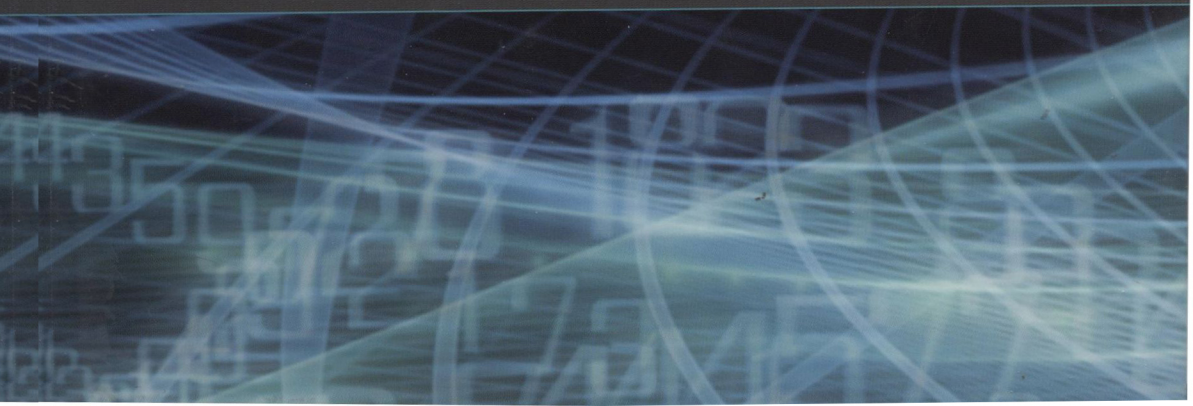
BIG DATA, LITTLE DATA, NO DATA

SCHOLARSHIP IN THE NETWORKED WORLD

Christine L. Borgman



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For Betty Champoux Borgman, 1926–2012,
and Ann O'Brien, 1951–2014

Preface

Big data begets big attention these days, but little data are equally essential to scholarly inquiry. As the absolute volume of data increases, the ability to inspect individual observations decreases. The observer must step ever further away from the phenomena of interest. New tools and new perspectives are required. However, big data is not necessarily better data. The farther the observer is from the point of origin, the more difficult it can be to determine what those observations mean—how they were collected; how they were handled, reduced, and transformed; and with what assumptions and what purposes in mind. Scholars often prefer smaller amounts of data that they can inspect closely. When data are undiscovered or undiscoverable, scholars may have no data.

Research data are much more—and less—than commodities to be exploited. Data management plans, data release requirements, and other well-intentioned policies of funding agencies, journals, and research institutions rarely accommodate the diversity of data or practices across domains. Few policies attempt to define *data* other than by listing examples of what they might be. Even fewer policies reflect the competing incentives and motivations of the many stakeholders involved in scholarship. Data can be many things to many people, all at the same time. They can be assets to be controlled, accumulated, bartered, combined, mined, and perhaps to be released. They can be liabilities to be managed, protected, or destroyed. They can be sensitive or confidential, carrying high risks if released. Their value may be immediately apparent or not realized until a time much later. Some are worth the investment to curate indefinitely, but many have only transient value. Within hours or months, advances in technology and research fronts have erased the value in some kinds of observations.

A starting point to understand the roles of data in scholarship is to acknowledge that data rarely are *things* at all. They are not natural objects with an essence of their own. Rather, data are representations of

observations, objects, or other entities used as evidence of phenomena for the purposes of research or scholarship. Those representations vary by scholar, circumstance, and over time. Across the sciences, social sciences, and the humanities, scholars create, use, analyze, and interpret data, often without agreeing on what those data are. Conceptualizing something as data is itself a scholarly act. Scholarship is about evidence, interpretation, and argument. Data are a means to an end, which is usually the journal article, book, conference paper, or other product worthy of scholarly recognition. Rarely is research done with data reuse in mind.

Galileo sketched in his notebook. Nineteenth-century astronomers took images on glass plates. Today's astronomers use digital devices to capture photons. Images of the night sky taken with consumer-grade cameras can be reconciled to those taken by space missions because astronomers have agreed on representations for data description and mapping. Astronomy has invested heavily in standards, tools, and archives so that observations collected over the course of several centuries can be aggregated. However, the knowledge infrastructure of astronomy is far from complete and far from fully automated. Information professionals play key roles in organizing and coordinating access to data, astronomical and otherwise.

Relationships between publications and data are manifold, which is why research data is fruitfully examined within the framework of scholarly communication. The making of data may be deliberate and long term, accumulating a trove of resources whose value increases over time. It may be ad hoc and serendipitous, grabbing whatever indicators of phenomena are available at the time of occurrence. No matter how well defined the research protocol, whether for astronomy, sociology, or ethnography, the collection of data may be stochastic, with findings in each stage influencing choices of data for the next. Part of becoming a scholar in any field is learning how to evaluate data, make decisions about reliability and validity, and adapt to conditions of the laboratory, field site, or archive. Publications that report findings set them in the context of the domain, grounding them in the expertise of the audience. Information necessary to understand the argument, methods, and conclusions are presented. Details necessary to replicate the study are often omitted because the audience is assumed to be familiar with the methods of the field. Replication and reproducibility, although a common argument for releasing data, are relevant only in selected fields and difficult to accomplish even in those. Determining which scholarly products are worth preserving is the harder problem.

Policies for data management, release, and sharing obscure the complex roles of data in scholarship and largely ignore the diversity of practices

within and between domains. Concepts of data vary widely across the sciences, social sciences, and humanities, and within each area. In most fields, data management is learned rather than taught, leading to ad hoc solutions. Researchers often have great difficulty reusing their own data. Making those data useful to unknown others, for unanticipated purposes, is even harder. Data sharing is the norm in only a few fields because it is very hard to do, incentives are minimal, and extensive investments in knowledge infrastructures are required.

This book is intended for the broad audience of stakeholders in research data, including scholars, researchers, university leaders, funding agencies, publishers, libraries, data archives, and policy makers. The first section frames data and scholarship in four chapters, provoking a discussion about concepts of data, scholarship, knowledge infrastructures, and the diversity of research practices. The second section consists of three chapters exploring data scholarship in the sciences, social sciences, and humanities. These case studies are parallel in structure, providing comparisons across domains. The concluding section spans data policy and practice in three chapters, exploring why data scholarship presents so many difficult problems. These include releasing, sharing, and reusing data; credit, attribution, and discovery; and what to keep and why.

Scholarship and data have long and deeply intertwined histories. Neither are new concepts. What is new are efforts to extract data from scholarly processes and to exploit them for other purposes. Costs, benefits, risks, and rewards associated with the use of research data are being redistributed among competing stakeholders. The goal of this book is to provoke a much fuller, and more fully informed, discussion among those parties. At stake is the future of scholarship.

Christine L. Borgman
Los Angeles, California
May 2014

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It takes a village to write a sole-authored book, especially one that spans as many topics and disciplines as does this one. My writing draws upon the work of a large and widely distributed village of colleagues—an "invisible college" in the language of scholarly communication. Scholars care passionately about their data and have given generously of their time in countless discussions, participation in seminars and workshops, and reading many drafts of chapters.

The genesis of this book project goes back too many years to list all who have influenced my thinking, thus these acknowledgments can thank, at best, those who have touched the words in this volume in some way. Many more are identified in the extensive bibliography. No doubt I have failed to mention more than a few of you with whom I have had memorable conversations about the topics therein.

My research on scholarly data practices dates to the latter 1990s, building on prior work on digital libraries, information-seeking behavior, human-computer interaction, information retrieval, bibliometrics, and scholarly communication. The data practices research has been conducted with a fabulous array of partners whose generative contributions to my thinking incorporate too much tacit knowledge to be made explicit here. Our joint work is cited throughout. Many of the faculty collaborators, students, and postdoctoral fellows participated in multiple projects; thus, they are combined into one alphabetical list. Research projects on scholarly data practices include the Alexandria Digital Earth Prototype Project (ADEPT); Center for Embedded Networked Sensing (CENS); Cyberlearning Task Force; Monitoring, Modeling, and Memory; Data Conservancy; Knowledge Infrastructures; and Long-Tail Research.

Faculty collaborators on these projects include Daniel Atkins, Geoffrey Bowker, Sayeed Choudhury, Paul Davis, Tim DiLauro, George Djorgovski, Paul Edwards, Noel Enyedy, Deborah Estrin, Thomas Finholt, Ian Foster,

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Most of this book was developed and written during my 2012–2013 sabbatical year at the University of Oxford. My Oxford colleagues were fountains of knowledge and new ideas, gamely responding to my queries of "what are your data?" Balliol College generously hosted me as the Oliver Smithies Visiting Fellow and Lecturer, and I concurrently held visiting scholar posts at the Oxford Internet Institute and the Oxford eResearch Centre. Conversations at high table and low led to insights that pervade my thinking about all things data—Buddhism, cosmology, Dante, genomics, chirality, nanotechnology, education, economics, classics, philosophy, mathematics, medicine, languages and literature, computation, and much more. The Oxford college system gathers people together around a table who otherwise might never meet, much less engage in boundary-spanning inquiry. I am forever grateful to my hosts, Sir Drummond Bone, Master of Balliol, and Nicola Trott, Senior Tutor; William Dutton of the Oxford Internet Institute; David de Roure, Oxford eResearch Centre; and Sarah Thomas, Bodley's Librarian. My inspiring constant companions at Oxford included Kofi Agawu, Martin Burton, George and Carmella Edwards, Panagis Filippakopoulos, Marina Jirotka, Will Jones, Elena Lombardi, Eric Meyer, Concepcion Naval, Peter and Shirley Northover, Ralph Schroeder, Anne Trefethen, and Stefano Zacchetti.

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Last, but by no means least, credit is due to my husband, George Mood, who has copyedited this manuscript and everything else I have published since 1977. He usually edits his name out of acknowledgments sections, however. Let the invisible work be made visible this time.