

Methodology

Before it is possible to explain variation in phenomena, it is first necessary to see that those phenomena exist. Information practice is vital for command and control, but it has been hiding in plain sight. My case studies have been highly granular, in part, to reveal something important that needs to be explained. As John Gerring notes, “Case studies enjoy a natural advantage in research of an exploratory nature,” even as discussion of “social science methodology has focused almost exclusively” on testing.¹ In Karl Popper’s terms, this is a project of conjecture rather than refutation. For ease of exposition I have encapsulated the theoretical framework in chapter 2, but the logic of discovery was very different from the logic of presentation. Too often the former is swept under the rug in an attempt to conform to the scientific norms of an academic discipline. The resulting scientific representations hide the details of their construction.

Consider the following: this book develops a theory to explain the conditions under which information practice creates knowledge (or confusion) to improve (or degrade) control. I employ ethnographic and historical methods to test the theory by leveraging variation on the key explanatory factors—the degree of constraint in the external problem and the internal solution—both across and within cases. By tracing measurement, coordination, and enforcement processes within different organizations in different wartime conditions, I show how the external problem and the internal solution interact to produce different patterns of information practice. The cases roughly confirm the logic of the theory, albeit with nuances aplenty.

This is all true enough. Yet the same cases were also important as generative studies. To understand the origin of theoretical concepts, which is the taproot of the scientific enterprise, some confessional acknowledgment of the path of discovery is helpful. Kenneth Waltz writes that the origin of concepts is something of a mystery: “At some point a brilliant intuition flashes, a creative idea emerges. One cannot say how the

intuition comes and how the idea is born."² In fact, it is possible to say something about the origin of ideas.

This book's theoretical framework can be applied reflexively to explain the very process that created it. Science and scholarship, after all, are forms of information practice that connect representations—theories, figures, models, books, articles—to an intellectual domain of human concern. Conversely, we can think of military information practice as a form of pragmatic science that tries to come up with actionable models of an operational domain. As Waltz observes, "A theory is a picture, mentally formed, of a bounded realm or domain of activity. A theory is a depiction of the organization of a domain and the connections among its parts."³ Systematic, formalized, and deductive theory can be likened to an institutionalized solution. Empirical, intuitive, and inductive research can be likened to organic adaptation. The former is most appropriate when the target domain is well defined ("a bounded realm"), but the latter is better when phenomena are ambiguous ("pictures, mentally formed" are still hazy). Mismatches create a lot of friction, and scientists have to cope with it. As Steven Shapin points out, "The making, maintaining, and modification of scientific knowledge is a local and a mundane affair."⁴ Shapin echoes Clausewitz's insight that war is "an area littered by endless minor obstacles" rather than "great, momentous questions, which are settled in solitary deliberation."⁵ A cycle of intellectual exploitation and reform in scientific practice generates four familiar patterns. Table A.1 provides new labels, but the logical framework is the same as that described in chapter 2.

This method is generally known as *abduction*, which is distinct from logical deduction or empirical induction.⁶ Abduction works by extending extant theory into conjectures about a new domain. Empirical exploration and experimentation then seek to find areas where theory works well or breaks down. The discovery and interpretation of challenges along the way, in turn, prompt reformulation of the theory. The hermeneutic cycle of scientific inquiry thus stabilizes a new (subjective) explanation that better fits with the (objective) structure of the world, which itself is clarified through the same process.⁷ As with information practice generally, researchers must be mindful of their own motivation and situation in selecting and engaging with any given material. An earnest commitment to understanding the phenomena of concern, moreover, should guide the scientific endeavor, lest

Table A.1 The method of abduction as information practice

	<i>Defined domain</i>		<i>Ambiguous phenomena</i>
Logical deduction	Theory		Conjecture
Empirical induction	Challenges		Experimentation

science get hijacked by more parochial concerns with empire building, careerism, or dogmatic consistency.

Ethnographic methods are especially well suited to abduction, which is also known as grounded theory development.⁸ The problem of “choosing on the dependent variable” is less important for case selection in this type of research since its goal is to identify and characterize the microlevel processes that create meaning for a community. Close engagement with repeated patterns of social interaction over an extended period of time, together with attention to the structural factors that shape and are shaped by those patterns, provides some confidence that the results are generalizable beyond the study community. I focus in particular on the mundane, tacit, taken-for-granted practice that animates working information systems.⁹ An ethnographic sensibility is particularly useful for understanding military information practice because data that get archived for eventual declassification can be difficult to interpret without understanding the pragmatic context of inscription. Ethnography is a way of bringing a calibrated instrument—a researcher sensitized to the relevant phenomena by prior engagement with the relevant scholarship—into a real-world laboratory to observe uncontrolled social practice as it unfolds, then returning to articulate more general concepts.¹⁰

My initial intuitions developed through reading academic scholarship while reflecting on my own military experience. I read widely across the disciplines of security studies, political science, cognitive science, and the sociology of technology and science. The diversity of conceptual assumptions and rhetorical styles in these intellectual communities posed a major challenge for synthesis. This tension ultimately was generative, but only after a lot of wrangling with empirical material, and no little frustration. Of the cases examined in this book, the first that I engaged with was FalconView. The application and I both entered the U.S. Navy at about the same time in the late 1990s. During my active duty years, I gained some experience writing software that interfaced with FalconView, which later facilitated my interaction with the mission planning community. Our modest projects (Quiver, A3) also failed where FalconView succeeded. Indeed, FalconView is the most sustained and successful case of bottom-up innovation in military software that I have been able to identify. I recognized that the conditions for FalconView’s success were unique in many ways, even as the impulse for users to innovate in the military was not.

I left active duty in 2003 but remained in the Naval Reserve. I thus had the opportunity to mobilize to Iraq while I was in graduate school. I knew that a protracted ground war would put interesting stress on theories about military innovation (i.e., the RMA). I did not yet appreciate how significantly the culture of Naval Special Warfare would determine the quality of representational practice in the unit to which I deployed in 2007–8. My active duty role imposed major constraints on field research, to be sure.

Official responsibilities and classified work spaces precluded the use of standard ethnographic methods like on-site interviews or video recording. I was open with military colleagues about my civilian life as an academic researcher, but as a mobilized reservist I was duty bound to be a participant first and an observer second. Fortunately, there was a natural synergy between these roles given my substantive interest in information systems. As discussed in the main text, military personnel often become preoccupied with the technologies that mediate their knowledge as they anticipate and respond to breakdowns. Conversations about data management and organizational effectiveness thus occurred naturally in the absence of any research agenda because they facilitated the ongoing debugging of our information systems.¹¹ Over the course of the deployment I filled up several little green notebooks, in which comments about staff work and systems issues were admixed with countless operational minutiae, and I would have done so in the absence of any research agenda.

After redeployment I mined my notebooks and recorded additional recollections as autoethnographic data.¹² I focused on recurring patterns of human-computer interaction at the SOTF rather than the content of specific operations or methods, which remain classified as of this writing. A subsequent classification review of my findings resulted in no redaction. Fortunately for this research, informal practices tend not to be formally classified. The everyday interactions between people and machines often go unnoted in explicit rules and prohibitions, precisely because they are part of the unarticulated milieu of practice, or what Pierre Bourdieu calls "habitus."¹³ The ethnographic data prompted me to reformulate the theoretical framework to take organizational culture more seriously. I also had to grapple with mixed modes of organization since the SOTF was simultaneously unified in its intentionality and fragmented in its implementation.

Once I developed more refined concepts about the relationship between organizational representations and operational realities, I wanted to examine some outside cases in order to test, extend, and generalize the concepts. The Battle of Britain (chapter 3) was an obvious choice for many reasons: simpler technology, intrinsic historical importance, a different warfighting domain, a successful outcome, and abundant archival data. Furthermore, a new appreciation of the decades-long development of the British information system militated against prominent arguments, by my dissertation adviser among others, about civilian intervention at the eleventh hour.¹⁴ While variation on so many factors at once would rightly be seen as anathema in a research design for theory testing via controlled comparison, the additional complexity can actually be useful for theory building. Rich detail, thickly described, can highlight unconsidered explanatory factors and underscore surprising similarities. The Battle of Britain case thus both broadened and improved my confidence in the insights that I developed in the U.S. cases.

I also wanted to examine an outside case from the digital era. The RMA thesis is about networked computers, not electromagnetic tabulators, after all. I decided to examine U.S. drone campaigns (chapter 6) because the bodily location of drone pilots, situated remotely from the battlefield, together with their close mental proximity and the attendant controversy over drone strikes, exemplified the problem of technologically mediated experience, which had become central to my argument. The case also offered opportunities for comparison with, and chronological extension of, the other U.S. cases. Drones were used for a similar counterterrorism process as the special operations unit examined in chapter 5, and they were used by some of the same organizations that used FalconView in chapter 4. Most fortuitously, the appearance of an outstanding ethnographic study on MQ-9 Reaper aircrew by Timothy Cullen provided me with comparable fine-grained detail on information practice.¹⁵

All four cases focused on the tactical or operational level of war. At this level of granularity I already had to account for tremendous heterogeneity in causal factors: different services, cultures, missions, tasks, weapons, infrastructures, protocols, and so on. To accommodate all of the particularity and idiosyncrasy within and across cases, I was driven to articulate the theory at a very high level of abstraction. I surmised that the fundamental tension in political economy between markets and governments also mediated the basic epistemological relationship between subject and object in distributed cognition. Therefore, the performance of any cybernetic feedback loop that enabled knowledge and control in an organization was also an institutional collective action problem. I combined these insights into the very simple framework presented in this book. While I was very sensitive to the fact that my synthesis rode roughshod through four very different traditions (security studies, political economy, cognitive science, sociology of technology), I felt that a parsimonious approximation could nonetheless reveal something important about the organizational context of information technology. These coarse but time-tested distinctions (inside-outside, sensing-acting, market-government, success-failure) seemed to carve nature at its joints. Given the degree of abstraction in my framework, moreover, the external and internal constraints that determine the quality of information practice necessarily require considerable interpretation in each case. Fortunately, the very abstraction of the theory also lends itself naturally to generalization. The concepts in this book should thus be relevant for many problems beyond those considered in it, whether beyond the military realm or even, reflexively, for science itself.

One outside problem is particularly important in the context of this book, and notable for its absence. At the same time that I was working on this project, I was also publishing on cybersecurity in international relations. Cybersecurity can be conceived as a second-order problem of protecting and exploiting information practice. To foreground the phenomena of

information practice itself, I eventually scoped the book to just military combat operations. I ultimately decided not to include any cyber research in this book, both because it focused on broader themes and because I did not have access to details of practitioner interaction comparable to the other cases. I leave the detailed argument for another time, but suffice it to say that my ideas about cybersecurity have both shaped and been shaped by my ideas about information practice.¹⁶

To summarize, my theoretical intuitions about representation emerged through personal experience in war and engagement with a diverse range of scholarship. An initial articulation of concepts guided further research in the field and in the library on cases of particular salience. Empirical exploration in turn prompted further refinement of concepts, which prompted the revisiting of cases and selection of new cases, and so on repeatedly. The entire manuscript then went through several major revisions during a lengthy review process, which pushed me to further refine and clarify the core theoretical concepts, their application to the cases, and their broader implications. My journey was full of unexpected opportunities, contingencies, and difficulties, but the endpoint was a more generalizable theory. The main text clears away the messy historical scaffolding, which I have revealed in this appendix. In it I attempt to deductively argue the theory on its own merits and perform a set of empirical tests through process tracing. We thus end up where we began.

My emphasis on the sociotechnical construction of knowledge by a community of practitioners has a clear affinity with the constructivist paradigm of international relations theory.¹⁷ Yet I also argue that military power is sensitive to strategic competition and geopolitical structure, which is more aligned with a realist worldview.¹⁸ I also stress the political-economic trade-offs in the design of information systems, which draws on liberal insights about the relative strengths of markets and institutions.¹⁹ My framework assumes that structural and organizational factors interact to produce military power, which is perhaps closest to the (neo)classical realist paradigm.²⁰ Ultimately I am less interested in paradigmatic allegiance than in making sense of the phenomena of information practice as they appear in the real world.²¹ Pragmatic criteria should be used to evaluate a pragmatic theory of knowledge. The ultimate measure of my success or failure is whether or not warfighters recognize something of their own experience in the ideas offered here.