step, however, the protest movement did not trust the announcements of the government and feared that the amendment would be reintroduced.

The sustained protest against the government that started in response to the proposed bill was marked by increasingly direct and at times violent confrontations between protesters and police. The Hong Kong police deployed an array of crowd control measures, including tear gas, pepper spray, rubber bullets, sponge grenades, and bean bag rounds, and protesters responded by engaging in running street battles with police, throwing petrol bombs, and performing various acts of vandalism.³ Examples of violent encounters include the stabbing of a pro-Beijing lawmaker, the shooting of a protester by police, and the barricading of the Hong Kong Polytechnic University campus by protesters.⁴

Throughout this time, the Hong Kong protest movement made heavy use of social media and other online communication channels, even using such tools to coordinate the timing and location of protests. The Hong Kong police were at the forefront of the government's response, rallying riot police and attempting to apprehend perceived law-breakers. However, China played an outsized roll in countering the protest movement with a major international

¹ U.S.-China Economic and Security Review Commission, *2020 Annual Report to Congress of the U.S.-China Economic and Security Review Commission*, Washington, D.C.: U.S. Government Publishing Office, 2020.

² "Timeline: Key Dates in Hong Kong's Anti-Government Protests," Reuters, May 30, 2020.

³ "Weapons of Mass Control, Tactics of Mass Resistance," Reuters, October 31, 2019.

⁴ "Timeline: Key Dates in Hong Kong's Anti-Government Protests," May 30, 2020; "The Hong Kong Protests Explained in 100 and 500 Words," *BBC News*, November 28, 2019.

propaganda campaign, small scale cyber attacks, and, ultimately, the creation of a major national security law.

To conduct this review, we conducted a systematic search for literature in a host of academic and policy related databases.⁵ For each database, we conducted a title, abstract, and keyword search using the following search query [(*Hong Kong* and *protest*) and (*social media* OR *facebook* OR *twitter* OR *influence* OR *censorship* OR *cyber** OR *hack** OR *disinformation* OR *encrypt** OR *propaganda*)].⁶ This query resulted in just over 700 reports, the vast majority of which were news articles.⁷

Note that the timing of this search and the drafting of this chapter likely affected the overall analysis. The original literature search was conducted for the dates of April 1, 2019, to January 13, 2020. In July 2020, we conducted an additional search to capture articles published since January. The protests reached a fever pitch in early 2020, and then China passed its National Security Law in June 2020. This law and many repressive actions that followed, along with the rise of the COVID-19 pandemic, had a deleterious effect on the protest movement. The impact of the national security law and the pandemic are detailed in an addendum at the conclusion of this chapter.

This chapter offers a direct comparison of protester use of technology and the Chinese (and to a lesser extent Hong Kong government) response. We conclude the chapter by detailing an influence diagram that summarizes the ways in which social media contributed to the protest movement. This diagram specifically highlights the role of social media in fomenting protester motivation, supporting event organization, and promoting international support.

Protesters

Protesters relied on social media and other technology platforms to aid in event organization, communications, the promotion of international support and protester safety.

Event Organization

By several accounts, the Hong Kong protest movement functioned as a form of leaderless resistance. It was noted that during the 2014 Umbrella protests the populace followed the direction emanating from the “main stage”—a term that referred to students and pro-democracy

⁵ The databases we searched included U.S. Major Dailies, Military database, Policy File, Sociological Abstracts, Christian Science Monitor, Nexis (news search), SCOPUS, Web of Science, Business Source Complete, Academic Search Complete, Newspaper Source, MAS Ultra, and Social Science Abstracts.

⁶ The original literature search was conducted for the dates of April 1, 2019, to January 13, 2020. In July 2020, we conducted an additional search to capture articles published since January.

⁷ This is a reflection of the recency of such protests and that there has been limited time for more scholarly analyses to make press.

groups that helped coordinate the protests.⁸ The “main stage,” however, played a much less defining role in the new protest movement.⁹ Instead, protesters began to crowdsource key protest decisions, which may have had the benefit of helping protest leaders avoid punishment, a contrast to the 2014 Umbrella movement, in which Hong Kong authorities jailed student leaders. One 22-year-old quoted in press reports observed that “I think it reflects and emphasizes that it is ‘by the people, for the people,’ and there is no true leader in this movement.”¹⁰

One scholar suggests that this use of social media and mobile technology helped protesters engage in what are called “wildcat” actions.¹¹ Instead of protesting in a single fixed area, ably networked protesters engaged in short-duration protests in multiple locations at once in a strategy referred to as “Blossom everywhere.” For example, it was reported that “netizens” launched small protests that blocked the entranceways to government offices.¹² Hong Kong students also self-organized via social media and engaged in a simultaneous boycott of classes across 10 universities and 180 secondary schools on September 2, 2019.¹³

Technology was critical to this endeavor, with encrypted Telegram messages and the “mass Airdrops over Bluetooth” helping to coordinate actions in real time.¹⁴ The protesters hence took to the phrase “Be Water,” and the *Financial Times* labeled the protest movement the “Water Revolution.”¹⁵ According to journalist Rebecca Wright, CNN asked one protester about subsequent protest plans and she replied, “We don’t know. We will follow the people. We want to be water.” Wright notes that being water was enabled by technology with “minute-by-minute updates” conveyed via Telegram and other social networks.¹⁶

This reported reliance on social media had its drawbacks. Despite preparations made before a planned protest on June 12, poor mobile signals made it difficult to go online. Whether it was poor cellular signal or the result of the DDoS attack on Telegram (see below)

⁸ Sum Lok-kei, “Hong Kong Reddit: How Leaderless Extradition Protests Took a Lead from Social Media,” *South China Morning Post*, June 29, 2019.

⁹ Gigi Choy, “Hong Kong Protests: Secondary School Pupils Take Charge of Their Own Strikes Using Social Media,” *South China Morning Post*, August 30, 2019; Mike Ives, Andrew Jacobs, and Tiffany May, “Tens of Thousands Rally in Hong Kong Before China’s National Holiday,” *New York Times*, September 28, 2019.

¹⁰ Rebecca Wright, “‘Be Water’: Hong Kong Protest Mantra Influences How Art Is Designed and Distributed,” CNN, August 8, 2019.

¹¹ Tin-yuet Ting, “From ‘Be Water’ to ‘Be Fire’: Nascent Smart Mob and Networked Protests in Hong Kong,” *Social Movement Studies*, Vol. 19, No. 3, 2020.

¹² Sum, 2019.

¹³ Choy, 2019.

¹⁴ Ting, 2020.

¹⁵ Jamil Anderlini, “Hong Kong’s ‘Water Revolution’ Spins Out of Control,” *Financial Times*, September 2, 2019, as cited in Ting, 2020.

¹⁶ Wright, 2019.

that occurred that same day, protesters did not know whether they should move forward with the protest plans to surround Hong Kong’s legislature in an effort to stop the bill’s passage.¹⁷ As one protester commented to the *South China Morning Post*, “Without Telegram and WhatsApp, people did not know what they had to do.”¹⁸ One protester also suggested that fake accounts and government online infiltrators can tar the results of online polls. He suggested that small online groups would be more protected against infiltration.¹⁹

Different Social Media Platforms

The following sections describe the role of Telegram, LIHKG, Facebook, and Airdrop in the Hong Kong protests.

Telegram

Telegram has proven particularly valuable because of ability to encrypt messages. The platform has even been seen as a more secure alternative to WhatsApp.²⁰ Telegram’s features include standard end-to-end encryption for chats, a “cloud chat” function for group messaging, and a “secret chats” function, in which the chats are stored on the phone and can be set to self-destruct.²¹ Telegram also hasn’t suffered a major hack in the recent past, or at least not one that has been reported. In contrast, in 2019, WhatsApp was reportedly infected with spyware as part of an attempt to access the messages of a human rights lawyer based in the UK.²² WhatsApp was also reportedly attacked during the 2014 protests.²³ While China may not have been able to eavesdrop on Telegram communications, it is likely responsible for the distributed DDoS attack that disrupted services on June 12, 2019 (see below section on cyber attacks).

Telegram offered a number of advantages to protesters. The site has reportedly been used extensively to share images that are relevant and presumably motivating to the protesters. In September 2019 alone, protesters shared over 5,000 images on a single Telegram channel.²⁴ The platform also aided in the protest’s “leaderless” resistance by allowing protesters to vote on protest tactics. For example, one post suggested that people lay a white flower in a section

¹⁷ Sum, 2019.

¹⁸ Sum, 2019.

¹⁹ Sum, 2019.

²⁰ Lillo Montalto Monella, “Hong Kong Protesters Abandoned Facebook for Other Platforms,” *Euronews*, July 12, 2019.

²¹ Stanley Shanapinda, “How a Cyber Attack Hampered Hong Kong Protesters,” *World.edu*, June 14, 2019.

²² Nick Hopkins and Dan Sabbagh, “WhatsApp Spyware Attack was Attempt to Hack Human Rights Data, Says Lawyer,” *The Guardian*, May 14, 2019.

²³ Monella, 2019.

²⁴ Linda Lew, “Hong Kong Protests and ‘Fake News’: In the Psychological War for Hearts and Minds, Disinformation Becomes a Weapon Used by Both Sides,” *South China Morning Post*, October 14, 2019.

of the business district called Admiralty to help remember the life of a protester who died in a fall on June 15. This suggestion received more than 9,000 upvotes, and the following day marchers turned the area into a “shrine” of white chrysanthemums.²⁵

LIHKG

Another popular application was LIHKG. LIHKG is a multi-category forum website based in Hong Kong and is often referred to as the Hong Kong Reddit. It has subforums akin to Reddit that allow for discussions on various topics, such as food, dating, and technology. The site is preferred in Hong Kong because LIHKG posts are predominantly in the native Cantonese language. The site is also known for advocating freedom of speech and allowing users to post anonymously (though police can use a warrant to gain information on protesters).²⁶ To accommodate increased demand for the service during the protests, LIHKG extended the number of replies allowed on threads from 1,001 to 5,001.²⁷

Posts on LIHKG can be voted up or down, with highly upvoted content appearing on the front page of the site, thus making it uniquely suited to crowdsourcing protest operations. For example, protesters used the voting feature to vote on poster designs, the winners of which would receive wide distribution.²⁸ Users also weigh in on the timing and location of protests. In one case, users debated the merits of storming police headquarters. The site also helped popularize the phrase “be water, my friend,” originally coined by martial arts legend Bruce Lee. Protesters have used the phrase to signify what they see as a “fluid approach to their rallies.”²⁹ The site, which can offer constantly updated discussions, can help protesters keep updated on the protests and unfolding events. The site can also be used for crowdfunding and was successfully used on multiple occasions to raise funds for various publicity campaigns (see “International Support” later in this chapter).

Facebook

Despite widespread use in Hong Kong, Facebook waned as a platform of choice for protesters. This has been partly attributed to a decline in usership among the young people who actively participated in the protests. It has also been suggested that Facebook’s use during the 2014 Umbrella movement in Hong Kong hurt more than helped the protest movement. Because Facebook’s algorithms prioritize posts triggering intense debate, the platform helped amplify disagreements within the protest community. According to one analysis, “Disagreement divided support for most new ideas and discouraged protesters from ‘experimenting’ new tactics. The whole protest soon evolved into ‘philosophical discussions.’” Protesters instead gravi-

²⁵ Sum, 2019.

²⁶ Rachel Yeo, “Hong Kong Protests: How the City’s Reddit-Like Forum LIHKG Has Become the Leading Platform for Organising Demonstrations,” *South China Morning Post*, August 3, 2019.

²⁷ Sum, 2019.

²⁸ Yeo, 2019; Wright, 2019.

²⁹ Yeo, 2019.

tated to LIHKG and its up-or-down voting system and anonymous posting, which enabled more decisive, and possibly also more rash, decisionmaking.³⁰

AirDrop

Protesters have used the AirDrop file-sharing function on Apple's iOS to anonymously distribute protest posters in busy public places.³¹ The service has also been used to transmit protest related content to people, including tourists, disembarking at the high-speed railway terminal. This material has included descriptions of the 1989 Chinese Tiananmen Square crackdown, arguments for protesting the proposed extradition law, and details of political prisoners.³²

International Support

Protesters used both technology and nontechnology means to raise international support. The digital rights group "Fight for the Future" called for an "Umbrella Protest" at Activision-Blizzard's annual conference, BlizzCon. The planned protest was in response to efforts by the gaming company, Blizzard, to silence voices in support of the Hong Kong protests.³³ In addition, crowdsourcing campaigns conducted on LIHKG were used to raise money for international advertising efforts. It was reported that "netizens" raised over HK\$5 million to place letters urging international support to the movement on the front pages of the *Financial Times* and the *New York Times*.³⁴ A separate campaign used GoFundMe to raise US\$1.9 million from 14,227 donors to create an advertisement that would warn the world about "war crimes committed by the Hong Kong communist government."³⁵ According to one news report, activists raised funding—an estimated US\$850,000 raised in about 12 hours—for advertisements in 19 newspapers in 13 countries that lobbied support for Hong Kong protesters by members of the Group of 20 (G20).³⁶

³⁰ Econ記者 [Econ Reporter], "The Generation Leading Hong Kong Protests Doesn't Use Facebook—and That Matters," *Thinking Out LOUD*, July 3, 2019.

³¹ Wright, 2019.

³² Louisa Lim and Ilaria Maria Sala, "Hong Kong's Propaganda Battle Is Playing Out in the Media—and in Cyberspace," *Washington Post*, July 11, 2019.

³³ Fight for the Future, "Internet Freedom Activists Call for 'Umbrella Protest' at BlizzCon Opposing Company's Hong Kong Censorship Decision," October 11, 2019.

³⁴ Sum, 2019.

³⁵ Wong Tsui-kai, "Hong Kong Protests: 'War Crimes' Ad Crowdfunding Campaign Reaches Million-Dollar Funding Target in One Hour," *Young Post*, August 12, 2019.

³⁶ Lim and Sala, 2019.

Protester Safety

Protesters undertook increased efforts to protect their safety, and technology proved helpful. First, as noted, the use of platforms such as Telegram provided key safety features in the form of encrypted chat and disappearing chat functions. This allowed more safe and secure communication between protesters. Such security did not exist for LIHKG, where user comments are posted publicly alongside the user's username. LIHKG users resorted to the use of innuendo to protect themselves from prosecution. Some, for example, avoided the use of the word *protest* and instead suggested that they would join a *picnic*.³⁷ Protest invitations on Facebook and Instagram also made reference to "one-person picnics" or "painting on your own." These references were intended to circumvent a recently enacted Hong Kong law that forbid gatherings of three or more without police consent.³⁸ It has also been speculated that the use of public-facing online platforms restrained protesters from taking "radical action," with some users cautioning fellow protesters to "watch out for traps."³⁹ Another threat to protesters was the facial recognition cameras used by Hong Kong police, which protesters sought to thwart by pointing lasers at the cameras.⁴⁰

The Chinese and Hong Kong Government Response to Protesters

As noted in the introduction, the government of Hong Kong responded to the protest movement with both policy concessions (e.g., backtracking plans for the extradition law) and an increasingly aggressive police response. The government of China responded in its own aggressive way, engaging in limited cyber operations and conducting a multifront propaganda campaign.

Cyber Operations

China may have launched a DDoS against Telegram in an effort to limit the use of the platform in Hong Kong. On June 12, 2019, Telegram's servers were flooded with high rates of junk communications, which slowed and disrupted functioning of the service.

Describing the origin of the attack on Twitter, Telegram's founder, Pavel Durov, noted, "IP [Internet Protocol] addresses coming mostly from China. Historically, all state actor-sized DDoS (200–400 Gb/s of junk) we experienced coincide in time with protests in Hong Kong

³⁷ Sum, 2019.

³⁸ Fion Li, Blake Schmidt, Shawna Kwan, and Tracy Alloway, "How Encrypted Messages and Car 'Crashes' Helped Hong Kong Protesters," Bloomberg.com, June 13, 2019.

³⁹ Sum, 2019.

⁴⁰ Anthony Cuthbertson, "Hong Kong Protesters Use Lasers to Avoid Facial Recognition Cameras and Blind Police," *The Independent*, August 1, 2019.

(coordinated on @telegram). This case was not an exception.⁴¹ The attack was stabilized by that same evening, Hong Kong time and Telegram notified users on Twitter that their data had not been compromised in the attack.⁴² The disruption appeared to coincide with a major protest event planned for Hong Kong that same day.

Shaping Opinions in Mainland China

China leveraged its control of Chinese state-sponsored media and selective use of its firewall to create a “parallel universe of narratives” for those living in mainland China.⁴³ The Communist Party of China issued guidelines mandating that state-run media outlets avoid positive reporting on the Hong Kong protesters and directing the outlets to “highlight Western flags used in protests” to promote the theme that the protests activists were backed by the CIA.⁴⁴ Chinese state media also highlighted the destructive behavior of Hong Kong protesters and called protesters “cockroaches” and “thugs.”⁴⁵ China sent reporters from regional state-run media organizations to Hong Kong to help tell the Chinese story of the events. These reporters have relied on interviews with pro-China officials and business leaders and have focused on the law-and-order role of the local police.⁴⁶ China also allowed hundreds of nationalist youths to override the great Chinese firewall and flood Twitter with pro-Beijing messages⁴⁷ and allowed select pictures of the Hong Kong protests to circulate online in an effort to fan the flames and control public opinion.⁴⁸

Shaping International Opinions

China has used a variety of tools and tactics to shape international opinion about the protests in Hong Kong. Its diplomats stationed in worldwide embassies have issued both statements and tweets on the matter. Ambassadors in Canada and Singapore and others in the Middle East, Africa, and Latin America have pushed China’s position on the protests. Others have

⁴¹ Quoted in Jon Porter, “Telegram Blames China for ‘Powerful DDoS Attack’ During Hong Kong Protests,” *The Verge*, June 13, 2019

⁴² Porter, 2019.

⁴³ Steven Lee Myers and Paul Mozur, “China Is Waging a Disinformation War Against Hong Kong Protesters,” *New York Times*, August 13, 2019.

⁴⁴ Bill Gertz, “China’s Hong Kong Propaganda Rules Revealed,” *Washington Times*, August 21, 2019.

⁴⁵ “China Sends Local Media to Cover Hong Kong in Shift From 2014,” *Bloomberg*, September 3, 2019.

⁴⁶ “Here’s What China Is Telling Its People About Hong Kong Protests,” *Bloomberg*, November 13, 2019.

⁴⁷ Ryan Ho Kilpatrick and Shibani Mahtani, “Hong Kong Protesters Defy National Security Law, Return to Streets to Oppose Election Delay,” *Washington Post*, September 6, 2020.

⁴⁸ MailOnline Reporter, “China Allows Pictures of Hong Kong Protest to Circulate on Social Media for the First Time to ‘Fan Public Anger’ After It Descended into Violence and Government Building Was Vandalsed,” *Daily Mail*, July 22, 2019.

done the same on Twitter and other mediums. For example, China's acting envoy to Australia, Wang Xining, reportedly, warned Australians to "think twice, think thrice" before commenting on the disturbances in Hong Kong. The Ambassador to the Czech Republic also commented on the "hypocrisy" of Western media and politicians, suggesting they held a double standard on the issue of such protests.⁴⁹

Seemingly independent Chinese organizations have also made similar statements. The Chinese Benevolent Association of Vancouver ran large advertisements in the Sing Tao and Ming Pao newspapers. Both are based in Hong Kong but have international reach. The ads denounced the protesters as "radicals" and argued that "The affairs of Hong Kong are the internal matters of China" and "we oppose any intervention by any foreign forces."⁵⁰

China has also successfully exerted economic pressure on various commercial entities it sees as supporting the protest movement. Most famously, Daryl Morey, the general manager of the Houston Rockets, published a tweet on October 4 stating "Fight for freedom, Stand with Hong Kong." Morey soon deleted the tweet and apologized, and the National Basketball Association worked overtime to avoid alienating itself from the lucrative Chinese basketball market.⁵¹ Other firms, when confronted with Chinese anger, have also reacted similarly. Cathay Pacific fired two pilots and two ground personnel who took part in the protests, and the head of the French lender BNP Paribas issued an apology after one of its employees called Hong Kong's pro-Beijing protesters "monkeys" on Facebook.⁵²

Questions also arise as to whether China is more directly censoring international content via TikTok, which is owned by the China-based parent company ByteDance. Although the company says that it does not censor U.S.-based user data, it has been observed that hashtags supporting the Hong Kong protests that are popular on other social media channels, such as Twitter, are virtually absent from TikTok. As one news post observed, on TikTok, there is "barely a hint of unrest" coming from Hong Kong.⁵³

⁴⁹ Shi Jiangtao, "China Launches PR Blitz to Combat 'Foreign Interference' in Hong Kong," *South China Morning Post*, December 11, 2019.

⁵⁰ Zak Vescera, "Local Chinese Groups Take out Pro-Communist Party Ads Amidst Hong Kong Protests," *Vancouver Sun*, June 26, 2019.

⁵¹ Theodora Yu, "One Tweet, a Week of Turmoil: NBA Steps Out of Bounds with China and Pays the Price," *Keene Sentinel*, October 14, 2019.

⁵² Tracy You, "Chinese People Call for Boycott Against French Bank After One of Its Employees Called Hong Kong's Pro-Beijing Protesters 'Monkeys' in a Facebook Post," *Daily Mail*, September 17, 2019; Oiwan Lam, "'White Terror' at Cathay Pacific: Flight Attendant Union Head Fired for Supporting Hong Kong Protests on Social Media," *Global Voices*, August 25, 2019.

⁵³ Drew Harwell and Tony Romm, "TikTok's Beijing Roots Fuel Censorship Suspicion as It Builds a Huge U.S. Audience," *Washington Post*, September 15, 2019.

Shaping Opinions of and About Protesters

On several occasions, China has used fake Chinese-language social media accounts to directly confront the Hong Kong protesters. First, on August 19, 2019, both Twitter and Facebook announced the discovery of the Chinese campaign. Twitter identified 936 Twitter accounts that originated within China that were “deliberately and specifically attempting to sow political discord in Hong Kong, including undermining the legitimacy and political positions of the protest movement on the ground.”⁵⁴ Fake accounts were also detected on Facebook and YouTube.⁵⁵

Subsequently, the Australian Strategic Policy Institute published an analysis by Uren, Thomas, and Wallis of the terminated Twitter accounts. The researchers discovered that the 940 false Twitter accounts had disseminated 3.6 million tweets.⁵⁶ Uren, Thomas, and Wallis identified three key narrative themes of the accounts: condemnation of the protesters; support for the Hong Kong police and the “rule of law”; and conspiracy theories about Western involvement in the protests. The authors describe the campaign as relatively small and “hastily assembled” and lacking in sophisticated advance planning. They observe that the accounts were cheaply acquired repurposed spam or marketing accounts. Prior account owners, for example, tweeted in Arabic, English, Korean, Japanese, and Russian on topics that ranged from British football to pornography.⁵⁷

Uren, Thomas, and Wallis also observe that there was “little attempt to target online communities with any degree of psychological sophistication.”⁵⁸ In contrast, they note that carefully crafted and long-running influence operations on social media, such as those conducted by the Russian state, are often characterized by tight network clusters associated with key target audiences. The researchers’ analysis of the Chinese database revealed no such network characteristics. Lastly, they observe that the Chinese dialect in some of the tweets were a dead giveaway for Chinese mainland authors.⁵⁹

On June 12, 2020, Twitter publicized a second takedown of Chinese affiliated fake accounts. Specifically, Twitter discovered more than 23,000 accounts that made up a highly engaged core network and an additional 150,000 accounts designed to boost that content (referred to as amplifiers). Twitter noted that the accounts were tweeting predominantly in Chinese languages and pushing, in part, “deceptive narratives about the political dynam-

⁵⁴ Twitter Safety, “Disclosing Networks of State-Linked Information Operations We’ve Removed,” *Twitter Safety Blog*, June 12, 2020.

⁵⁵ Nathaniel Gleicher, “Removing Coordinated Inauthentic Behavior from China,” *Meta* (blog), August 19, 2019; Chris Welch, “YouTube Disabled 210 Accounts for Spreading Disinformation About Hong Kong Protests,” *The Verge*, August 22, 2019.

⁵⁶ Tom Uren, Elise Thomas, and Jacob Wallis, *Tweeting Through the Great Firewall*, Sydney, Australia: Australian Strategic Policy Institute, 2019.

⁵⁷ Uren, Thomas, and Wallis, 2019, p. 4.

⁵⁸ Uren, Thomas, and Wallis, 2019, p. 4.

⁵⁹ Uren, Thomas, and Wallis, 2019, p. 11.

ics in Hong Kong.”⁶⁰ In analysis of these accounts, Diresta et al. of the Stanford Internet Observatory note that the newly terminated accounts were created to reconstitute the accounts terminated in 2019 and, like those in 2019, the 2020 accounts were “thematically similar,” with both sharing narratives that were discouraging or demonizing “pro-democracy demonstrations in Hong Kong.” Diresta et al. also observe that there was little evidence that China made few improvements in their campaign as they continued to rely on underdeveloped personas.⁶¹

Addendum: Implementation of the Chinese National Security Law

In what some described as an attempt to address activists in Hong Kong, China passed a broad law on June 30, 2020, that criminalized a range of acts related to “secession, subversion, terrorism or collusion with foreign or external sources.”⁶² The goal of this law appeared to be to criminalize and ultimately make it easier to target and punish participants in the city’s growing protest movement.

The law has raised widespread concerns about the undermining of Hong Kong autonomy. As part of the law’s implementation, China appointed a “protest and propaganda enforcer” named Zheng Yanxiong.⁶³ Zheng’s official title is director of Beijing’s Office for Safeguarding National Security in Hong Kong, and he is known for his past experience as a propagandist and in battling past protests in China. The same day that China announced his accession to the post, Hong Kong authorities issued charges against one of the Hong Kong protesters. More arrests soon followed.⁶⁴

The protests continued in the face of this new law, though questions persist about whether the movement can survive. Thousands marched in defiance of a protest ban on June 4, 2020, to memorialize those killed and wounded in the 1989 Tiananmen Square Massacre.⁶⁵ Thousands also gathered on September 6 to protest delays in the election of new city legislators that was reportedly instituted due to the novel coronavirus epidemic. Hong Kong police responded by conducting widespread stops and searches and arresting 289 people, including

⁶⁰ Twitter Safety, 2020.

⁶¹ Renée Diresta, Carly Miller, Vanessa Molter, John Pomfret, and Glenn Tiffert, *Telling China’s Story: The Chinese Communist Party’s Campaign to Shape Global Narratives*, Stanford, Calif.: Hoover Institution, Stanford Internet Observatory Cyber Policy Center, 2020.

⁶² “Hong Kong Security Law: What Is It and Is It Worrying?” *BBC News*, June 30, 2020.

⁶³ Chun Han Wong, “China Appoints Protest and Propaganda Enforcer to Tame Hong Kong,” *Wall Street Journal*, July 3, 2020.

⁶⁴ Natasha Khan, “Hong Kong Police Arrest 53 Opposition Figures Over Alleged Subversion,” *Wall Street Journal*, January 6, 2021.

⁶⁵ Austin Ramzy, and Mike Ives, “Hong Kong Protests, One Year Later,” *New York Times*, June 9, 2020.

one under the new national security law.⁶⁶ The Hong Kong government has also responded with a wave of authoritarian attacks against the protesters. In early 2021, police conducted a pre-dawn raid and arrested scores of government critics and protest leaders.⁶⁷ They subsequently fired 129 civil servants who refused to pledge allegiance to the state;⁶⁸ froze the assets of and then arrested the top editors of Hong Kong's *Apple Daily*, a major pro-democracy tabloid;⁶⁹ and prompted Next Digital, a Hong Kong media company that was critical of the Chinese government, to shut down and liquidate its assets.⁷⁰ The security crackdown raised the risk of protest to such a degree that *New York Times* headlines blared that "Hong Kong's Opposition Quits in Droves."⁷¹ The headline refers to pro-democracy activists who had swept nearly 90 percent of 452 district council seats in Hong Kong in fall 2019—by summer 2021, nearly half of those council members had quit to avoid repercussions of the National Security Law.

Assessment of the Role of Social Media in the Hong Kong Protests

Figure 4.1 presents a notional model or factor tree that attempts to explain of how the factors cited in this review interact with one another to help contribute to the Hong Kong protest movement.

The primary precipitant factors, highlighted in red text in the figure, are motivation, event organization, and international support. Online platforms such as Telegram and LIHKG helped in the selection and dissemination of protest propaganda that helped build support for the protest movement. And past protest efforts, such as the 2014 Umbrella movement, likely created a generation of Hong Kong natives who were receptive to and willing to act on such propaganda content.

Technology likely made the most significant contribution to protest organization. Through secure direct messaging, upvoting of protest plans and tactics, and the airdropping

⁶⁶ Kilpatrick and Mahtani, 2020.

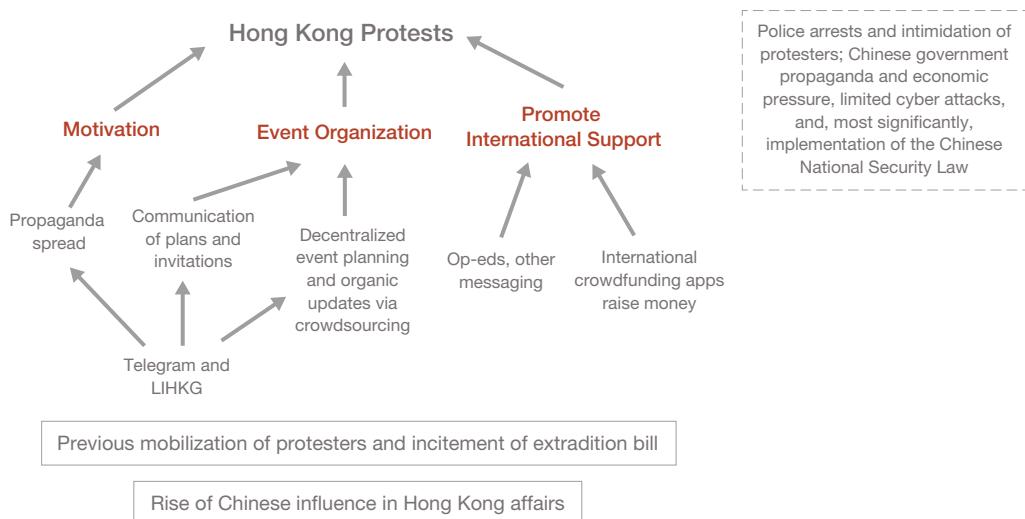
⁶⁷ Vivian Wang, Austin Ramzy, and Tiffany May, "With Mass Arrests, Beijing Exerts an Increasingly Heavy Hand in Hong Kong," *New York Times*, January 6, 2021.

⁶⁸ Chan Yun Nam and Lau Siu Fung, "Hong Kong to Fire 129 Civil Servants Who Refused to Pledge Allegiance," *Radio Free Asia*, April 19, 2021l.

⁶⁹ Jessie Pang and Marius Zaharia, "Hong Kong's Apple Daily Says Only Has Cash for Few Weeks After Assets Frozen," *Reuters*, June 20, 2021; Austin Ramzy and Tiffany May, "Hong Kong Cracks Down on a Pro-Democracy Newspaper," *New York Times*, June 16, 2021a.

⁷⁰ Austin Ramzy, "In Hong Kong, Jimmy Lai's Media Company Moves to Close Down," *New York Times*, September 5, 2021.

⁷¹ Austin Ramzy and Tiffany May, "'Our Hands and Feet Are Tied': Hong Kong's Opposition Quits in Droves," *New York Times*, August 15, 2021b.

FIGURE 4.1**Influence Diagram of the Role of Social Media in Hong Kong Protests**

NOTES: Unboxed text indicates a precipitant root cause factor, and red text indicates a primary precipitant root cause factor. The two solid-line boxes at the bottom of the figure indicates permissive root cause factors, and the broken-line box at the upper right indicates the government responses to the protest.

of plans, technology not only enabled a form of “leaderless resistance” but also contributed to nimble protest actions that kept police responses off guard.

In addition, the protest movement also waged an internationally based messaging campaign with the goal of building support for their actions and placing international pressure against China. Fundraising via crowdsource applications played a significant role in this effort.

The Chinese and Hong Kong government responses to the protests can be bifurcated to efforts undertaken before and after the implementation of the National Security Law. Before the law’s implementation, Hong Kong police responded to the protests with policy concessions and increasing violence against protesters, and China allegedly responded with a DDoS attack on Telegram, as well as with propaganda campaigns targeting the Chinese homeland and propaganda and economic pressure campaigns targeting international audiences. After the National Security Law took effect, such propaganda efforts likely persisted, but the law’s implementation most significantly led to the arrest of key protest leaders, shuttered protest media, and intimidated anti-Chinese politicians. Such efforts leave the long-term survival of the protest movement in doubt.

Theories and Models of Social Movements

In Chapter Six, we present a simple model of network-based activation based on homophily. The demonstrated ABM also shows how information observing agent attributes and network ties can be used to predict the movement's size and participants. The coupling of network growth and network observation in a common model demonstrates the potential for ABMs to develop a new understanding of the role of ICTs in competitive, social processes. Before introducing the model, in this chapter we describe the primary approaches to examining social movements, in order to provide a preliminary basis for the model's design and ultimately further extensions.

There are four broad approaches to the study of social movements that have shaped the contours of the field for the past several decades, each focusing on different aspects of social movements and the environments they exist in—political opportunities, mobilizing structures, cultural framing, and agentic identities and expectations.¹ Each approach advances a different core question, rests on different sets of assumptions, and emphasizes different aspects of social and political phenomenon. But all four seek to explain the conditions that produce collective mobilization around shared grievances—in some places, at some times, and not at others—or, more specifically, to characterize the criteria that explain and predict the success or failure of social movements.

Political Opportunities

One approach to studying social movements focuses on “the effects of the political and institutional context on social movements’ development and evolution.”² The key insight of this “political opportunity” perspective is that movements emerge and thrive in political environ-

¹ Donatella Della Porta and Mario Diani, eds., *The Oxford Handbook of Social Movements*, New York: Oxford University Press, 2015a; Alain Touraine, *The Voice and the Eye: An Analysis of Social Movements*, New York: Cambridge University Press, 1981; Alberto Melucci, *Nomads of the Present: Social Movements and Individual Needs in Contemporary Society*, John Keane and Paul Mier, eds., Philadelphia, Pa.: Temple University Press, 1989; Enrique Laraña, Hank Johnston, and Joseph R. Gusfield, eds., *New Social Movements: From Ideology to Identity*, Philadelphia, Pa.: Temple University Press, 1994.

² Donatella Della Porta and Mario Diani, “Introduction: The Field of Social Movement Studies,” in Della Porta and Diani, 2015, p. 4.

ments that are conducive to mobilization.³ Of course, “conducive” is relative, and so political shifts that make a regime somewhat less repressive than it used to be can be seen as creating opportunities for activists looking to challenge the status quo.

Mobilizing Structures

The study of mobilizing structures examines whether and when it is rational to participate in protests and social movements. The starting point of this perspective is Olson’s argument, in *The Logic of Collective Action*, that rational actors would prefer to free-ride on the work of others, and thus shared grievances, especially those that are widespread and deeply felt, are unlikely to trigger collective mobilization.⁴ Yet we observe collective action all around us, meaning that there must be conditions that make the personal benefits of mobilizing for a collective cause greater than their costs. Some of the variables that create space for rational collective action uncovered by scholars of this approach include the mobilization of economic, organizational, and human resources by formal social movement organizations and other community organizations;⁵ the provision of selective material rewards to participants and imposition of social costs on free-riders;⁶ and dense networks of social ties among potential activists that lower the costs and increase the benefits associated with participation (by making information about action opportunities more readily available, making participation more fun and appealing, etc.).⁷

³ Charles Tilly, *From Mobilization to Revolution*, Reading, Mass.: Addison-Wesley, 1978; Doug McAdam, *Political Process and the Development of Black Insurgency, 1930–1970*. Chicago, Ill.: University of Chicago Press, 1999; Sidney G. Tarrow, *Power in Movement: Social Movements and Contentious Politics*, New York: Cambridge University Press, 2011.

⁴ Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups*, Cambridge, Mass.: Harvard University Press, 1965.

⁵ John D. McCarthy and Mayer N. Zald, “Resource Mobilization and Social Movements: A Partial Theory,” *American Journal of Sociology*, Vol. 82, No. 6, May 1977; McAdam, 1999.

⁶ Samuel L. Popkin, *The Rational Peasant: The Political Economy of Rural Society in Vietnam*, Berkeley, Calif.: University of California Press, 1979; Mark Irving Lichbach, *The Rebel’s Dilemma*, Ann Arbor, Mich.: University of Michigan Press, 1995; Dennis Chong, *Collective Action and the Civil Rights Movement*, Chicago, Ill.: University of Chicago Press, 1991.

⁷ David A. Snow, Louis A. Zurcher, Jr., and Sheldon Ekland-Olson, “Social Networks and Social Movements: A Microstructural Approach to Differential Recruitment,” *American Sociological Review*, Vol. 45, No. 5, October 1980; Doug McAdam, “Recruitment to High-Risk Activism: The Case of Freedom Summer,” *American Journal of Sociology*, Vol. 92, No. 1, July 1986; Doug McAdam and Ronnelle Paulsen “Specifying the Relationship Between Social Ties and Activism,” *American Journal of Sociology*, Vol. 99, No. 3, November 1993; Alan Schussman and Sarah A. Soule, “Process and Protest: Accounting for Individual Protest Participation,” *Social Forces*, Vol. 84, No. 2, December 2005.

Cultural Framing, or Political Process Theory

A third approach to social movements focuses on how framing processes can employ culture and cultural resources to facilitate collective mobilization. A narrow perspective on the role of culture points to the dynamics of framing and identity construction by movements as they try to convince people to adopt their interpretation of an issue or situation and motivate participation.⁸ A broader perspective considers that movements' cultural work is not simply an instrumental activity aimed at recruitment, shifting public opinion, or gaining favorable media coverage, but in fact suffuses all aspects of movement activity. Thus, the uses of culture are not merely strategic but are expressive and even reflexive and manifest across a wide range of symbols (e.g., meaningful and important images, objects, places, or people), identities (ethnicity, class, gender, party, etc.), and emotions (urges, moods, affective loyalties, etc.).⁹

These major theories are often grouped together under the broad label of Political Process Theory (PPT),¹⁰ which has become "the prevailing consensus among social movement scholars."¹¹ Collectively, PPT posits that social movements are born, live, and die according to the key factors articulated above: political opportunity structures, mobilizing structures, and cultural framings, yet there exists strong opposition to PPT's hegemonic status within the research community. The core of this critique is that PPT privileges structural features of

⁸ David A. Snow, E. Burke Rochford, Jr., Steven K. Worden, and Robert D. Benford, "Frame Alignment Processes, Micromobilization, and Movement Participation," *American Sociological Review*, Vol. 51, No. 4, August 1986; Robert D. Benford, "'You Could Be the Hundredth Monkey': Collective Action Frames and Vocabularies of Motive Within the Nuclear Disarmament Movement." *Sociological Quarterly*, Vol. 34, No. 2, May 1993; Robert D. Benford and David A. Snow, "Framing Processes and Social Movements: An Overview and Assessment," *Annual Review of Sociology*, Vol. 26, No. 1, 2000; David A. Snow, "Framing Processes, Ideology, and Discursive Fields," in David A. Snow, Sarah A. Soule, and Hanspeter Kriesi, eds., *The Blackwell Companion to Social Movements*, Malden, Mass.: Blackwell, 2004.

⁹ James M. Jasper, *The Art of Moral Protest: Culture, Biography, and Creativity in Social Movements*, Chicago, Ill.: University of Chicago Press, 1997; Jeff Goodwin, James M. Jasper, and Francesca Polletta, eds., *Passionate Politics: Emotions and Social Movements*, Chicago, Ill.: University of Chicago Press, 2001; Suzanne Staggenborg and Amy Lang, "Culture and Ritual in the Montreal Women's Movement," *Social Movement Studies*, Vol. 6, No. 2, September 1, 2007; Deborah B. Gould, *Moving Politics: Emotion and ACT UP's Fight Against AIDS*, Chicago, Ill.: University of Chicago Press, 2009; Verta Taylor, Katrina Kimport, Nella Van Dyke, and Ellen Ann Andersen, "Culture and Mobilization: Tactical Repertoires, Same-Sex Weddings, and the Impact on Gay Activism," *American Sociological Review*, Vol. 74, No. 6, December 1, 2009; James M. Jasper, "Emotions and Social Movements: Twenty Years of Theory and Research," *Annual Review of Sociology*, Vol. 37, No. 1, 2011.

¹⁰ Doug McAdam, John D. McCarthy, and Mayer N. Zald, "Introduction: Opportunities, Mobilizing Structures, and Framing Processes—Toward a Synthetic, Comparative Perspective on Social Movements," in Doug McAdam, John D. McCarthy, and Mayer N. Zald, eds., *Comparative Perspectives on Social Movements: Political Opportunities, Mobilizing Structures, and Cultural Framings*, New York: Cambridge University Press, 1996.

¹¹ At least according to one of its most prominent advocates. See Doug McAdam, "Social Movement Theory and the Prospects for Climate Change Activism in the United States," *Annual Review of Political Science*, Vol. 20, May 2017.

environments and movements while ignoring, or at least minimizing, the agentic aspects of thinking and feeling human beings.¹²

Agent Identities and Expectations, or New Social Movement Theory

In contrast to PPT's emphasis on structural forces, an additional body of research has developed that emphasizes knowledge, information, and decisionmaking—that is, individual agency—to explain the dynamics of social movements.¹³ “A major insight of new social movement theory is that collective identity, which translates structural inequality and injustice into individual dissatisfaction, is a primary social psychological dynamic of mobilization.”¹⁴

Opportunities to Integrate and Compare Social Movement Theories

These four approaches to understanding social movements present opportunities to advance their research and analysis. The first opportunity is to integrate theories vertically, creating a hierarchy of nested models that seek to unify multiple theories into a single, coherent model. This vertical integration is possible when one theory applies to a unit of analysis that is a subcomponent of another theory. For example, models of identity formulation, activation, and mobilization may be applied to agents that reside within social structures in which their access to resources and opportunities to organize are variably permissive.

The second opportunity is to compare alternative models, operating each in parallel to examine the same initial conditions. Such an approach presents each theory as a lens by which convergent or divergent expectations arise given a common set of conditions. This allows for researchers and policy analysts to understand the consequences of different assumptions, and conditions to focus their attention on uncertainties of greatest consequence.

By providing a middle ground between multiple methods, ABMs offer a technical means for bringing structural and agent-focused models into a common framework. The ability more closely aligns formal, algorithmic models with the descriptive models provided by naturalistic approaches while replicating the results derived from more structural approaches,

¹² Jeff Goodwin, James M. Jasper, and Jaswinder Khattri, “Caught in a Winding, Snarling Vine: The Structural Bias of Political Process Theory,” *Sociological Forum*, Vol. 14, No. 1, March 1999.

¹³ Della Porta and Diani, 2015b, pp. 4–5.

¹⁴ Stephen Wulff, Mary Bernstein, and Verta Taylor, “New Theoretical Directions from the Study of Gender and Sexuality Movements: Collective Identity, Multi-Institutional Politics, and Emotions,” in Della Porta and Diani, 2015a, p. 110.

allowing for the integration of multiple methods that serve the interests and needs of research and policy alike.

In Chapter Six, we present a simple ABM of a social movement in which a population of agents develops network relationships at a pace that is contingent on alternative ICTs. The model bridges the gaps between the first three approaches as part of the PPT tradition, yet because it renders each individual explicitly, it can be extended to include increasingly complex and differentiated decisionmaking processes affecting many levels of agent behavior. In doing so, existing structural and emerging agent-centric approaches to understanding social movements and their participants can be integrated into a common framework.

Importantly, this is not the first, or even the most sophisticated model to be inspired by major social movements, including the Arab Spring,¹⁵ as well as earlier accounts of collective action, such as those that occurred during the final years of the Cold War.¹⁶ Indeed, the existence of these models shows movement in a variety of fields regarding the potential of ABMs and related methods for modeling the conditions under which the coordinated actions of individuals can produce societal change, and, equally important, when they cannot.¹⁷

¹⁵ Michael D. Makowsky and Jared Rubin, “An Agent-Based Model of Centralized Institutions, Social Network Technology, and Revolution,” *PLOS ONE*, Vol. 8, No. 11, November 21, 2013; Dana Downey, “Convergence Versus Emergence of Youth Extremism: An Agent-Based Model of the Arab Spring,” in Paul A. Youngman and Mirsad Hadzikadic, eds., *Complexity and the Human Experience: Modeling Complexity in the Humanities and Social Sciences*, Boca Raton, Fl.: CRC Press, 2014; Alessandro Moro, “Understanding the Dynamics of Violent Political Revolutions in an Agent-Based Framework,” *PLOS ONE*, Vol. 11, No. 4, April 22, 2016; Carlos M. Lemos, *Agent-Based Modeling of Social Conflict: From Mechanisms to Complex Behavior*, Cham, Switzerland: Springer, 2017.

¹⁶ Susanne Lohmann, “The Dynamics of Informational Cascades: The Monday Demonstrations in Leipzig, East Germany, 1989–91,” *World Politics*, Vol. 47, No. 1, 1994.

¹⁷ H. Peyton Young, *Individual Strategy and Social Structure: An Evolutionary Theory of Institutions*, Princeton, N.J.: Princeton University Press, 2001; Damon Centola, *Change: How to Make Big Things Happen*, New York: Little, Brown Spark, 2021.

Modeling Network Formation

In this chapter, we investigate the multifaceted role of information technologies in the spread and dynamics of social movement mobilization using an ABM. Specifically, we ask two main questions: (1) What are the conditions under which communication and network technologies impact the total number and organizational capacity of protesters? and (2) How do surveillance technologies affect an authority's ability to learn about the protest? Importantly, in this context, the terms *protest* and *protester* cover a wide range of activities that may be performed by individuals that have mobilized against authority (most commonly a national government), including marches, rallies, sit-ins, and other visible street-level activities.¹ The presentation of this model is relatively brief, as a more comprehensive examination of the model's behavior has been performed in a separate academic publication, which also includes sufficient technical detail to replicate the model's behaviors computationally.²

This work develops and analyzes an ABM of network formation and social monitoring. The first research question is how an increased ability to communicate over alternative communication modes affects the overall growth of a social movement, represented as the number of protesters and the communication links between them (network nodes and links). To understand the effects of technological advances in surveillance, the analysis then proceeds to investigate how government authorities may observe the population and estimate the size and state of the movement via different methods.

To remain as general as possible, the model's abstraction is ecumenical regarding the specific tactics of mobilized groups and focuses how communication within a population allows protesters to mobilize in pursuit of an objective—with the intensity of a group's actions determined by the total number of participants and the density of the network connecting them. The benefit of this approach is that the model is independent of the goals of the protesters and thus provides general insights into *any* protest. The drawback of this approach is that the model is insensitive to the specific strategies employed by real-world movements and their members, as each may have distinct beliefs about technologies and their applications that

¹ Importantly, given the configuration of this model into protesters and oppositional authority, it does not cover circumstances in which a social movement has been mobilized in support of a governing regime.

² Krystyna Marcinek, Rushil Zutshi, Omair Khan, Justin Grana, Marek Posard, Todd Helmus, and Aaron Frank, "The Role of Communication and Network Technology in the Dynamics of Social Movements," working paper, November 9, 2021.

do (or do not) capitalize on the full range of affordances they provide or account for their risks. However, by establishing a framework that explains how social movements grow and connect, the ABM serves as a building block for larger models that could consider both communication and mobilization within specific idiosyncratic contexts. Thus, as noted in Chapter Five, this model fits squarely within the PPT framework of analyzing social movements, yet it offers a platform in which increasingly complex agent behaviors can be used to develop and examine a broader range of theoretical questions than PPT considers.

Just as the model focuses on the overall role of technology on protester relationships and behaviors, it also provides a general view of how regimes surveille social movements. The model examines how authorities develop assessments of a protest's size and identities of members but does not consider what security forces may do with that information. The value of this approach rests on the assumption that—except in the most extreme cases, where authorities are willing to employ indiscriminate force against the population—all authorities (whether governmental or not) will want or need to acquire information about how many people are mobilized by a social movement, and who they are. For example, if an authority wanted to disrupt a protest by severing communication links between protester factions, it would need to know which of the citizens are protesters and the ways in which they are connected to one another. Again, while this means that our model isn't precisely tailored to any *particular* protest, it serves as a measure of how authorities could develop intelligence before applying a wide variety of enforcement or policing actions.

To ensure that the results are rooted in established research on social movements and more general social theory, the technologies in the model are aligned with well-known social processes of homophily and social influence. Homophily is the notion that individuals are more likely to have contact with those they share relevant attributes with than those with whom they differ.³ Social influence is the idea that an individual's opinions and beliefs are shaped by those in their social network.⁴ Both homophily and social influence have been linked to social movements.⁵

Model Overview

The network model presented in this chapter is a dynamic model of network formation containing both *citizens* and an *authority*. A fixed number of citizens are considered protesters, and the rest of the citizens are nonprotesters. Each citizen, whether they are a protester or not, has an additional attribute called their *identity*. This independent variable represents

³ McPherson, Smith-Lovin, and Cook, 2001.

⁴ Noah E. Friedkin and Eugene C. Johnsen, "Social Influence and Opinions," *Journal of Mathematical Sociology*, Vol. 15, No. 3–4, 1990.

⁵ Monica Di Gregorio, "Networking in Environmental Movement Organisation Coalitions: Interest, Values or Discourse?" *Environmental Politics*, Vol. 21, No. 1, January 24, 2012.

the type of characteristics of the citizen, such as its demographics and social and economic status, and may be regarded as the citizen's social type. Although abstract, this social type, or identity, places each citizen in a social position against which its similarity and difference to other citizens can be compared.⁶

In the model, the social types of citizens are independent of their protesting status.⁷ This identity, or social type, variable is modeled as a decimal value on the interval between 0 and 1 and is an immutable value assigned during initialization; it does not change during the simulations discussed in this chapter.⁸ A citizen's protester status is binary—each citizen either is a protester or is not. A more sophisticated treatment of the model might have protesting status and social type interact, having one influence the other, but ours does not.

At the start of the simulation, all citizens are disconnected—that is, there are no communication channels between any two citizens. In network terms, the graph of citizens is fully disconnected. Each node is isolated. After initialization, the model progresses through several actions. In each timestep, a citizen, or agent, is chosen at random to form links with other agents. The selected citizen forms these links through two mechanisms, which we label “outreach” and “networking.” These mechanisms govern *which* other agents the selected agent will attempt to form links with. In the model, all links are symmetric or undirected.

The outreach mechanism allows the selected agent (ego) to survey a fixed number of randomly selected citizens (alters), with that number determined through the value of the outreach parameter. If both ego and alter are protesters, or if both ego and alter are similar in their identities, then they form a link. This represents a simple notion of homophily and can be interpreted as serendipitous networking, such as meeting a person at a public park or cafe. As a digital example, an agent might “stumble” upon another agent's blog while on the internet and then subsequently connect to that person through a social media platform.

The networking mechanism refers to the process whereby the selected citizen (ego) can survey a fixed number of agents (alters) that *already have connections with ego*—that is, in network terms, have a network degree distance of two. As with outreach, this number is determined by the numerical value of the networking parameter. For example, if ego Alex is connected to alter-1 Bob and Bob is connected to alter-2 Chris, then Alex can survey Chris

⁶ For discussions on the varieties of identity properties, their combination into distinctive social practices and groupings, and relations to social structure, see Richard Jenkins, *Social Identity*, New York: Routledge, 2014; Steph Lawler, *Identity: Sociological Perspectives*, 2nd ed., Malden, Mass.: Polity Press, 2014; Daniel DellaPosta, Yongren Shi, and Michael Macy, “Why Do Liberals Drink Lattes?” *American Journal of Sociology*, Vol. 120, No. 5, March 2015; Sabloff and Cragg, 2018.

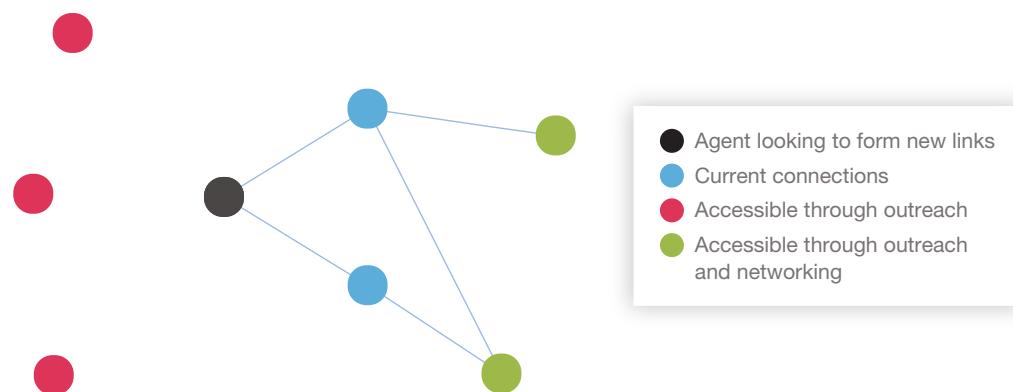
⁷ In reality, the social status and identities of actors are likely correlated with their political preferences and grievances, and therefore are unlikely to be independent of one another (DellaPosta, Shi, and Macy, 2015).

⁸ Alternative formulations of this model may have influence operate on identity values or social types as a way of affecting the underlying structure of society. This would be more appropriate for models investigating the long-term patterns for framing and recruitment new members into movements, as opposed to tactical questions of activation into protest activity discussed here.

using networking because they are connected through Bob. Again, homophily dictates that agents form a link if ego and alter-2 are either both protesters or if their identities are sufficiently similar. A digital example of the networking mechanism would be two agents that connect via a closed online group to which they were both invited to by a common friend. An example of outreach and networking capabilities for communication is shown in Figure 6.1, which depicts the network and communication opportunities for a single agent, shown in black. The red-colored agents are accessible via the outreach mechanism, while the green-colored agents are “friends of friends” and are accessible via both outreach and networking.

Because the outreach and networking parameters determine the number of citizens that an agent may survey when selected, these parameters can be interpreted as the inverse of the communication costs to forming links through each mechanism. For example, if an agent has a fixed amount of time it can dedicate to communicating and meeting new people, then raising the number of queries an agent can make to other agents is equivalent to lowering the cost of communication. A key feature of this model is that there are separate parameters that govern outreach and networking, and thus it is possible to isolate the impacts of advances in technologies that improve one or the other. For example, social networking platforms may attempt to connect individuals who don’t know one another based on their shared interests—for example, fans of the same sports team or job applicants with employers, each with similar interests—reducing the cost of outreach, as opposed to connecting individuals

FIGURE 6.1
Agent Linking Options Through Outreach and Networking



NOTE: In this example, the black circle represents ego that has two alternative paths for forming new network links. Through outreach, ego may contact red and green alters, attempting to grow its network. Through networking, ego may contact green alters, as they are “friends-of-friends” within ego’s existing network.

based on their status as friends-of-friends, promoting transitive closure, thus reducing the cost of networking.⁹

The final piece of the model is an authority agent. While the authority may ultimately wish to alter the course of the protest, this model specifically focuses on how the authority collects information about the protest. To form beliefs about which citizens are protesters, the authority observes a random subset of agents at regular time intervals. The number of agents observed by the authority per timestep represents the total of its human and computing capabilities that can commit to social surveillance. The authority's observation of a given agent consists of two components.

The first component of social surveillance is a *node observation process* whereby the authority observes a noisy signal of whether a given citizen is a protester. The amount of noise captures the quality of the surveillance technology that the authority uses to observe whether a selected citizen is a protester.¹⁰ The second component of social surveillance is an *edge observation process* whereby, for each citizen the authority observes, the authority observes a subset of the agent's individual network. Mechanically, the authority has a fixed probability of observing each of the agent's existing edges. This probability represents the quality of the authority's technology allowing network structure surveillance (or, alternatively, the degree of control the authority exerts over the ICTs being used for citizen communication). A low probability of edge observation may mean that the authority can observe connections only under very strict conditions—for example, when two agents are physically co-located. A high probability could, for example, mean that the authority can observe connections despite the mode of communication chosen by the protesters, such as via social network data mining or the ability to decrypt electronic communications. Importantly, the node and edge observation technologies are governed by separate parameters. Separating parameters allows for disentangling the impacts of increased individual surveillance versus increased network surveillance, our key comparative statics when analyzing the authority.

A fully rational authority would have a prior belief and use the data from its node observation process and its edge observation process to compute a Bayesian probability of each agent being a protester. However, this exact probability is analytically intractable because of the underlying model of network formation and would require significant Monte Carlo experiments to estimate. This is exacerbated in models in which social influence can cause citizens to switch from being nonprotesters to protesters. Since it is unlikely that a real-world authority would be able to accurately compute these probabilities, our implementation of an authority adopts a heuristic that, with infinite samples, can separate protesters from nonprotesters. Intuitively, the heuristic uses the fact that, on average, protesters have more connections than

⁹ Mark S. Granovetter, "The Strength of Weak Ties," *American Journal of Sociology*, Vol. 78, No. 6, May 1973.

¹⁰ It is important to remember that while some representations of protest behavior may be obvious, such as carrying signs at a political rally, other activities may be less obvious, such as participating in an economic boycott.

nonprotesters, because they can form connections outside the social identity groups, and thus combines the degree of a node with the node observation data to assign a numerical value to a node being a protester. With infinite samples, the score of all protesters would be strictly positive, and the score of all nonprotesters would approach 0.

Parameters

Tables 6.1 and 6.2 describe the parameters in the model. Each parameter takes one fixed value each time the model is run. The precise parameter values are of less interest than their relative values: For instance, one might ask how quickly all citizens become protesters if the model begins with 15 versus 5 protesters and social influence allows them to convince others to join the protest. The remainder of this chapter therefore refers to the parameter values as “low,” “medium,” and “high” rather than with the numerical values, as the directionality of changing numerical values on protest size and connectivity, and estimates thereof, is more important than specifical numerical results.

The parameters in Tables 6.1 and 6.2 were selected to explore the model’s core dynamics and not to represent any specific, real-world social movement. Indeed, real-world applications of the model would require much larger populations, greater differentiation between ICTs, and separating out information and communication channels that may be visual or

TABLE 6.1
Parameters Governing Citizen Behavior

Characteristic	Parameter	Values
Underlying characteristics of the population	Population size N	100
	Initial number of protesters p	5, 10, 15
	Inclusivity c	0.05, 10, 15
Technological capabilities	Social influence ^a w	∞ (no influence), 5, 4, 3
	Outreach technology L_1	1, 2, 3
	Networking technology L_2	1, 2, 3

^a As previously noted, experiments including social influence are not discussed in this chapter but appear in the supplementary paper containing more detailed analysis of this model.

TABLE 6.2
Parameters Governing Authority Behavior

Characteristic	Parameter	Values
Computing power	Sampling frequency k	100, 20, 5
Surveillance capabilities	Initial number of protesters δ	0.5, 0.3, 0.1
	Probability of link observation γ	0.05, 0.3, 0.7

spatial in nature from those that may be nonspatial for coordinating protest action in space. Likewise, as agent-types are uniformly distributed on the $[0,1]$ interval, the size of the population affects the density of identity values, determining the ability of nonprotester linkages based on the inclusivity (c) parameter. Thus, the parameters used in the model in this chapter are specifically selected to isolate and explore the effects of the outreach (L_1) and networking (L_2) parameters.

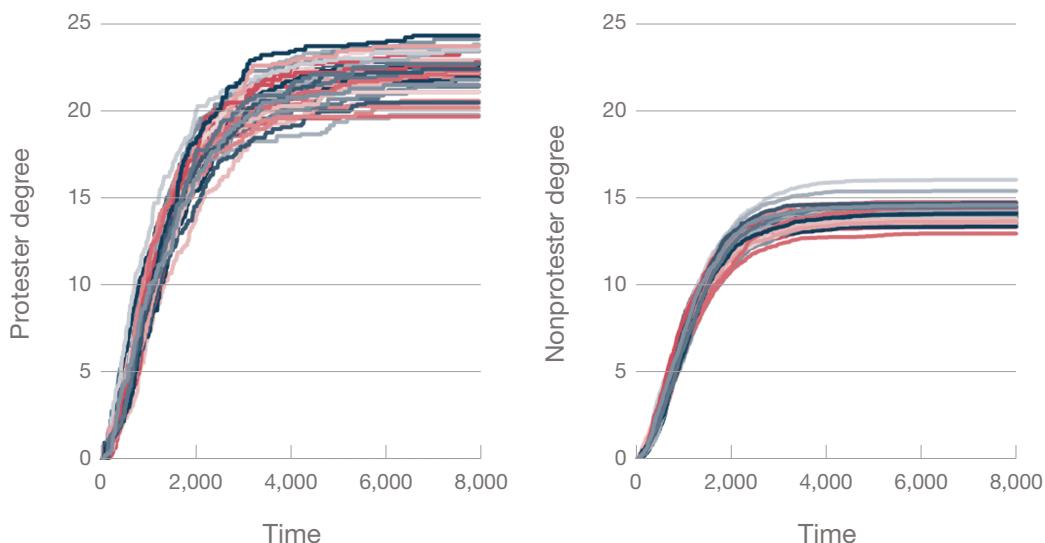
Results

Analysis of the model was performed under a variety of configurations, each increasing in terms of complexity to isolate the ways individual parameters, and combinations of them, change protest dynamics and surveillance. The analysis begins with a simple scenario that establishes a baseline for protest growth—network formation in the absence of social influence. After examining *connectivity* among protesters, we then introduce an authority figure and show how the accuracy of its beliefs about which citizens are protesters depends on the parameters governing its observation process.

Protester Dynamics Without Social Influence

Figure 6.2 shows how the degree centrality—that is, the number of connections—of protesters evolves over time when the number of protesters is fixed. Each line shows the average degree

FIGURE 6.2
Convergence and Stochasticity of Average Degree over Time for Runs with the Same Parameters

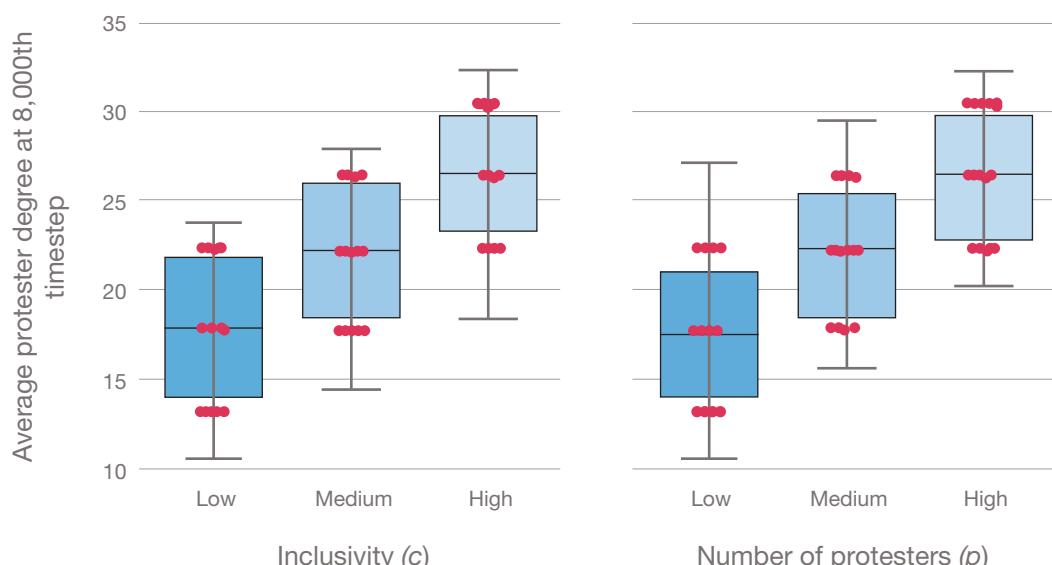


of a protester and a nonprotester in one simulation. The simulation was run 40 times with the same parameter values, producing slightly different results each time. The key insights are that the average degree of protesters (1) achieves its maximum value, (2) is stochastic, and (3) is higher than that of nonprotesters. The process being modeled here is fundamentally convergent. With infinite samples and without social influence, each nonprotester will eventually connect to all agents with a sufficiently similar identity. Each protester will eventually connect to every other protester *and* every nonprotester with a similar identity. Citizens' identities are determined by a random draw, and the maximum number of possible connections will vary based on the distribution of identities for that instance of the model.

Because protesters can form connections based on their shared status as active protesters *or* based on sharing sufficiently similar identities, the average degree of a protester increases with both (1) the total number of protesters in the population and (2) the inclusivity parameter that allows for citizens to connect to other citizens who are more different from themselves. Figure 6.3 plots the average degree of protesters for different values of these parameters (low, medium, and high).

Both communication technologies of interest in this study—open networking and near-peer networking—have a positive effect on the speed of connecting protesters to one another within the agent population. That is, giving agents the ability to survey one additional citizen using either outreach or networking capabilities leads to links being formed more quickly. However, these technologies are not identical. To understand the effect of a citizen reaching out to their neighbors versus reaching out to distant nodes, the speed at which the agent pop-

FIGURE 6.3
Distribution of Average Protesters Degree at the Limit, Grouped by c and p

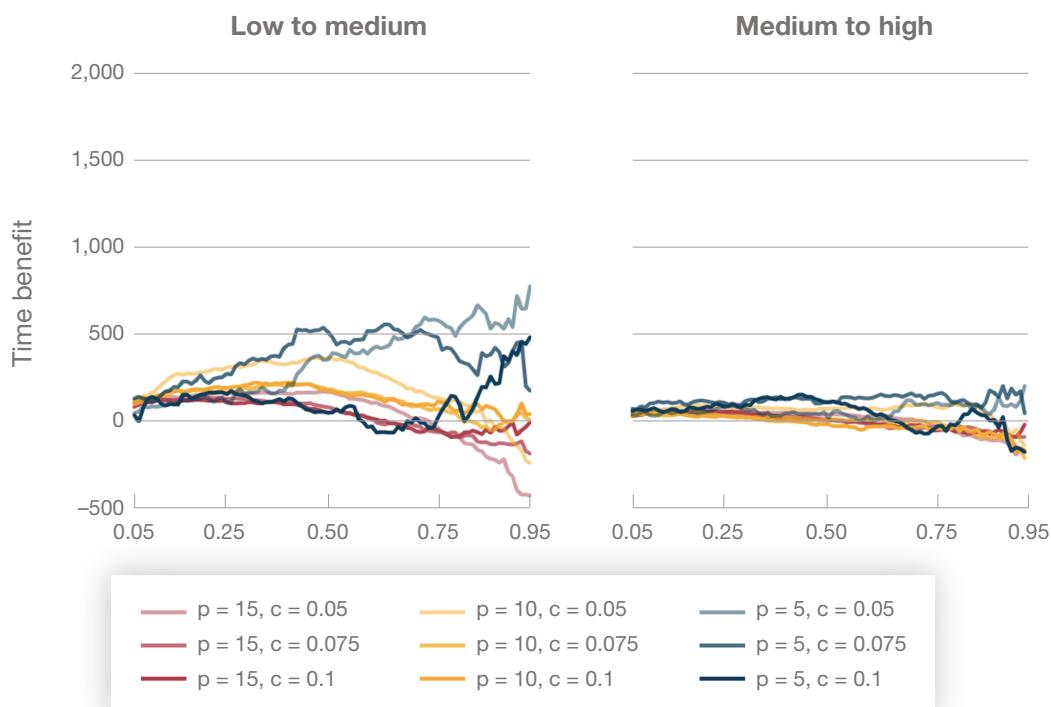


ulation reached its maximum level of connectedness given the same parameter and identity values within the model's agent population.

In Figure 6.4, each line represents the relative value of outreach versus networking, respectively. The horizontal axis represents the proportion of possible links that have been formed. The vertical axis represents, in terms of timesteps in the model, how much more quickly that proportion is reached because of an increase in outreach versus an increase in networking. For example, in the left plot, when $p = 5$ and $c = 0.1$ (the dark blue line), increasing outreach (L_1) from low to medium causes the proportion of connections to reach 50 percent approximately 400 timesteps sooner than if networking (L_2) were to increase from low to medium. These graphs provide two key insights.

The plots show that the relative benefits of both outreach and networking depend on the initial size of the protesting population (p). With a small number of protesters, increasing outreach leads to faster link formation for any given level of connectivity. However, with a

FIGURE 6.4
Time Benefits of Increasing Outreach Versus Networking (as a function of the level of convergence)



NOTES: The panels depict the relative increase in speed resulting from increasing outreach versus networking. The panel on the left depicts the relative gains in speed when outreach is increased over networking from low to medium (with networking remaining at medium). The lines depict the average differences in timesteps to achieve the same level of network as connectivity as the case when they are equal. The right panel depicts the same transition of outreach and networking technologies transitioning from medium to high.

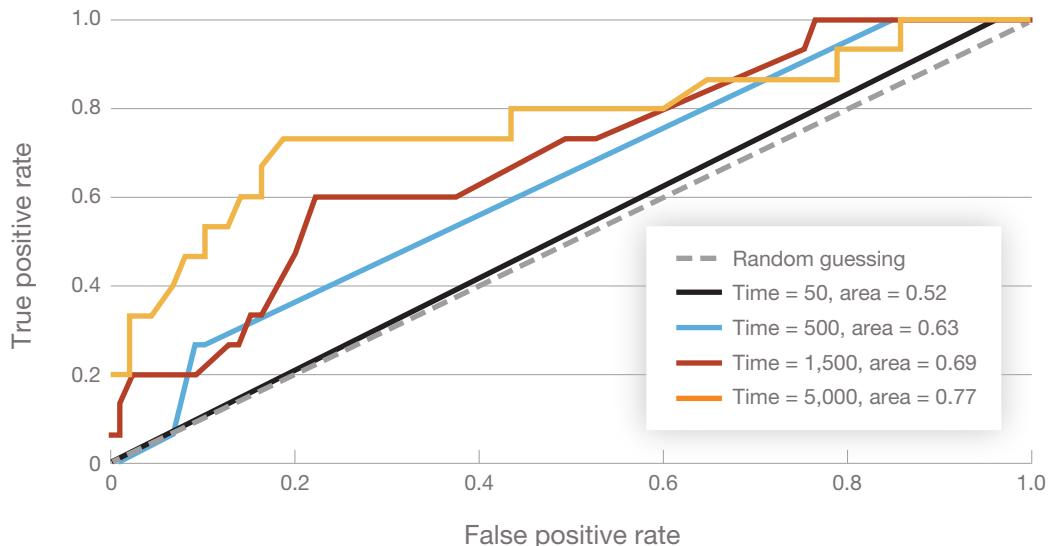
larger number of protesters, increasing networking can lead to faster link formation. Intuitively, if there are very few protesters, most of the connections are formed based on identity. Therefore, it is unlikely that a protester would find another protester through networking. However, when there are more protesters in the population, more links are initially formed among protesters, resulting in higher chances of meeting other protesters via one's existing connections. When the initial population of protesters is relatively large, increasing outreach is more likely to "ignite" the network formation process, whereas increasing networking is more effective at eventually bringing the protester network to its ultimate potential.

Additionally, the plots show that the relative impact of increasing outreach versus networking is nonlinear, which is evident from the difference in the height of the lines in the left and right plots. Specifically, the relative difference in convergence time from increasing outreach versus networking from low to medium is much more than an increase from medium to high. This suggests that when technology is limited, asymmetries exist regarding the affordances provided by outreach and networking capabilities. However, as communications become less constrained, the two types of technology become indistinguishable in terms of their impact on network formation.

Surveillance Without Social Influence

Just as citizens employ communication technologies in this model to connect and communicate, the authority has surveillance technologies that vary in their ability to discern protesters from nonprotesters. We analyzed the effectiveness of surveillance within the model by employing a receiver operator curve (ROC) to assess the authority's success at identifying protesters based on limited and noisy information about the population. Classification models typically face a trade-off between false positives and true positives, and the ROC provides a visual depiction of this trade-off. For a given set of parameters, the ROC plots the true positive rate on the y-axis and the false positive rate on the x-axis. Each true positive rate has an associated false positive rate—essentially, to achieve more true positives, a model becomes less discerning and therefore increases its rate of false positives. The bottom left of the graph (0,0) therefore represents a model that carefully avoids all false positives, at the cost of also failing to achieve any true positives. The upper right corner of the graph (1,1) represents a strategy of always issuing positives. The point (0,1) represents a perfect classifier. The 45-degree line represents the strategy of randomly guessing. A typical ROC graph for the authority in this model is shown in Figure 6.5.

An ROC can be summarized as a single number by using the area under the curve (AUC). Because a perfect classifier will have only true positives and no false positives, the AUC in a perfect graph is 1, and the AUC is rarely below 0.5 (random guessing at classifications). The AUC is equivalent to the probability that the classifier will rank a randomly chosen positive instance higher than a randomly chosen negative instance, which makes it a reasonable proxy for classifier performance. To examine how the surveillance ability of the authority changes

FIGURE 6.5
Receiver Operator Curves at Various Timesteps for a Representative Parameter Set


NOTES: Depictions of the ROC at different timesteps of the simulation for a typical simulation run. Each line shows the ROC regarding false and positive classifications of citizens as protesters and nonprotesters by the authority performed at different timesteps.

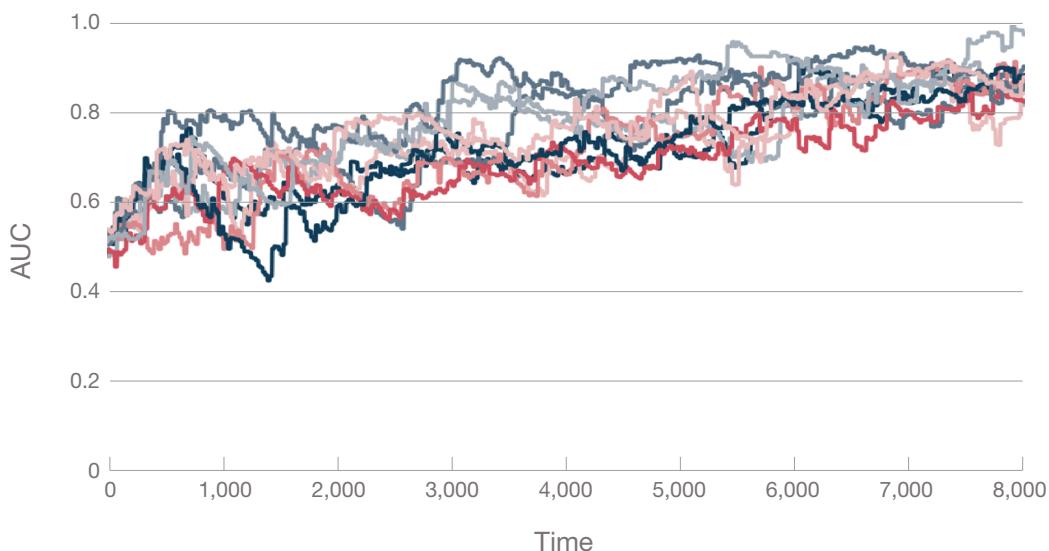
as the network evolves and the authority gains more information, we plot the AUC over time as in Figure 6.6.

These results demonstrate how authorities with access to network data and individual attributes may see both increasing capabilities to predict the size and membership of social movement's active members, while nevertheless being subject to noise. Within this context, the use of AUC on classification tasks provides a basis for comparing alternative ICTs and processes that authorities may employ to understand the behavior of populations and who becomes a protester and who does not. Example changes in ICTs that may affect surveillance capabilities may include the frequency and accuracy of sampling of network ties, and the maintenance and veracity of data on individual identities.

An important variation to the problem of surveillance is one of prediction. Specifically, the problem of classification constitutes a first step in developing a more interesting and complex surveillance capability that uses existing observations of the population to forecast how large a protest may become and who will participate in it.

Summary

This chapter provided a brief glimpse into the dynamics of protests and their surveillance through the lens of networking technologies. The modeling results presented here build on

FIGURE 6.6**AUC over Time for Ten Runs of the Model with the Same Parameters**

NOTE: Each line depicts the AUC of a single simulation run using the same parameters to show how classification performance generally increases over time, as more information becomes available to the authority, but it does not do so monotonically.

the principle of homophily, and its role in mobilization for collective action, while also demonstrating that essential social processes can be analyzed endogenously within the model by simulating how authorities acquire variable quantities and qualities of information that also are subject to technological change. Importantly, these results only begin to scratch the surface of the potential of models of this type. Adding that social influence—the ability of citizens to alter one another's social identity or status as a protester—to the model can add greater complexity and provide insights into whether movements successfully mobilize the population or are demobilized as protesters become increasingly connected to, and more influenced by, nonprotesters. Moreover, strategic interaction between protesters and authorities has not yet been modeled, but intuition suggests that if protesters and their network contacts are subject to arrest, increasingly large and densely connected movements may be easy to disrupt, and alternative structures may be desired in the strategic contest between authorities and those that would challenge them.

Applying Agent-Based Modeling to Social Science and Social Movements

In this chapter, we offer a discursive look at how ABMs may be productively employed in the study of social movements. This discussion includes scientific and policy considerations. Broadly, ABMs offer an opportunity to create deeper ties between empirical analysis, theories of social movements, contentious politics, and computational modeling. A desired approach articulates a methodology that can support and advance basic research—the development of new knowledge regarding the structure and dynamics of social movements—as well as support applied, case-specific analyses that can inform policy choices and actions.

Formal models, both equation-based and algorithmic, have had a long history supporting the study of social movements, contentious politics, and the broader challenge posed by collective action. For example, one of the most famous studies of collective action used formal modeling to explain the counterintuitive finding that special interests with a narrow constituency would be more effective at mobilizing than issues with large, broad constituencies because of the problems posed by free-riders—those individuals who would benefit from action but do not participate based on the assumptions that others will sacrifice for the cause.¹

We argue that ABMs present opportunities to represent a broader range of social behavior and dynamics than traditional equation-based models, and in doing so can facilitate social movement research that (1) extends established quantitative modeling already performed by scholars, (2) integrates multiple levels and units of analysis that would otherwise remain fragmented, (3) facilitates extending existing models and theories to incorporate new variables, such as social media, and, as a result, (4) present policymakers and analysts with the ability to experiment with policy interventions and understand their consequences.

Modeling to Mediate Research Traditions

The social sciences are in the midst of significant methodological change. The ICTs that have affected social movements and social surveillance have created the ability to collect massive

¹ Olson, 1965.

quantities of data, often from new sources, allowing for new insights into social actors and their behavior.² While increases in the quality and quantity of data have captured the imagination of researchers and decisionmakers, the scope of the changes posed by ICTs are far greater than just those resulting from access to new, more, or better information.

The advance of computing power has enabled classes of models to be developed that allow for the algorithmic representation of social actors, their behaviors, and the environments in which they interact. Many of these methods were developed in the early and mid-20th century, including social network analysis (SNA)³ and system dynamics.⁴ However, with the increasing power and availability of computing capabilities since the 1990s, computational modeling methods, including ABMs, have become increasingly capable of modeling systems at large scales, even approaches 1:1 correspondence with referent systems,⁵ employing increasingly realistic interactive structures, such as social and geographic networks,⁶ representing the behaviors of actors as bounded rational satisficers capable of acting with limited information,⁷ all while drawing on increasingly plentiful data.⁸

When taken as a whole, algorithmic models of the social world offer both a “third way” of performing scientific research in which models mediate between theory and data, being neither purely inductive and empirical nor purely deductive and theoretical.⁹ The result is that a laboratory devoted to developing, testing, and experimenting with computational models of the social world, in this case social movements, can bridge the divide between the high-verisimilitude/low-abstraction tradition of naturalistic, small-*N* case-based observational

² Gary King, “The Changing Evidence Base of Social Science Research,” in Gary King, Kay Lehman Schlozman, and Norman H. Nie, eds., *The Future of Political Science: 100 Perspectives*, New York: Routledge, 2009; Rob Kitchin, *The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences*, Kindle ed., Los Angeles, Calif.: SAGE, 2014; Matthew J. Salganik, *Bit by Bit: Social Research in the Digital Age*, Princeton, N.J.: Princeton University Press, 2017.

³ Linton C. Freeman, Linton C., *The Development of Social Network Analysis: A Study in the Sociology of Science*, Vancouver, Canada: Empirical Press, 2004.

⁴ Jay Wright Forrester, *Industrial Dynamics*, Cambridge, Mass.: MIT Press, 1961.

⁵ Robert L. Axtell, “120 Million Agents Self-Organize into 6 Million Firms: A Model of the U.S. Private Sector,” J. Thangarajah, K. Tuyls, C. Jonker, and S. Marsella, eds., *AAMAS ’16: Proceedings of the 2016 International Conference on Autonomous Agents and Multiagent Systems*, Singapore, May 9, 2016.

⁶ Alison J. Heppenstall, Andrew T. Crooks, Linda M. See, and Michael Batty, eds., *Agent-Based Models of Geographical Systems*, New York: Springer, 2011.

⁷ Joshua M. Epstein, *Agent_Zero: Toward Neurocognitive Foundations for Generative Social Science*. Princeton, N.J.: Princeton University Press, 2013.

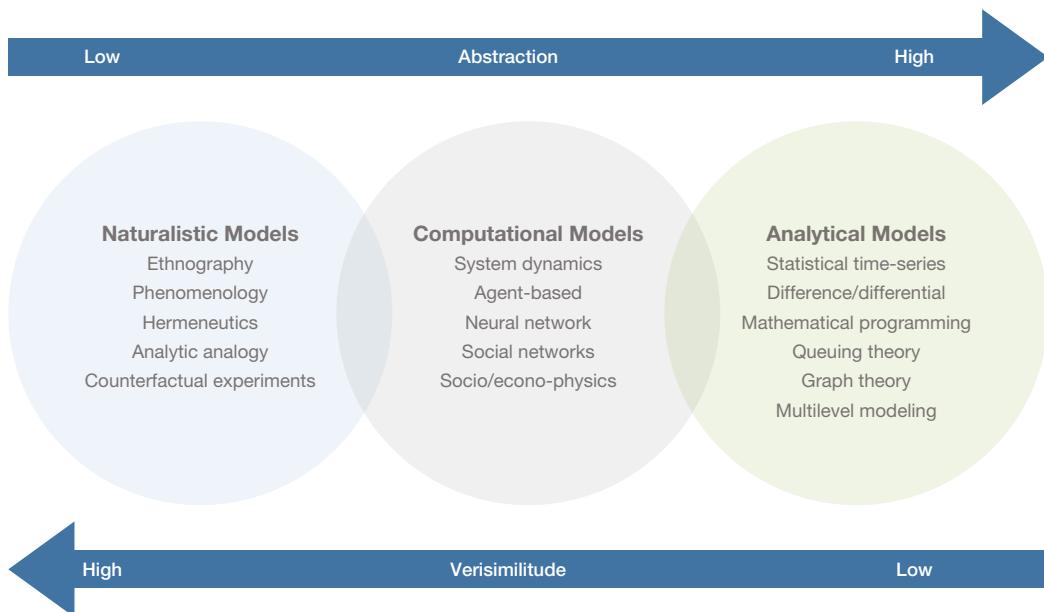
⁸ John Geanakoplos, Robert Axtell, J. Doyne Farmer, Peter Howitt, Benjamin Conlee, Jonathan Goldstein, Matthew Hendrey, Nathan M. Palmer, and Chun-Yi Yang, “Getting at Systemic Risk via an Agent-Based Model of the Housing Market,” *American Economic Review: Papers and Proceedings*, Vol. 102, No. 3, May 2012.

⁹ Robert Axelrod, “Advancing the Art of Simulation in the Social Sciences,” *Complex*, Vol. 3, No. 2, 1997; Mary S. Morgan and Margaret Morrison, *Models as Mediators: Perspectives on Natural and Social Science*, New York: Cambridge University Press, 1999.

research, and the low-verisimilitude/high-abstraction large- N or universal claims posed by more traditional inductive and deductive formal analytic models (see Figure 7.1).¹⁰

Indeed, a frontier topic in ABM research is the “agentization” of more traditional equation-based models. This research seeks to test the robustness of findings derived from established equation-based models by reimplementing these models into ABMs.¹¹ Such a process allows for many subtle, yet significant, changes to how real-world phenomena are handled by formal models. For example, mathematical models may assume that populations or prices are continuous, and therefore infinitely subdividable; they may assume that actors possess internally consistent, well-ordered preferences and employ all available information when making choices; and they may treat all interactions between actors to be equally likely.¹² While tra-

FIGURE 7.1
Computational Models Provide a Middle Ground and the Potential to Unify Alternative Research Traditions in the Social Sciences



SOURCE: Adapted from Desmond Saunders-Newtown, “When Worlds Collide: Reflections on the Credible Uses of Agent-Based Models in International and Global Studies,” in Neil E. Harrison, ed., *Complexity in World Politics: Concepts and Methods of a New Paradigm*, Albany, N.Y.: State University of New York Press, 2006, p. 175.

¹⁰ Desmond Saunders-Newtown, “When Worlds Collide: Reflections on the Credible Uses of Agent-Based Models in International and Global Studies,” in Neil E. Harrison, ed., *Complexity in World Politics: Concepts and Methods of a New Paradigm*, Albany, N.Y.: State University of New York Press, 2006.

¹¹ W. Brian Arthur, “Rendering Conventional Models with Agent-Based Computing,” First International Workshop on Agentization, September 15–17, 2021.

¹² For a deeper articulation of the assumptions commonly built into traditional equation-based models and the need to relax them see Robert Axtell, Alan Kirman, Ian D. Couzin, Daniel Fricke, Thorsten Hens,

ditional equation-based models have proven useful in many research applications, they have also failed to capture much of the complexity of the real world, such as the problems posed by more than two players in social games, each bounded by limited time, attention, and unknown and (internally) inconsistent preferences or goals.

Meeting Two Models in the Middle

Of particular importance for scientific and policy research is the ability to bring multiple models together into a common framework. ABMs provide an opportunity to join alternative models, often representing concepts and phenomenon that exist at different levels of analysis, into a unified model to see how their individual claims interact.

Two models, each directly related to social movements, show the importance of integrating alternative theories (further discussed in the next section) and the potential to use computational models to bridge across models from different traditions. Consider these two models: one a formal mathematical model examining the macroscopic diffusion of riots between populations and the other a graphical model depicting identity activation within individual, microlevel actors that has not been formally expressed in mathematical or algorithmic terms.

The mathematical model, discussed in Daniel Myers's *American Journal of Sociology* article "The Diffusion of Collective Violence: Infectiousness, Susceptibility, and Mass Media Networks,"¹³ represents how riots at one location spread to new locations. Importantly, this model unified four alternative factors regarding (1) the intrinsic characteristics of the population at a given location, (2) the infectiousness of the riot (or other abstract contagion), (3) the susceptibility of the population at a location for becoming "infected" by a riot, and (4) the proximity of each location to other locations. The formal model is shown as follows:¹⁴

$$\lambda_n(t) = \exp\left[\alpha X_n + \sum_{s \in S(t)} (\beta V_s + \gamma W_n + \delta Z_{ns})\right].$$

This formulation calculates the hazard that location n will experience a riot at time t based on its intrinsic features (X_n), the infectiousness of other locations where riots are already occurring (V_s), i.e., location s 's influence over n , n 's susceptibility (W_n) copying the behavior of other locations, and the proximity of location n and s to one another (Z_{ns}). α , β , γ , and δ are estimated parameters that adjust the relative weights of these factors that contribute to diffusion of riot behavior. For the purposes of this chapter, the specific dynamics of the model are

Michael E. Hochberg, John E. Mayfield, Peter Schuster, and Rajiv Sethi, "Challenges of Integrating Complexity and Evolution into Economics," in David S. Wilson and Alan Kirman, eds., *Complexity and Evolution: Toward a New Synthesis for Economics*, Cambridge, Mass.: MIT Press, Strüngmann Forum Reports, 2016; W. Brian Arthur, "Foundations of Complexity Economics," *Nature Reviews Physics*. Vol.3, No. 2, February 2021.

¹³ Daniel J. Myers, "The Diffusion of Collective Violence: Infectiousness, Susceptibility, and Mass Media Networks," *American Journal of Sociology*, Vol. 106, No. 1, July 2000.

¹⁴ Myers, 2000, p. 180.

less interesting than the fact that it represents the types of outputs that formal models provide to researchers and policy analysts.

Alternatively, at the microscopic level of individual actors is a model of identity formation and activation developed by Peter Burke and Jan Stets.¹⁵ Like Myers's diffusion model, Burke and Stets's model of identity dynamics is a set of interactive systems developed through empirical study. Yet, the result is not a formal, mathematical model, but a set of system diagrams displaying the dynamics of identity activation and performance within agents and between them (Figure 7.2).

These models are descriptive, and potentially predictive, depending on the alignment of concepts, how they are operationalized, and the availability of data, and they are increasingly being rendered computationally as ABMs.¹⁶ By implementing these models, researchers have found new opportunities to explore whether the descriptions of cognitive and social processes generate expected outcomes.¹⁷

ABMs offer the opportunity to join these—and many other models that may already exist in formal, mathematical forms—with those that may be described graphically or in text. This middle ground is more than a “third way of science”¹⁸—it represents an opportunity bridge disciplinary and interdisciplinary divides and advance social science and policy analysis by unifying lines of research into models that can serve as tools for triangulating, extending, and comparing theories, and serve as focal points for building communities around which new models, methods, and data may be developed.¹⁹

Given that future social movements serve as both a counter to authoritarian rule—as demonstrated by the case studies presented in Chapters Two through Four—and, unfortunately, a threat to liberal democratic governance—as demonstrated by the organization and mobilization of aggrieved individuals within the United States on January 6, 2021—creating an infrastructure in which many lines of currently fragmented research can be integrated should be a policy and scientific priority.

¹⁵ Peter J. Burke and Jan E. Stets, *Identity Theory*, New York, N.Y.: Oxford University Press, 2009.

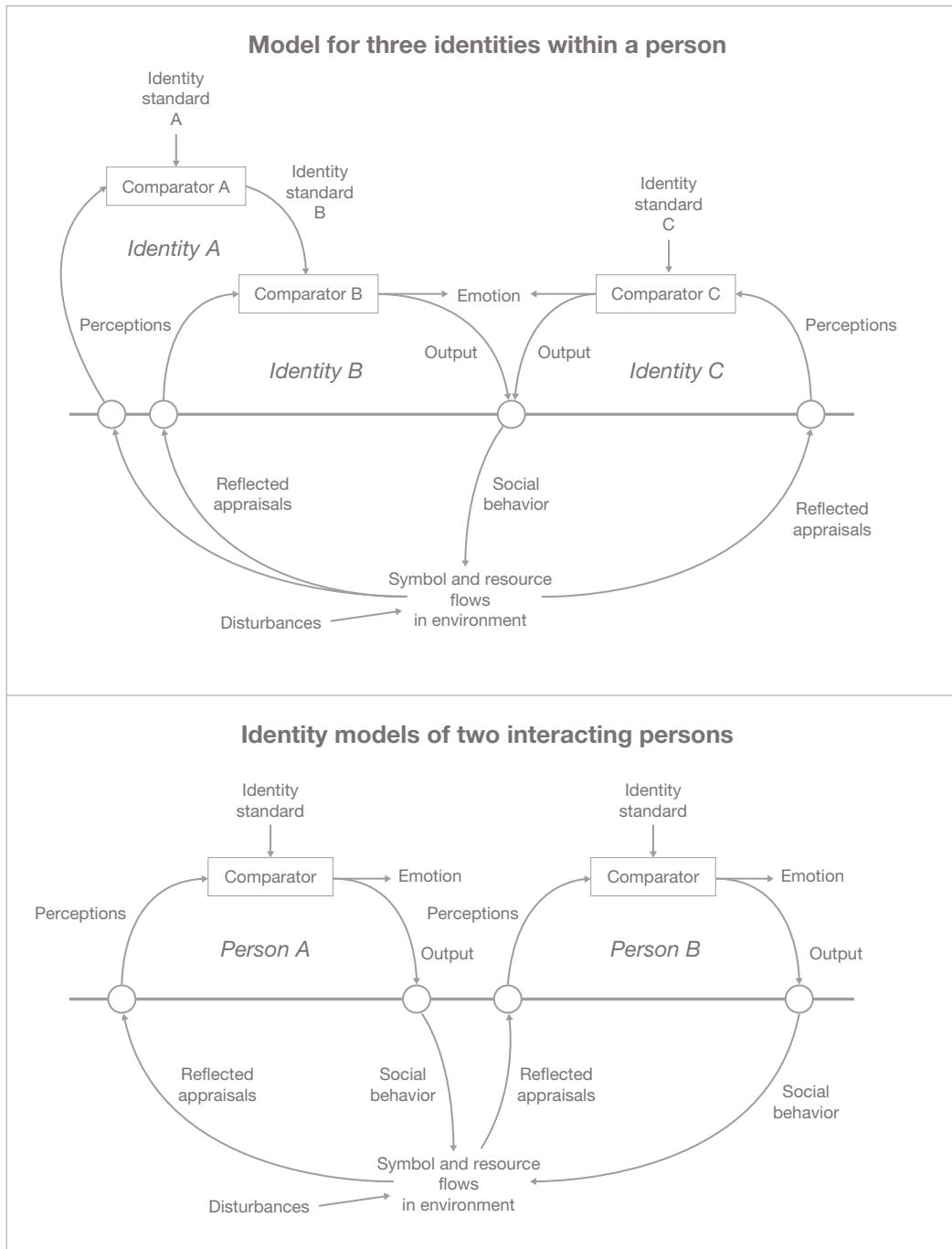
¹⁶ See Jan E. Stets and Richard T. Serpe, eds., *New Directions in Identity Theory and Research*. New York: Oxford University Press, 2016.

¹⁷ Joshua M. Epstein, *Generative Social Science: Studies in Agent-Based Computational Modeling*, Princeton, N.J.: Princeton University Press, 2006; Jason Martinez and Ben G. Fitzpatrick, “The Role of Identity Commitment and Selective Interaction Strategies on the Drinking Behavior of Simulated Agent Interactions,” in Stets and Serpe, 2016.

¹⁸ Axelrod, 1997.

¹⁹ For a thoughtful examination of the role of models in the organization and conduct of social sciences see Hunter Heyck, *Age of System: Understanding the Development of Modern Social Science*, Baltimore, Md.: Johns Hopkins University Press, 2015.

FIGURE 7.2
Models of Identity Interaction Within and Between People



SOURCE: Peter J. Burke and Jan E. Stets, *Identity Theory*, New York: Oxford University Press, 2009, pp. 134 and 149, © Oxford University Press. Reproduced with permission of the Licensor through PLSclear.

Extending Models

ABMs provide an opportunity to extend models quickly, adding new actors and variables to their representation of social phenomenon. While such a capability must be used cautiously—it is easy to add increasing complexity to models to the point they become uninterpretable—a disciplined approach to model building can enable exploratory analysis to support research and policy by providing an inclusive framework for developing and exploring how concepts are related.

Adding Networks to Models of Civil Violence

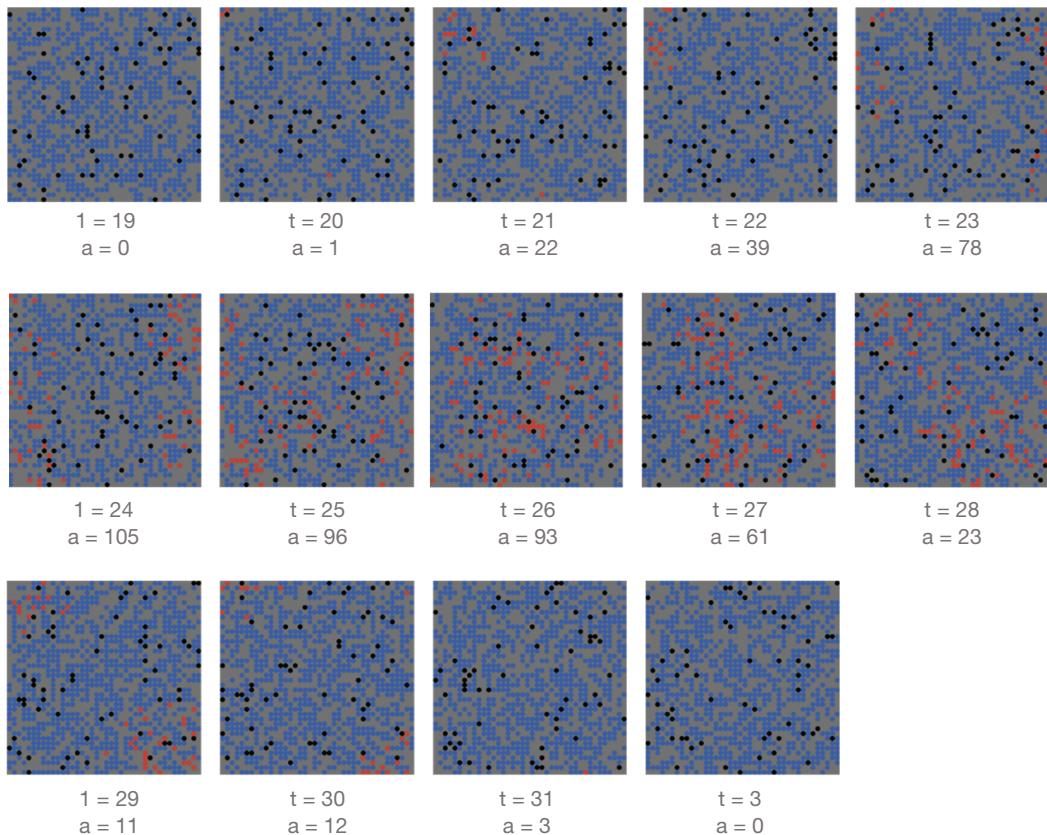
A simple demonstration of how ABMs can quickly be extended to incorporate new variables and behavior is presented below. We show this by taking the network formation model of protesters discussed in Chapter Six and inserting it into Joshua Epstein's model of civil violence.²⁰ While the full details of Epstein's original civil violence model are not discussed here for the sake of brevity, interested readers can find the details in the original sources and in a NetLogo implementation that is included in the default "model library" packaged with the standard NetLogo installation.²¹ The baseline model notes that dissatisfied members of a population will protest against the government and that less aggrieved and more risk-averse citizens will join the protests when they find safety in numbers—that is, when they perceive the number of actively protesting citizens exceed the number of local police, thereby reducing the likelihood the new protesters will be arrested.

A typical example of a protest increasing and then decreasing in size as a result of local social interactions is depicted in Figure 7.3. This figure shows pacified citizens in blue, police in black, and active protesters in red. Each panel in the figure shows the timestep (t) and total number of active protesters (a). A standard progression is that protests emerge and then recede as a result of three processes:

1. A small number of protesters cluster in space, enticing more individuals to join the protest as its size overwhelms the number of local protesters.
2. The size of protest peaks when (a) all aggrieved citizens are protesting or (b) citizens on its periphery cease to find the ratio of active protesters to police within their vision larger than individual tolerance for risk.

²⁰ J. M. Epstein, John D. Steinbruner, and Miles T. Parker, "Modeling Civil Violence: An Agent-Based Computational Approach," working paper, Washington, D.C.: Brookings Institution, January 2001; Joshua M. Epstein, "Modeling Civil Violence: An Agent-Based Computational Approach," *Proceedings of the National Academy of Sciences*, Vol. 99, Suppl. 3, May 14, 2002.

²¹ Uri Wilensky, "NetLogo," webpage, Center for Connected Learning and Computer-Based Modeling, Northwestern University, 1999; Uri Wilensky, NetLogo Rebellion Model," webpage, Center for Connected Learning and Computer-Based Modeling, Northwestern University, 2004.

FIGURE 7.3**A Typical Protest Burst from the Standard Civil Violence Model**

NOTES: A typical progression of a protesting agent population over time, where pacified citizens (blue dots) determine whether to actively protest the government based on their internal grievance levels (turning into red dots) and the number of visible police (black dots) and other protesters: t is the timestep of the model, and a is total number of active protesters for that timestep.

3. The protest declines as police make enough arrests to pacify the population, with all protesters either being arrested or deterred.

A critical feature of the Epstein model is that citizens and police sense their environment locally. They possess a radius of vision in which they can count the number of visible police and the number of active protesters, allowing them to make their own determination as to whether they should join the protest. As suggested by the use of ICTs in Chapters Two, Three, and Four, social movements have fruitfully employed social media platforms to recruit and organize members, even coordinating their actions at the tactical level during protests, thus extending the information available to participants beyond their local observations. The addition of social networking technologies can be simulated by allowing citizens to share their personal, local observations with those they are connected to, thus allowing for

new paths of protest diffusion through the activation of agents that are not in direct physical proximity to one another.

This combined model, then, blends a spatially explicit model, in which the physical location of agents has direct effects on their behavior, with a nonspatial model of network formation that provides new and often divergent perspectives on agent's perceptions of their local environment. This new model replicates the results of the original Epstein model when extended communications between agents is not permitted, effectively setting outreach and networking parameters to zero, ensuring that any subsequent changes in outcomes can be attributed to the new features of the model. However, with the inclusion of these features, a new and counterintuitive pattern of behavior emerges.

The changing dynamics introduced by networking are shown in Figure 7.4. In these plots, the horizontal axis depicts the log of the protest size, and the vertical axis shows the log of the count of protests of that size over 1,000 simulation ticks. By projecting protest size and frequency counts into log-log space, the large, low-frequency events can be seen clearer. Importantly, these results depict typical runs for the given parameter settings, and while stochastic variance is expected, the general structure of protest sizes and frequencies is stable across parameter settings.

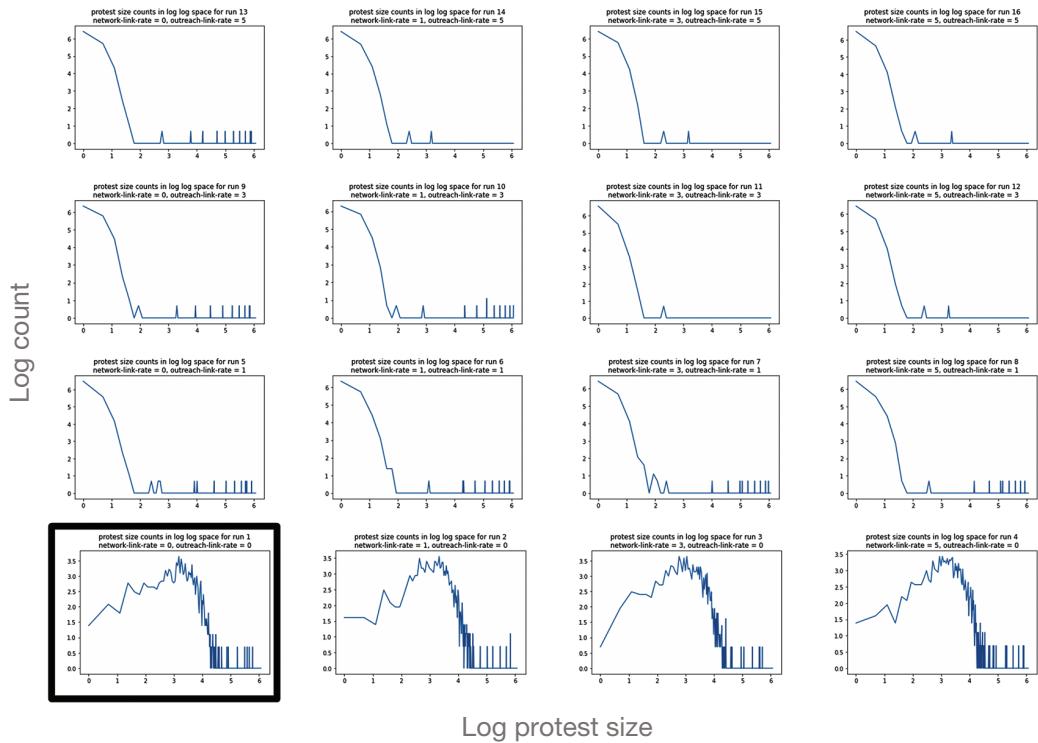
The bottom row of Figure 7.4 contains the baseline run with outreach and networking set to zero surrounded by the black box, and then three additional runs with networking set to 1, 3, and 5. Because networking relies on friends-of-friends to form links, without any outreach capabilities no networks form, as no citizens have any links to build from. As a result, each of these plots shows similar patterns of behavior, with minor differences in very large-scale, low-frequency events that characterize the peak observed protest sizes.

By contrast, the introduction of outreach capabilities that enable networks amongst citizens to grow alters the structure of protests. Specifically, every panel with outreach enabled (all except the bottom row of Figure 7.4) shows a higher frequency of small protests and smaller number of large protests when compared with the baseline cases. These indicate that when citizens are sharing information over social networks, the middle range of protest sizes practically vanishes, and the result is that the overwhelming majority of timesteps have very small protests and a small number of large protests occur. This change results from the sharing of information distorting what agents believe about the size of those committed to protesting and therefore their relative risk of being arrested for also protesting. Thus, citizens become active protesters faster, with a distorted understanding of their risk of being arrested resulting in a steady stream of active protests that are easily contained by police.

The combination of models—Epstein's original spatial model and the network formation model from Chapter Six—reveals how non-local information affects and distorts local perceptions of risk leading to qualitatively different patterns of protest. By distorting risk perceptions, aggrieved agents are more likely to protest when it is disadvantageous to do so, resulting in many small protests that are easily handled by police forces, with fewer large-scale demonstrations. Importantly, this counterintuitive result may be evident when examining

FIGURE 7.4

Typical Protest Size Distributions for 1,000 Timesteps with Networking and Outreach Enabled



NOTES: The panels depict the results of 16 simulation runs of 1,000 timesteps varying the networking and outlook parameters, setting each to the values of 0, 1, 3, or 5. Each run produces a different distribution of protest sizes depicted in log-log space. The arrangement of the panels shows the networking parameter value increasing horizontally and the outreach parameter increasing vertically, with the bottom-left (bold border) panel representing the default model with all networking parameters set to zero.

any of the two models joined here in isolation, but only apparent when they are combined, allowing for feedback between nonspatial information and risk perception to occur.

A more detailed formal analysis of the combined model is not presented in this chapter for the sake of brevity and relevance. The purpose here is not to examine the full consequences of networking within the civil violence model, but rather provide a simple demonstration of how such an analysis could easily proceed by combining and extending ABMs. In doing so, new lines of investigation are opened that raise new questions that may be of interest to researchers and policymakers alike as variables present in one model share the interpretation and manipulation of another. For example, are social network ties between citizens decreased when they are arrested and sent to jail? Does being in jail create new social networking opportunities between citizens? Does mischaracterizing citizens as protesters result in false arrests that may alter the structure of grievances within the population? Do citizens move strategically based on the location of others in their social networks or shared information regard-

ing the location of police? Are grievances within the population correlated with agent attributes or types—for example, do bikers and bankers have different levels of trust, confidence, and commitment to the government and its legitimacy? Each of these questions reveals how extending models may reveal additional insights that can aid in determining the robustness of established findings, identifying alternative explanations of events, and opening new frontiers for theoretical and empirical exploration, thus deepening research and analysis.

Experimenting with Policy

The benefits of an SBML devoted to the modeling of social movements and contentious politics have emphasized the benefits to research, primarily as a matter of theory building and assessment. However, an ABM-based SBML offers additional opportunities to inform policy. As already noted, ABMs can be quickly adapted and extended, which presents a special property for policymakers and analysts, who often encounter unanticipated and complex events for which a large body of robust social science research may not be available to draw upon.

The speed of model development and assessment is consequential and rests on three factors: (1) an existing modeling infrastructure and set of models are already computationally extant, (2) resident expertise covering both the existing models and pressing policy matters, and (3) access to policymakers and their analytic staff, data, computing power, and additional resources that enable the tailoring of generalized models to address situationally specific circumstances of interest and can serve as an invested audience that can guide model-based analysis in directions relevant to decisionmaking needs. Absent any of these three factors, the ability to bring ABMs into the orbit of real-world decisionmaking is suspect, either being too slow to operate on relevant timelines, too abstract or misguided to be relevant to decisionmaking needs, or both.

An important distinction between employing ABMs in an SBML for policy versus research concerns trade-offs between rigor and explanation. Given their high dimensionality and propensity for complex interactions, effective analysis often proceeds slowly, employing carefully constructed experiments to isolate each feature of a model to better understand how they affect the dynamics of the complex system. Such rigor is required to advance the scientific understanding of phenomenon. However, in a policy environment, ABMs present the opportunity to develop and communicate causal stories or analytic narratives whose outputs can be rendered closer to the presentation of naturalistic methods, making them easier for nonspecialist policymakers and their staffs to understand.

On this point, an important divergence exists between science and policy. Science tends to value research results that are derived from analytic methods that are proven true, rather than results from simulations that (1) may be contingent on the selection of solution heuristics, (2) may not be reproducible, (3) may contain software artifacts, a nontrivial possibility as programs become increasingly complex, and (4) cannot guarantee that additional simulation

results will always confirm prior ones.²² Yet, in a policy context, decisionmakers are often far more comfortable with uncertainty and cannot afford to wait until findings can be proven.²³ Instead, a premium is placed on information that is understandable, both in terms of its substance and limitations, over information that may be reliable but not understandable.

Modeling Policy Options and Consequences of Information and Communications Technologies and Social Movements

As discussed in prior chapters, ICTs are reshaping social movements. Their changes range from issues of tactical command and control via real-time, mobile communications, to strategic considerations of framing, recruitment, and resourcing. ICTs sit behind a vast array of changes in society, each affecting the balance of power between those engaged in contentious politics, including social movements. For example, in open societies, legal and illegal access to digital information has brought state, corporate, and personal secrets into the public sphere, often to advance mobilizing narratives of victimization²⁴ and inequality, as demonstrated by the public response to the Panama Papers.²⁵ Likewise, influential actors have found it increasingly difficult to remain on the sidelines of contentious issues, as U.S. corporations have faced pressure from activists to publicly oppose changes to state voting laws following the 2020 presidential election.²⁶

Simultaneously, ICTs have reinvigorated authoritarian states, providing them with newfound powers to control and manipulate information. The exuberance over the internet's ability to connect people through social media and provide platforms generating content has

²² Peter Godfrey-Smith, “Induction, Samples, and Kinds,” in Joseph Keim Campbell, Michael O’Rourke, and Matthew H. Slater, eds., *Carving Nature at Its Joints: Natural Kinds in Metaphysics and Science*, Cambridge, Mass.: MIT Press, 2011.

²³ Francis X. Diebold, Neil A. Doherty, and Richard J. Herring, eds., *The Known, the Unknown, and the Unknowable in Financial Risk Management: Measurement and Theory Advancing Practice*, Princeton, N.J.: Princeton University Press, 2010; Thomas Fingar, *Reducing Uncertainty: Intelligence Analysis and National Security*, Stanford, Calif.: Stanford University Press, 2011.

²⁴ On the broad importance of narratives of victimization as a basis for collective identity formation see Lawler, 2008.

²⁵ The 2016 Panama Papers consisted of a leak of more than 11 million documents that revealed a vast network of companies, foundations, trusts, banks, and governments that were involved in tax avoidance and fraud. See Andy Greenberg, “How Reporters Pulled Off the Panama Papers, the Biggest Leak in Whistleblower History,” *Wired*, April 4, 2016; International Consortium of Investigative Journalists, “The Panama Papers: Exposing the Rogue Offshore Finance Industry,” webpage, undated; Frederik Obermaier, Bastian Obermayer, Vanessa Wormer, and Wolfgang Jaschensky, “About the Panama Papers,” *Süddeutsche Zeitung*, undated.

²⁶ Melanie Mason and Seema Mehta, and Seema Mehta, “‘There Is No Middle Ground’: Corporate America Feels the Pressure on Voting Rights,” *Los Angeles Times*, April 2, 2021.

given way to concerns over algorithmically enabled social surveillance and computational propaganda.²⁷

A pressing policy issue is developing an understanding of how the subtleties of ICTs and their developments may bias the balance of power between social movements and governments (including the ability of governments to generate, coopt, align with, mobilize, or otherwise harness movements in their defense). More formally, frontier policy issues at the intersection of democracy, security, and technological investments may ask whether certain aspects of ICTs may be more or less beneficial to the development and sustainment of open societies versus authoritarian regimes.

Answering this question may rest on teasing out the observed and potential relationships between the dimensions of computing power and the affordances they provide to actors in the social world. Computing capabilities can be decomposed into three elements: networking, processing, and storage (Figure 7.5). Together, they provide a combination of affordances that undergird modern ICTs, running the gamut from cellular telephones, social media applications, Internet-of-Things (IoT), and big data processing that undergirds modern machine learning (ML) and artificial intelligence (AI), and yet each uses processing power, data storage, and connectivity in different ways.

Networking Technology

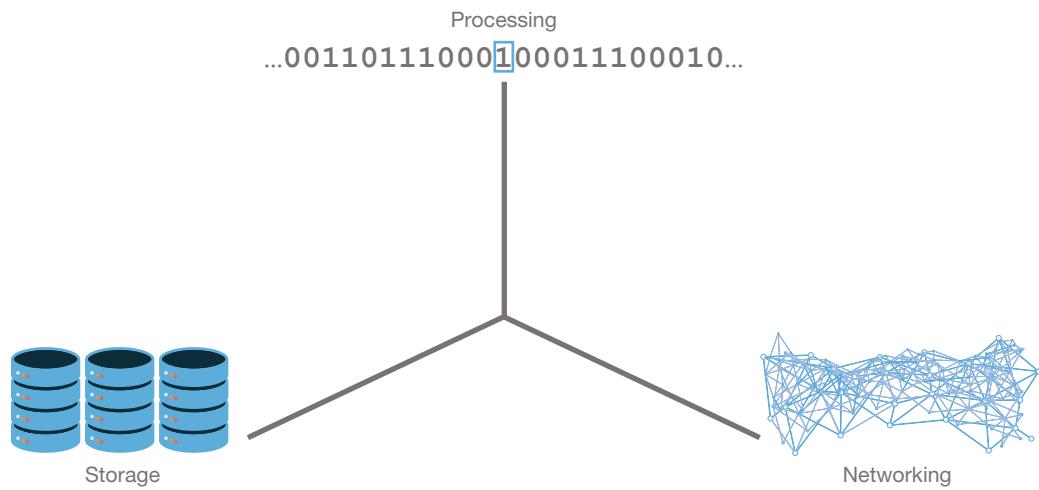
The belief that ICTs, most prominently the networking capabilities provided by the internet, facilitate communication and coordinated action has become commonplace. However, this has not always been the case. While activists in social movements have experimented with and embraced technologies for generating and distributing messages that promote their cause, using computing resources to extend and organizational structures has been viewed with greater skepticism.²⁸ Indeed, research on computer usage by social movements conducted in the 1990s noted that adoption was limited by the belief that effective use required high levels of expertise that were usually not available to organizations and activists in large quantities.²⁹ Importantly, this suggest that generalizations about social movements may adopt and adapt to new technologies should not be accepted uncritically—some may eschew

²⁷ Nicholas D. Wright, ed., *AI, China, Russia, and the Global Order: Technological, Political, Global, and Creative Perspectives*, Strategic Multilayer Assessment Periodic Publication, December 2018; Fan Liang, Vishnupriya Das, Nadiya Kostyuk, and Muzammil M. Hussain, “Constructing a Data-Driven Society: China’s Social Credit System as a State Surveillance Infrastructure,” *Policy & Internet*, Vol. 10, No. 4, 2018; Samuel C. Woolley and Philip N. Howard, eds., *Computational Propaganda: Political Parties, Politicians, and Political Manipulation on Social Media*, New York: Oxford University Press, 2018; Steven Feldstein, “The Global Expansion of AI Surveillance,” Washington, D.C.: Carnegie Endowment for International Peace, September 17, 2019.

²⁸ For example, in a set of interviews conducted with environmental activists during the early 2000s, noted group members approached internet-enabled communication with caution. See Jenny Pickerill, *Cyberprotest: Environmental Activism Online*, New York: Manchester University Press, 2003.

²⁹ Daniel J. Myers, “Communication Technology and Social Movements: Contributions of Computer Networks to Activism,” *Social Science Computer Review*, Vol. 12, No. 2, July 1994.

FIGURE 7.5
Elements of Computing



NOTES: There are three dimensions of computing power:

1. Networking considers the extent to which data can be moved across processing and storage components. This includes across separate devices, such as personal computers, cell phones, and servers within data centers, and within computers, such as bus speeds, memory, and interconnects that move data across specialized components, such as central processing unit (CPU) cores or to multiple graphics processing units (GPUs).
2. Processing considers the speed and scale at which machines can transform data inputs into outputs.
3. Storage considers the amount of data that can be captured and retrieved for transmission and processing, including via hard drives, solid state memory and random access memory (RAM).

beneficial technologies that could securely increase their access to motivated people and resources, while others may enthusiastically adopt technologies that may prove ineffective or even expose leaders and members to increased risk from those they oppose.

Currently, uncertainties exist over the role of networking technologies in social movement participation and activation. Divisions exist over whether enabling activism online translates into real-world expressions of behavior. Terms such as “desktop activism” and “slacktivism” have emerged as a critique of those whose support for social movements amounts to cheap talk—low-cost actions with no tangible real-world effects or risks.³⁰ Additionally, governments have questioned whether it is better for those who are committed activists to be able to act online rather than in the real world. As observers noted, shutting down the internet

³⁰ Pickerill, 2003; Jennifer Earl, Jayson Hunt, R. Kelly Garrett, and Aysenur Dal, “New Technologies and Social Movements,” in Della Porta and Diani, 2015a.

in Egypt during the Arab Spring protests made the crowds larger, as people who would have remained online spilled into the streets.³¹ As one writer puts it,

A prime reason that so many went to Tahrir Square was the Mubarak regime's mistake of shutting down most Internet access when the initial protests began in late January, leaving Egypt's urban youth without an online outlet and forcing them to express themselves the old-fashioned way.³²

Since the Arab Spring, many authoritarian states have enhanced their ability to monitor internet networks. These governments have enhanced their capabilities to directly monitor, control, and impede internet networking traffic—starting from simplistic censorship to sophisticated cost-imposing strategies designed to disrupt and degrade the capacity of activists to organize.³³ Moreover, internet organizations have proven to be lucrative sources of information for government regimes looking to monitor and censor activists, using overt means to influence organizations that possess sensitive user data and provide services, as well as covertly target organizations in order to gain access to sensitive data.³⁴ Indeed, the network space that was previously a safe place for dissent has become increasingly policed and hazardous, ironically leading to increasingly divergent views regarding the efficacy of supporting protests online, where relatively benign activities, such as liking a Facebook page or retweeting a blog post, can carry real-world penalties.³⁵

Policy questions regarding networking technologies may point to two areas of investigation. The first is the differential effects of social networking capabilities in open versus closed societies, particularly with respect to strategies for growing networks that are robust to surveillance and penetration versus strategies for surveillance and disruption. Of increasing

³¹ Gary R. Bunt, "Mediterranean Islamic Expression and Web 2.0," in Cesare Merlini and Oliver Roy, eds., *Arab Society in Revolt: The West's Mediterranean Challenge*, Washington, D.C.: Brookings Institution Press, 2012.

³² Michael S. Doran, "The Impact of New Media: The Revolution Will Be Tweeted," in Kenneth M. Pollack and Daniel L. Byman, eds., *The Arab Awakening: America and the Transformation of the Middle East*, Washington, D.C.: Brookings Institution Press, 2011, p. 44.

³³ Mike Orcutt, "A Peek Behind China's 'Great Firewall,'" *MIT Technology Review*, June 13, 2012; Gary King, Jennifer Pan, and Margaret E. Roberts, "How Censorship in China Allows Government Criticism but Silences Collective Expression," *American Political Science Review*, Vol. 107, No. 2, May 2013; Margaret E. Roberts, *Censored: Distraction and Diversion Inside China's Great Firewall*, Princeton, N.J.: Princeton University Press, 2018.

³⁴ Ellen Nakashima and Greg Bensinger, "Former Twitter Employees Charged with Spying for Saudi Arabia by Digging into the Accounts of Kingdom Critics," *Washington Post*, November 6, 2019; Jonathan Shieber, "Zoom Admits to Shutting Down Activist Accounts at the Request of the Chinese Government," *TechCrunch*, June 11, 2020.

³⁵ Hank Johnston, "'The Game's Afoot' Social Movements in Authoritarian States," in Della Porta and Diani, 2015a; An Xiao Mina, *Memes to Movements: How the World's Most Viral Media Is Changing Social Protest and Power*, Boston, Mass.: Beacon Press, 2019.

interest is the need to do so within the bounds of open societies, in which situational awareness of social movement membership and activation can be maintained without impinging on the freedom of individuals to assemble (physically or virtually) and express their grievances.

The second area is the need to link front-end tactical observations of networking capabilities used for the command and control of collective action with the longer-term strategic needs of identity formation and activation that produces the pipeline of supporters and participants. On this level, questions about social movements and technology largely shift from matters of organization and action to communication, recruitment, and polarization.³⁶ Here, the shaping of identities to motivate action are where networking technologies interact most profitably with the other elements of computing technology—processing and storage—as these other elements provide capabilities that develop and analyze the content of communications between agents and channel attention in productive pathways—for example, the microtargeting capabilities adapted from commercial businesses and political campaigns.

Processing Technology

By using data collected via networked information systems and analyzing these datasets of increasingly large size and diversity, analytics are playing an increasingly important role in shaping the political behavior and realities of governments and those they govern.³⁷ The role of analytics (including AI and ML technologies), the most obvious hallmark of processing technologies, may be less familiar to social movement researchers, but present the tools that policymakers and analysts will be reliant on in one form or another when dealing with contentious politics. Processing technologies based on sophisticated online data collection and experiments, include content generation, such as memes and deep fake videos, and distribution via targeted information campaigns. The integrated use of these analytic capabilities was shown during the 2016 Brexit and U.S. presidential campaigns, in which the integrated harvesting of personal profiles from social media networks was used to design and administer surveys to refine psychological profiles of users and target populations, which subsequently employed to design propaganda and target users through online advertising.³⁸

Competitive strategies for social movements are evolving in new ways, fusing economic and lifestyle choices with political preferences and expression—effectively turning daily life

³⁶ Jo Reger, Daniel J. Myers, and Rachel L. Einwohner, eds., *Identity Work in Social Movements*. Minneapolis, Minn.: University of Minnesota Press, 2008; Woolley and Howard, 2018.

³⁷ Kitchin, 2014.

³⁸ Sean Illing, “Cambridge Analytica, the Shady Data Firm That Might Be a Key Trump-Russia Link, Explained,” *Vox*, October 16, 2017; Carole Cadwalladr and Emma Graham-Harrison, “Revealed: 50 Million Facebook Profiles Harvested for Cambridge Analytica in Major Data Breach,” *The Guardian*, March 17, 2018; Carole Cadwalladr, “Arron Banks, Brexit and the Russia Connection,” *The Observer*, June 16, 2018; Alvin Chang, “The Facebook and Cambridge Analytica Scandal, Explained with a Simple Diagram,” *Vox*, March 23, 2018; Carole Cadwalladr, “Mueller Questions Cambridge Analytica Director Brittany Kaiser,” *The Guardian*, February 17, 2019a; Carole Cadwalladr, “Cambridge Analytica a Year On: ‘A Lesson in Institutional Failure,’” *The Guardian*, March 17, 2019b.

into an opportunity to signify support for political causes, resulting in assortative mixing.³⁹ The ability to analyze corporate board membership, supply chains, business practices, and more has the potential to transform social movements into broader cultural ones that can affect the flow of resources within the economy and society. In doing so, all of society may become politicized, as the distinction between the public and private is blurred, as demonstrated by the collision between the political preferences of business owners and those of consumers. In the United States, a long list of businesses have been scrutinized for their owner's personal or official positions on political or social matters as a litmus test for consumers' commitments to various causes.⁴⁰ As Quentin Fottrell noted, the shift in public and corporate support for Black Lives Matter and social justice coincided: "I don't believe the Black Lives Matter movement would have spurred a reckoning that reached the C-suites of corporate America had companies not had one eye on the social-justice movement, and the inequalities of race in America, and the other eye on their bottom lines."⁴¹ Likewise, while the protests in Hong Kong regarding the increasing encroachment by China on its local autonomy have garnered headlines, the protest movement has been backstopped by a less visible but influential economic campaign of targeting businesses to boycott or patronize based on their respective ties to China.⁴² Access to processing power, and the data to process, will likely amplify social movements, as analytics can discover inequalities that fuel grievance and efficiently target individuals and subgroups that can be persuaded to mobilize.

By contrast, social theorists have long regarded surveillance as a means for extending governmental power, noting that citizens modulate their behavior to align with observers' expectations.⁴³ While processing power has enabled the development of intricate machinery for identity formation, activation, and political mobilization, emerging systems of government censorship and information manipulation for the purposes of demobilizing populations are developing and expanding.⁴⁴ The most ambitious system to date is the Chinese social credit system (Figure 7.6). This system does more than monitor the public behavior of

³⁹ DellaPosta, Shi, and Macy, 2015.

⁴⁰ Alex Abad-Santos, "Why the Social Media Boycott over Colin Kaepernick Is a Win for Nike," *Vox*, September 4, 2018; R. J. Casey, "It Is Time to Boycott Marvel," *Comics Journal*, August 14, 2019; Dan Q. Dao, "So Is It Okay to Eat at Chick-Fil-A Now?" *Delish*, December 12, 2019; David Yaffe-Bellany, "Chick-Fil-A Stops Giving to 2 Groups Criticized by L.G.B.T.Q. Advocates," *New York Times*, November 18, 2019; Quentin Fottrell, "I Told My Family I Boycotted Chick-Fil-A over Its Support of Anti-LGBTQ Causes—Now They 'Like' It on Facebook and Go There for Lunch," *MarketWatch*, August 1, 2020.

⁴¹ Fottrell, 2020.

⁴² Hannah Beech, "Yellow or Blue? In Hong Kong, Businesses Choose Political Sides," *New York Times*, January 19, 2020; Simon Shen, "How the Yellow Economic Circle Can Revolutionize Hong Kong," *The Diplomat*, May 19, 2020.

⁴³ Steph Lawler *Identity: Sociological Perspectives*, Malden, Mass.: Polity Press, 2008, pp. 61–63.

⁴⁴ Roberts, 2018; Woolley and Howard, 2018; Kai Strittmatter, *We Have Been Harmonized: Life in China's Surveillance State*, New York: Custom House, 2020; Bertelsmann Stiftung, "China's Social Credit System," infographic, undated.

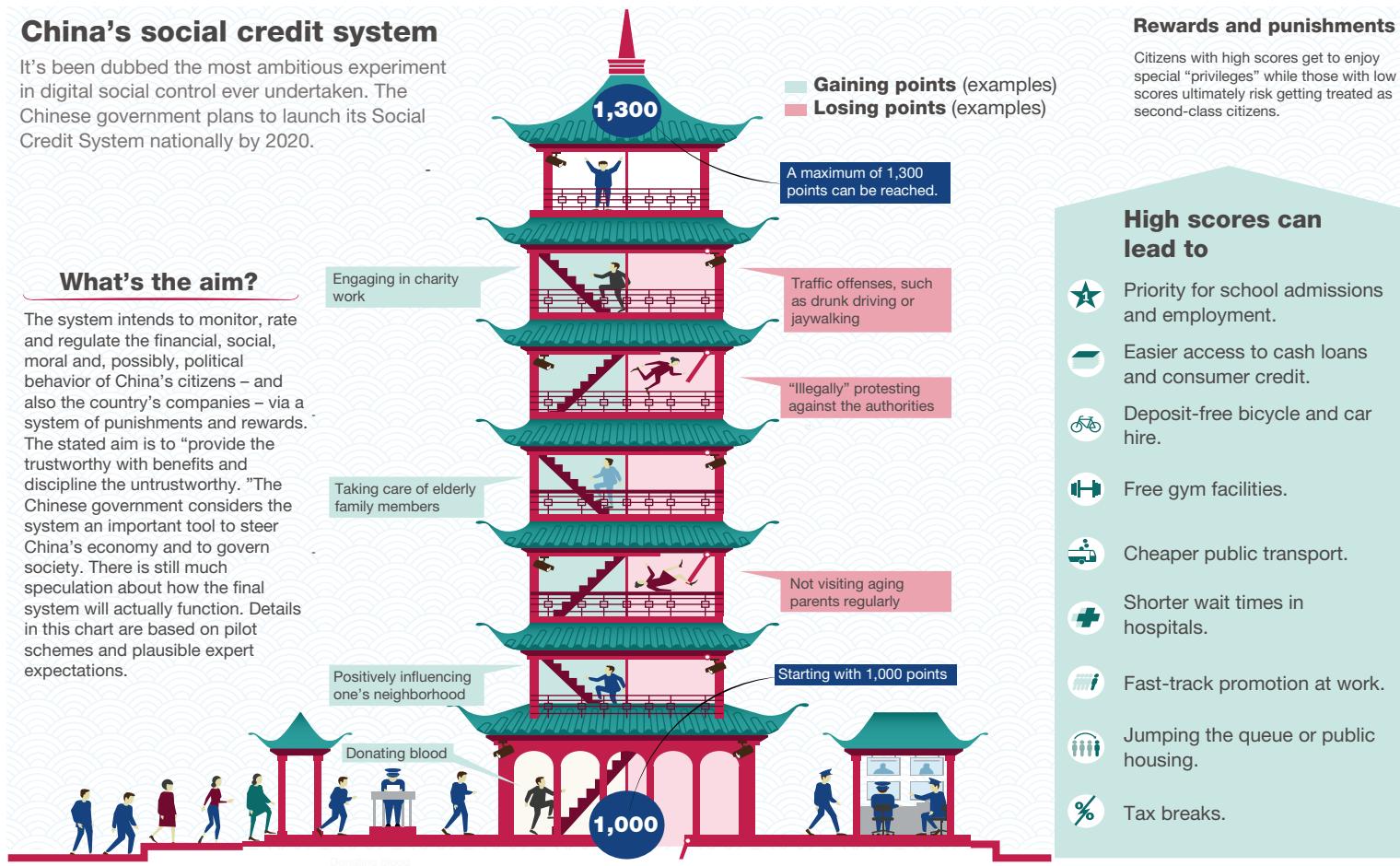
FIGURE 7.6
The Chinese Social Credit System

China's social credit system

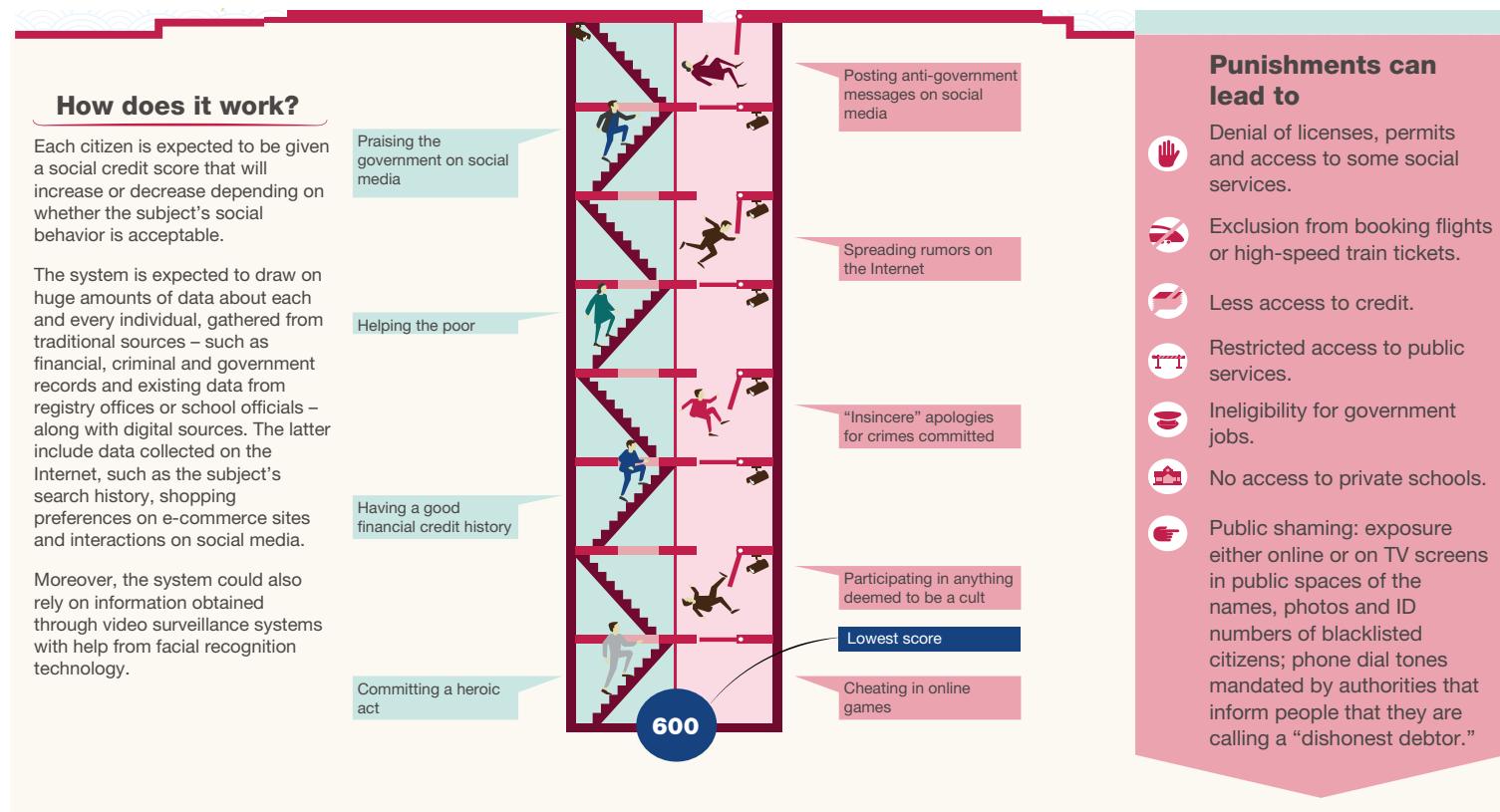
It's been dubbed the most ambitious experiment in digital social control ever undertaken. The Chinese government plans to launch its Social Credit System nationally by 2020.

What's the aim?

The system intends to monitor, rate and regulate the financial, social, moral and, possibly, political behavior of China's citizens – and also the country's companies – via a system of punishments and rewards. The stated aim is to "provide the trustworthy with benefits and discipline the untrustworthy." The Chinese government considers the system an important tool to steer China's economy and to govern society. There is still much speculation about how the final system will actually function. Details in this chart are based on pilot schemes and plausible expert expectations.



The Chinese Social Credit System—Continued



citizens through a massive network of physical, economic, and cyber surveillance. The novelty of the system lies in its employment of algorithms to score citizens and businesses based on their observable behavior and accordance with regulations and societal ideals. Feedback between observable behavior and rewards and punishments positions citizens under the control of algorithms.

Pressing policy issues pertain to how to better understand whether analytics, including AI and ML capabilities, are more capable of dividing, rather than unifying, society by exacerbating inequalities and amplifying the natural tendencies for social systems to self-segregate.⁴⁵ Equally important are issues of how to undermine social surveillance algorithms in order to create space to organize and operate within closed societies. Analytics may ultimately transform how social movements and contentious politics operate, but, in doing so, the ability to collect and retain data becomes a critical capability.

Data Storage

The importance of data storage technologies exists at three levels. At the most basic level, the ability to store increasingly large quantities of information in long- and short-term memory on computers has served as the bedrock of technical advances, most prominently in the domain of analytics previously noted. Second, when connected to information networks, data storage has enabled the collection of big data, whether through large-scale static analytics or streaming in-memory. Third, stored data itself has become a valuable target for politically motivated actors, and while certainly not always big data, the competition to keep information private or render it transparent has become part of the larger domain of contentious politics.

Hadoop, Spark, NoSQL and graph databases, JSON file formats, and more sit beneath data collection, search, retrieval, and analytic capabilities that enable networking and processing to occur. These technologies have enabled the creation of massive datasets that serve as the engine of contemporary research in ML and AI, as well as in other fields, such as bioinformatics through the creation and maintenance of gene sequence databases.⁴⁶ Likewise, big data has enabled a second generation of computational social science (CSS) to emerge, based on the ability to identify structure and patterns in massive datasets generated by human activity,

⁴⁵ Kate Crawford, “The Hidden Biases in Big Data,” *Harvard Business Review*, April 1, 2013; Andres O’Hara, “Is Gentrification Fueling More 311 Calls & Police Harassment?” *Gothamist*, June 29, 2018; Karen Hao, “Police Across the U.S. Are Training Crime-Predicting AIs on Falsified Data,” *MIT Technology Review*, February 13, 2019; Will Douglas Heaven, “Predictive Policing Algorithms Are Racist. They Need to Be Dismantled,” *MIT Technology Review*, July 17, 2020.

⁴⁶ Alon Halevy, Peter Norvig, and Fernando Pereira, “The Unreasonable Effectiveness of Data,” *IEEE Intelligent Systems*, March/April 2009; Terrence J. Sejnowski, *The Deep Learning Revolution*, Cambridge, Mass.: MIT Press, 2018a; Terrence J. Sejnowski, “Why Data Is the New Oil: What We Mean When We Talk about ‘Deep Learning,’” *Salon*, November 4, 2018b; National Center for Biotechnology Information, “GenBank Overview,” webpage, undated.

such as social media, economic transactions, and mobility.⁴⁷ This approach to social science differs from prior approaches to CSS, in which humans, individually and collectively, were viewed as boundedly rational information-processing agents.⁴⁸

In the context of social movements, the potential for aggregating information containing known features and the potential discoveries that they may offer may put individuals and groups at risk. For example, in 2013, researchers demonstrated that highly aggregated cellular phone location data could nevertheless be disaggregated to identify individual users.⁴⁹ Six years later, the *New York Times*'s Privacy Project gained access to a file containing 50 billion location datapoints from 12 million cellular phones over several months during 2016 and 2017.⁵⁰ Analysts were able to identify individuals and locations, including classified locations and the home addresses of senior government officials and celebrities, from this dataset.

Policy issues associated with data storage technologies may consider a variety of questions that serve as enablers of networking and processing. For example, can storage technologies be designed with built-in limitations regarding the retention or transmission of data, inhibiting the creation of larger, permanent datasets that may put individuals at risk? Indeed, it may be the case that, in closed societies, social movements may have the greatest longevity if individuals can communicate to coordinate their actions, without creating records of their interactions that can be collected and aggregated for use by other parties, whereas, in open societies, decreasing access to information and transparency would undermine democratic governance.

In each of these cases, policymakers are confronting the need to prioritize investments in technologies and would benefit from studies and analyses that align their choices with broader social and political objectives and values. While it is generally assumed that science provides the basis upon which policy can be made, the reality is often more complex. The state of social movement research is evolving, and although the internet's role in their evolution and contentious politics more broadly is squarely in the researcher's focus, the questions regarding how technical affordances affect these movements is ahead of what deep, rigorous scholarship can answer. Thus, as is often the case, the needs of applications often precede what researchers have been able to investigate in-depth. An ABM-based SBML, then, offers a surprising capability: to quickly develop needed models, often from parts already extant

⁴⁷ David Lazer, Alex Pentland, Lada Adamic, Sinan Aral, Albert-László Barabási, Devon Brewer, Nicholas Christakis, Noshir Contractor, James Fowler, Myron Gutmann, et al., "Computational Social Science," *Science*, Vol. 323, No. 5915, February 6, 2009; Stanford University, "Center for Computational Social Science," webpage, undated; Salganik, 2017.

⁴⁸ Herbert A. Simon, "Bounded Rationality in Social Science: Today and Tomorrow," *Mind & Society*, Vol. 1, No. 1, March 2000; Epstein, 2006; Aaron Frank, "Computational Social Science and Intelligence Analysis," *Intelligence and National Security*, Vol. 32, No. 5, May 22, 2017.

⁴⁹ Yves-Alexandre de Montjoye, César A. Hidalgo, Michel Verleysen, and Vincent D. Blondel, "Unique in the Crowd: The Privacy Bounds of Human Mobility," *Scientific Reports*, Vol. 3, March 25, 2013.

⁵⁰ Stuart A. Thompson and Charlie Warzel, "Twelve Million Phones, One Dataset, Zero Privacy," *New York Times*, December 19, 2019.

from research, that provide a means for structuring and explicating policy analysis, focusing attention on understanding and intervention. While caution is needed—models that simulate social processes and policy actions for insight should not be confused with models that have been carefully research and vetted as part of the scientific process—the opportunity to blend the formality of mathematical approaches with the accessibility and descriptive power of naturalistic ones, again, places computation in the position of adding rigor and transparency where it is most needed.

Conclusion

The purpose of this study was to demonstrate the application of ABMs for the study of social movements, and specifically to consider how to better understand the importance of ICTs in enabling or hindering the effectiveness of collective action. We began with a review of three recent case studies from Egypt, Syria, and Hong Kong. The analysis from these cases suggested that the capacity for technology to connect people is a key factor for how these movements evolved over time, and that governing regimes are increasingly employing ICTs to disrupt and counter movements that challenge their authority.

Based on these case studies, in this report we presented an ABM that elaborated the conditions under which communications and networking technologies affect who connects with whom during protests. Furthermore, the model provided an initial examination of the role of surveillance technologies on an authority's capacity to monitor protest activities and protester identities. Both use cases highlight the use of ABMs to analyze key factors (e.g., protest activity, technology, government responses) during complex social phenomena (e.g., social movements). Finally, in the preceding chapter we provided an extended speculation on the ways that ABMs can bridge gaps within the social sciences generally and leading theories of social movements specifically. Additionally, the affordances of agent-centric representations of complex collective action, organization, and information may bridge gaps between science and policy, particularly on frontier issues that policymakers must attend to and for which a body of reliable social science research requires further development.

We reached three conclusions based on these previous chapters.

First, from both our case studies and ABM we reached similar conclusions about the role of technology as a means for individuals to interact with each other, find common ground, and organize collective action together. Thus, **technology tends to accelerate the opportunity for collective action to form based on some preexisting grievance that groups of people may hold.**

Second, **recent advances in technology shaped the dynamics of the formation of collective action in our limited sample of case studies.** For example, Twitter and Al Jazeera's broadcasts helped publicize the Arab Spring protests in Egypt. Social media platforms such as Facebook helped organize collective action by these protesters. Similarly, Telegram and LIHKG were examples of key platforms in the dissemination of content that attracted protesters to organize together.

Third, **agent-based modeling provides a useful tool for studying the role of technology in shaping the underlying characteristics that define a social movement.** Combining case-based research with theory and computational modeling offers opportunities to develop insights that would otherwise not be available using these methods in isolation. Indeed, because of the centrality that ABMs place on individual actors and their choices, they are particularly well suited methodologically for exploring the complex, multiscale challenges that undergird social movements, collective action, and contentious politics more broadly.

Figure 8.1 displays our research approach. First, we presented recent case studies of social movements and identified several features of these events. Second, we referenced theory and research to translate these features into underlying characteristics. Third, we identified specific characteristics of interest, including the population, technological capabilities (e.g., social influence) of movements, and the computing power and surveillance capabilities of authorities.

Fourth, we **operationalized these characteristics by translating them into decision-making and behavioral processes used in an ABM**, employing a small set of parameters that enabled the isolation of networking and surveillance approaches for analysis. Finally, we **analyzed the results from the ABM and interpreted them as generalizable lessons about ICTs and social movements.**

Fifth, we demonstrated that **ABMs provide a useful tool for studying the role of technology in shaping the underlying characteristics that define a social movement**, particularly because of their ability to explicitly represent individuals and the flows of information between them. This was shown in Chapter Six, where individual agents formed connections based on their status as protesters or social identities, and then subsequently used those connections to find new connections. Likewise, in Chapter Seven, a simple experiment connecting the networking model with a spatial protest model showed how additional, non-local information affected agents' perceptions of risk and altered the protest dynamics.

In total, we believe that combining case-based research with theory and computational modeling offers opportunities to develop insights that would otherwise not be available using these methods in isolation. Specifically, while the empirical grounding offered by case studies are essentially, the ability to generalize from cases and isolate key variables and dynamics in simulation allows for the ability to look beyond the limits of those instances that the real-world has offered and peer into a larger range of cases, including those of interest to researchers or policymakers.

FIGURE 8.1
Research Approach for Using ABMs to Study Social Movements



An Example Use Case for ABMs

To conclude with an illustration on the usefulness of ABM methods, consider the recent example of the insurrection at the U.S. Capitol Building on January 6, 2021.¹ Based on open-source reporting, this event had at least three features that relate to our exploratory ABM presented in Chapter Six. First, a crowd of people joined together in Washington, D.C.—many of whom appeared to express a shared grievance surrounding the results of the 2020 U.S. presidential election.² Second, members of this crowd expressed their grievances and connected with others over social media.³ Third, some of these members forced their entry in to the Capitol Building, using ICTs to coordinate their actions in time and space, and interrupted the certification of election results during a joint session of Congress that included members of the U.S. House of Representatives, U.S. Senate, and the Vice President of the United States.⁴ Fourth, federal law enforcement authorities collected evidence on some of the people who participated in this insurrection using cell phone usage, social media content, and public informants who identified suspects based on crowdsourced information.⁵

ABMs are capable of creating simulations of these events, and effectively gaming out various conditions that could have occurred on January 6. For example, models of identity formation and activation may have created a long-term view of the background conditions in which participants were recruited into the many formal organizations and informal groups that ultimately financed and mobilized for the January 6 rally. Models of social influence may have identified shifting patterns in the production of information between agents in social networks, both open networks performing an outreach function and private networks used for coordinating action. Models of each of these types may have further examined the role and changes in relationships between agents that became increasingly aligned with and committed to protesting on behalf of President Donald Trump and those who believed that such actions were at best misguided and more likely anti-democratic, allowing for a better understanding of competitive recruitment and mobilization versus demobilization efforts during periods of contestation. Still other models may have simulated the use of information technology to coordinate the physical movement of actors in time and space, including

¹ U.S. Attorney's Office, District of Colombia, "Capitol Breach Cases," U.S. Department of Justice, webpage, undated.

² The U.S. Department of Justice described some members of this crowd as follows: "The investigation determined that, on January 6, 2021, Ms. Babbitt joined a crowd of people that gathered on the U.S. Capitol grounds to protest the results of the 2020 presidential election" (U.S. Attorney's Office, "Department of Justice Closes Investigation into the Death of Ashli Babbitt," U.S. Department of Justice, press release, April 14, 2021).

³ For one example, see *United States v. Clark*, criminal complaint, case 1:21-mj-00209, document 1, D.D.C., filed February 8, 2021.

⁴ For one example, see *United States v. Gonzalez*, statement of facts, cases 1:21-cr-00115-CRC, document 1-1, and 1:21-mj-00189, D.D.C., assigned January 31, 2021.

⁵ For one example, see *United States v. Stager*, criminal complaint, case 1:21-mj-00057-ZMF, document 1, D.D.C., filed January 14, 2021.

specific actions to probe and discover vulnerabilities in the defensive positions of the Capitol Police. In all these instances and more, a layering of models examining social mechanisms in which information is collected, processed, and communicated between agents, opportunities exist for both tightly focused research on specific processes and relationships and broader, integrated explorations in which these are linked into a larger, systemic perspective.

The results of the exploratory research in this report, then, highlight and advocate the development of ABMs and a dedicated infrastructure for their use in integrating social science research and policy analysis on critical, complex issues that are changing as a result of technological development. Given the myriad of challenges posed by the success and failure of social movements—from the balance of power between democratic forces and governments within authoritarian states to the increasing fragmentation and polarization of politics and society in democratic ones—the stakes are high, and new perspectives derived from new tools are needed.

Abbreviations

ABM	agent-based model/modeling
AI	artificial intelligence
AUC	area under the curve
CSS	computational social science
DDoS	distributed denial of service
ICT	information and communications technology
IoT	Internet of Things
ML	machine learning
PPT	political process theory
ROC	receiver operator curve
SBML	social, behavioral, modeling, laboratory
STE	Syrian Telecommunication Establishment

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ocial movement research is becoming increasingly important, as information and communications technologies (ICTs) have altered the ways movements form, organize, mobilize, and act, as well as the ways in which they are surveilled and disrupted. The authors of this report explore the use of agent-based modeling as a method for studying the effects of ICTs on the formation, maintenance, and dissolution of social movements over time.

The authors first reviewed selected research on recent technologies and social movements and conducted case studies of the Arab Spring protests in Egypt in 2010, the civil uprising in Syria in 2010, and the Hong Kong protests in 2019. They then developed and tested an agent-based model (ABM) that simulates the role of technology on specific features of social movements. The authors present conclusions from this exploratory research and discuss how to better employ ABMs as a tool for understanding the dynamics of social movements.

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