Literature Review

A Case for Critical Data Studies in Library and Information Studies

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ABSTRACT

The proliferation, ubiquity, and growth of data, big data, and digital infrastructure raise a number of questions for library and information studies (LIS) practitioners, researchers, and educators. While some uncritically accept and embrace the idea that big data will fundamentally alter every sector of society including economics, politics, health care, and knowledge production, others are more critical of the data turn. Data can be contradictory in that it can be used for surveillance, impinge on privacy, be used for secondary purposes (often without consent), and can be totalizing in that we continually create data exhaust, it can be hacked, searched, aggregated, and preserved for years. Conversely, data can be used for the public good, to promote progressive social change, and to empower people. The overarching argument presented in this paper is that critical library and information studies must include critical data studies. To develop this argument, this paper explores the ontological nature of data and their contradictory implications and effects in terms of broader society, the academy, and in LIS research, education, and practice. Next, the philosophical foundations and the work being done in the budding area of critical data studies are presented (most notably work by Rob Kitchin). Finally, the intersections between critical data studies and LIS are discussed in terms of research methodologies, philosophical underpinnings, and application of critical social theory, values, and ethics using Dalton and Thatcher's seven data criticisms.

INTRODUCTION

The era of data, data hype, and data backlash is upon us with the *Harvard Business Review* breathlessly calling "Data Scientist: The Sexiest Job of the 21St Century." [1] Data proponents make hubristic claims about how the analysis and application of data can solve the world's most complex and pressing problems and how big data and data analytics are reshaping entire industries such as education and healthcare as well as relationships via the analysis, correlation, segregation, aggregation, and combination of large datasets. [2]

The data turn is often portrayed as a boon for library and information professionals, educators, and researchers. Teets and Goldner argue that the proliferation of, and the heightened attention to, data (e.g., big data, research data, digital data, linked data, open data, web of data, and data repositories) offers a renewed perspective of the ways in which academics and practitioners can understand, make sense of, and use data. [3] Curating, managing, publishing, visualizing, and preserving data and datasets, teaching data literacy, providing data services such as mining humanities texts and geographic information systems, and developing digital data infrastructures are areas of expertise in which librarians and information professionals can make significant contributions. [4] Others suggest that creating and managing data services and curation are natural extensions of the library's core mission to protect and disseminate information. [5]

In post-secondary education, the interest in data and the concomitant development of data analytics and tools has facilitated the expansion of new, and often

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[1] Thomas H. Davenport and D. J. Patil, "Data Scientist: The Sexiest Job of the 21St Century." *Harvard Business Review*, October (2012): 70.

[2] Eric T. Meyer, Ralph Schroeder, and Linnet E. M. Taylor, "Big Data: Rewards and Risks for the Social Sciences." Oxford Internet Institute. Call for workshop papers. http://www.oii.ox.ac.uk/events/?id=557.

[3] Michael Teets and Matthew Goldner, "Libraries' Role in Curating and Exposing Big Data." *Future Internet* 5, no. 3 (2013): 429–438.

[4] Dane Ward, "It Takes a University to Build a Library," *Inside Higher Education*, April 21, 2015. https://www.insidehighered.com/views/2015/04/21/essay-calls-librarians-seek-more-involvement-their-campuses-developing-future, para.7; Rebecca A. Brown, Malcolm Wolski, and Joanna Richardson, "Developing New Skills for Research Support Librarians," *Australian Library Journal* 64, no. 3 (2015): 224–234; Jake Carlson, and Lisa Johnston, Data Information Literacy: Librarians, Data and the Education of a New Generation of Researchers (West Lafayette: Purdue University Press, 2014); Deborah E. Keil, "Research Data Needs from Academic Libraries: The Perspective of a Faculty Researcher," *Journal of Library Administration* 54 (2014): 233–240.

[5] Lauren Reinhalter, and Rachel Jane Wittman, "The Library: Big Data's Boomtown," *The Serials Librarian* 67, no. 4 (2014): 363.

collaborative or interdisciplinary, academic programs in data science.[6] To some, the data turn will revitalize and rejuvenate library and information science (LIS) education via data science master's degree programs, data curation specializations, revised LIS competency-based and data focused curriculum, and professional development and training.[7] According to this view, librarians and information professionals are positioned and poised to become "experts and authorities in the data age"[8] and "the core of future cadres of data scientists"[9] providing the "skills, the knowledge, and the service mentality to help businesses, governments, universities, and nonprofits capitalize on all that Big Data has to offer."[10] Consequently, there is an urgent need to educate and train professionals who have a deep understanding of how to collect, analyze, transform, and present data along with the ability to code, derive insights from large datasets, navigate and structure large datasets, and to assist in data-driven decision-making.[11]

However, the notion that the data turn will ensure the relevancy of librarians and information professional are underpinned by assumptions about LIS education. Day, writing about Rob Kling's work on social informatics, states that for Kling professional *training* focuses on technical training and problem-solving whereas professional *education* engages the critical: that is, "reflective questioning of the value and meaning of discourse and other activities in an interventional manner that is guided by informed judgment and reference to the empirical."[12] The emphasis on data science training and skill acquisition to maintain professional relevancy has been critiqued as another example of LIS following fads.[13] In addition, Furner suggests that this celebratory view of data demonstrates a lack of understanding of the historical antecedents and principles of LIS. The principles of storing, collecting, preserving, managing, analyzing, providing access, ethical considerations, and ongoing interest in the social, cultural, political, and economic contexts of data creation and use in LIS are being "rediscovered and

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[6] Doug Henshen, "Big Data Analytics Master's Degrees: 20 Top Programs," *Information Week*, January 7, 2013. http://www.informationweek.com/big-data/big-data-analytics/big-data-analytics-masters-degrees-20-top-programs/d/d-id/1108042?piddl_msgpage=2#msgs.

[7] Jeonghyun Kim, "Competency-based Curriculum: An Effective Approach to Digital Curation Education." *Journal of Education for Library and Information Science* 56, no. 4 (2015): 283–297.

[8] Reinhalter, and Jane Wittman, "The Library," 363.

[9] Jeffrey Staunton, "Big Data and the Library Professional." *Journal of the Library Administration & Management Section* 8, no. 2 (2012): 24.

[10] Laura Gordon-Murnane, "Big Data: A Big Opportunity for Librarians." *Online* 36 no. 5 (2012): 30.

[11] Reinhalter and Wittman, "The Library," 368.

[12] Ronald E. Day, "Kling and the 'Critical': Social Informatics and Critical Informatics." *Journal of the American Society for Information Science and Technology* 58, no. 4 (2007): 577.

[13] Sam Trosow, "The Commodification of Information and the Public Good: New Challenges for a Progressive Librarianship," *Progressive Librarian*, no. 43 (2015): 23.

reframed" and perhaps appropriated by data curators.[14] Furner states that "data studies" is not as new as what some of its practitioners and proponents believe.

Given the complexities, potential benefits, and questions raised by the data turn, in this literature review I discuss how data (including big data) have been conceptualized in research and corporate communities and in LIS. I then draw upon Thatcher and Dalton's seven data criticisms—a "systematic approach" to data or critical data studies—to explore how these data criticisms or "provocations" are or might be addressed in LIS as an academic discipline, in LIS education, and professional practice.[15] LIS's core areas of inquiry—knowledge organization, management, policy, focus on people, social justice orientation, concern for privacy, ethical and philosophical underpinnings, and promotion of the public good—not only necessitates engagement with data and interdisciplinary work, but also positions LIS to make significant contributions to critical data studies.

DATA

It is outside the scope of this literature review to define data, information, and knowledge (please see Bates (2005, 2010), Buckland (1991), Frohmann (2004), and Hjørland (2007)). However, it is essential to highlight some of the debates in LIS about the nature of data, information, and knowledge in order to understand if and how the concepts are interrelated, the nature of these relations, and the meanings ascribed to them.[16] Borgman offers the provocation that the question is not "What are data?" but rather "when are data?" because data are ubiquitous, ephemeral and "because recognizing that some phenomenon could be treated as data is itself a scholarly act."[17] Other conceptualizations of data include data as a reified, external resource, as information that is generated as data, and as a process of ascribing meaning. For example, one of the five distinct definitions of information in the discipline of information science that Furner outlines is "information-as-data" which is defined as

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[14] Jonathan Furner, "Information Science is Neither," *Library Trends* 63, no. 3 (2015): 360.

[15] Craig Dalton and Jim Thatcher, "What Does a Critical Data Studies Look Like, and Why Do We Care? Seven Points for a Critical Approach to 'Big Data'." *Society & Space.* 2014, http://societyandspace.com/material/commentaries/craig-dalton-and-jim-thatcher-what-does-a-critical-data-studies-look-like-and-why-do-we-care-seven-points-for-a-critical-approach-to-big-data/.Dalton and Thatcher, 2014 website

[16] Chaim Zins, "Conceptual Approaches for Defining Data, Information, and Knowledge," *Journal of the American Society for Information Science and Technolog*y 58, no. 4 (2007): 479–493.

[17] Christine Borgman, Big Data, Little Data, No Data: Scholarship in a Networked World (Cambridge, MA: MIT Press, 2015), 5.

"Any object, event, or property (or aggregate of such) that takes material form and to which it is possible to ascribe meaning."[18]

Zins also attempts to define these concepts by creating a knowledge map of the field that involved analyzing 130 definitions of data, information, and knowledge formulated by forty-five scholars in LIS. He found that the conceptual model of data, information, and knowledge most often used by LIS scholars is one in which data and information are conceptualized as external phenomenon and where knowledge is viewed as internal.[19] While Douglas and Peppard also view data as an independent, reified resource (external), they argue that both information and knowledge are "embodied and embrained" (internal).[20] Bates offers two definitions of data in which data are defined as both a process and a reified resource. In Bates' data 1 definition, data become information when meaning is ascribed to them, and they become knowledge when they are integrated with pre-existing knowledge residing in the brain or mind. Data 2 "refers to information selected or generated by human beings for social purposes" in order to acquire new understanding or knowledge and includes information generated for research and scholarship—the reified resource definition.[21] Buckland also supports this view of data as a resource stating that datasets are "a key product of intellectual work."[22]

Similar to the treatment of data definitions, it is beyond the scope of this literature review to define big data. However, a few pertinent definitions are given below. In LIS, Ekbia et al. provide an exemplary critical overview of big data through the discussion of dilemmas—"a situation that presents itself as a set of indeterminate outcomes that do not easily lend themselves to a compromise or resolution"[23]—that serve to frame their discussions of big data and epistemology, methodology, aesthetics, ethics, and technology (also see Borgman 2015). Other definitions of big data abound, from simple definitions that big data are those datasets that are so large and complex it is difficult for traditional database tools and data processing software applications to process them,[24] to definitions that give greater consideration to the political economy of

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[18] Furner, "Information Science," 364.

[19] Zins, "Conceptual Approaches."

[20] Martin Douglas and Joe Peppard, "Theorizing Data, Information and Knowledge Constructs and Their Inter-Relationship for Effective Data Analytics," *UK Academy for Information Systems Conference Proceedings 2013,* Paper 7 (2013). http://aisel.aisnet.org/ukais2013/7.

[21] Marcia J. Bates, "Information and Knowledge: An Evolutionary Framework for Information Science," *Information Research* 10, no. 4 (2005). http://InformationR.net/ir/10-4/paper239.html.

[22] Michael Buckland, "Data Management as Bibliography," *Bulletin of the American Society for Information Science and Technology* 37, no. 6 (2011): 34-37.

[23] Hamid Ekbia et al, "Big Data, Bigger Dilemmas: A Critical Review." *Journal of the Association for Information Science and Technology* 66, no. 8 (2015): 1523-1545.

[24] Chris Sherman, "What's the Big Deal About Big Data?" *Online Searcher* 38, no. 2 (2014): 10–16.

big data.[25] Mayer-Schonberger and Cukier claim that big data "create new forms of value" and reshape ideas about innovation and relationships as it "overturns centuries of established practices and challenges our most basic understanding of how to make decisions and comprehend reality."[26] Others define big data based upon a number of data characteristics with the three v's being most frequently cited: volume, velocity, variety, and the recent additions of veracity and value.[27] Other definitions and discussions of big data focus on their implications in terms of processing and innovation[28] including academic research and scholarship.[29]

Furthermore, developments in ICTs have enabled information systems to store, aggregate, process, and transfer data, and to continually generate new data (wittingly or unwittingly known by users). Data is continuously generated by people and about people. Data created by people about themselves are "increasingly recognized as raw material for new products and services"[30] as companies turn user-generated data into information about user preferences (often to sell to advertisers) in a model that has become mainstream (e.g., Facebook, Google). Furthermore, while self-monitoring has a long history, the development of mobile technologies in particular have encouraged people to collect and share data about themselves in practices that go by many names: self-surveillance, self-tracking, participatory sensing,[31] and "the quantified self."[32] Shilton dubs these data "participatory personal data: "any representation recorded by an individual, about an individual, using a mediated technology." She distinguishes participatory personal data, which is accessible to the user, from research and

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[25] Vincent Mosco, *To the Cloud: Big Data in a Turbulent World* (Paradigm Press. Boulder, Colorado, 2014).

[26] Viktor Mayer-Schonberger and Kenneth Cukier, *Big Data* (New York: Houghton Mifflin, 2013), 6–7.

[27] Rob Kitchin, "Big Data and Human Geography: Opportunities, Challenges, and Risks," *Dialogues in Human Geography* 3, no. 3 (2013): 262–267.

[28] Nasrine Olson, Joe H. Steinhauer, Alexander Karlsson, Gustaf Nelhans, Goran Falkman, and Jan Nolin, "Little Scientist, Big Data Information Fusion Towards Meeting the Information Needs of Scholars." In *Libraries in the Digital Age (LIDA) Proceedings*. (Zadar, Croatia, June 16–20, 2014); Steve Lohr, Data-Ism: The Revolution Transforming Decision Making, Consumer Behavior, and Almost Everything Else (New York: HarperCollins, 2015), 3; Shane Greenstein, "Behind the Buzz of Behavioral Data," *IEEE Micro*, no. 2 (2015): 88–89.

[29] Meyer, Schroeder, and Taylor, "Big Data," para. 8; Luciano Floridi, "Big Data and Their Epistemological Challenge." *Philosophy and Technology* 25, no. 4 (2012): 435–437.

[30] Aleski Aaltonen and Niccolo Tempini, "Everything Counts in Large Amounts: A Critical Realist Study on Data-Based Production," *Journal of Information Technology* 29, (2014): 108.

[31] Katie Shilton, "Participatory Sensing: Building Empowering Surveillance," *Surveillance & Society* 8, no. 2 (2010): 131-150.

[32] Nora Young, The Virtual Self: How Our Digital Lives are Altering the World Around Us (Toronto: McClelland & Stewart, 2012).

surveillance data, which are typically obscured or inaccessible to the "data subjects."[33] The data turn has also focused greater attention on the role of metadata in knowledge organization such as digital libraries, data repositories, and data re-use, and in terms of personal user-generated data. Shiri argues that metadata is different from other data types because "of its unique function in identifying and locating data packages" and that it plays an important role in "the organization, access, retrieval and reuse of big data."[34] Often metadata is more valuable than the content it is describing because metadata connects content to a broader context such as being mined for profit or predictive analytics, used for surveillance, or organized to provide structure to heterogeneous datasets.[35]

Another aspect of data to consider is its ontological and epistemological status. Rosenberg traces the etymology and use of the word "data" and differentiates among facts, evidence, and data:

> …facts are ontological, evidence is epistemological, data is rhetorical. A datum may also be a fact, just as a fact may be evidence. But from its first vernacular formulation, the existence of a datum has been independent of any consideration of corresponding ontological truth. When a fact is proven false, it ceases to be a fact. False data is data nonetheless.[36]

Because data have no ontological "truth," data are a rhetorical device that can be used to support different ideologies. Day, writing from an LIS perspective, argues that "social big data" perpetuates neoliberal ideology by governing online identity and interactions, conflating opinion with knowledge, and undermining knowledge claims. Representations of one's online identity or one's online self (which Day argues is a "unified semantic form" or documents) enable people to participate in online marketplaces. These documents are exchanged with, and for, other abstract commodities. Additionally, interaction with information systems that solicit user preferences and present a limited series of options for expression conflates opinion with

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[33] Katie Shilton, "Participatory Personal Data: An Emerging Research Challenge for the Information Sciences," *Journal of the American Society for Information Science and Technology* 63, no. 10 (2012): 1906.

[34] Ali Shiri, "Making Sense of Big Data: A Facet Analysis Approach," *Knowledge Organization* 41, no. 5 (2014): 362.

[35] Rasmus Helles and Klaus Bruhn Jensen, "Making Data and Beyond: Introduction to the Special Issue," *First Monday* 18, no. 10 (2013); Schneier, Bruce. Data and Goliath: The Hidden Battles to Collect Your Data and Control Your World. New York: W.W. Norton & Company, 2015.

[36] Daniel Rosenberg, "Data Before the Fact." In *Raw Data Is an Oxymoron,* edited by Lisa Gitelman, 15–40. Cambridge, Massachusetts: MIT Press, 2013, 18.

knowledge as "opinion becomes a choice of options within a market of delivered or retrieved goods" instead of expression formed from the "rigor of argument or as a product of technical knowledge."[37] Day also discusses how big data "facts" established through data modeling and indexical databases undermine the production of knowledge by presenting knowledge claims "as immediate—"factual"—rather than as emergent through technologies, techniques, and methods."[38] In these ways, neoliberal ideology inherent in social big data shapes and governs the subject.

Furthermore, overabundance or excess data and information have epistemological and ontological implications. Berry states that "big data provides 'destabilizing amounts of knowledge and information that lack the regulating force of philosophy.'[39] Not only is there a dearth in big data theory development, Berry suggests that too much data undermines our ability to make sense of the world using systematic and philosophically grounded approaches to knowledge production. Similarly, Andrejevic argues that the destabilizing effects of information glut (he uses the words data and information synonymously) undermines and unmoors theory and critique. Consequently, competing narratives and counter-narratives and new strategies for control emerge in every realm of life from politics, financial matters, security and policing, to knowledge production as "information proliferation can work to reinforce, rather than threaten, relations of power and control."[40]

Data are socially constructed and consequently, "do not exist independently of ideas, techniques, technologies, systems, people and contexts, regardless of them often being offered in this manner."[41] They are not, and cannot be neutral or objective. Nor do they exist in a vacuum; they are a socio-technical phenomenon, embedded in institutions and power relations that offer a "limited representation of the world."[42] Because data are contextualized, partial, and biased representations, they are unable to "speak for themselves" and are aggregated, searched, and analyzed in order to accomplish action in the world. Datasets can be inclusive and exclusive and used in ways that inevitably benefits some but perhaps not others.

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[37] Ronald Day, Indexing It All: The Subject in the Age of Documentation, Information, and Data, Cambridge, Massachusetts: MIT Press, 2014, 130.

[38] Ibid., 134.

[39] Berry qtd. in danah boyd and Kate Crawford, "Critical Questions for Big Data." *Information, Communication and Society* 15, no. 5 (2012): 666.

[40] Mark Andrejevic, Infoglut: How Too Much Information Is Changing the Way We Think and Know. New York: Routledge, 2013, 11.

[41] Rob Kitchin. The Data Revolution: Big Data, Open Data, Data Infrastructures & Their Consequences. London: Sage Publications, 2014, 24.

[42] danah boyd and Kate Crawford, "Critical Questions for Big Data." *Information, Communication and Society* 15, no. 5 (2012): 662–679; Loudon et al., quoted in Tom Boellstorff, "Making Big Data, in Theory." *First Monday*, 18, no. 10 (2013). para. 5. http://firstmonday.org/article/view/4869/3750.

Critical data studies "applies critical social theory to data to explore the ways in which they are never simply neutral, objective, independent, raw representations of the world, but are situated, contingent, relational, contextual, and do active work in the world."[43] LIS can contribute to critical data studies by applying critical social theory to analyze power relations relating to data, the emancipatory and contradictory ways in which data and metadata can be used, the ontological and epistemological status of data, and how data are visualized, presented, analyzed, accessed, and managed, among other topics. While Dalton and Thatcher call for a "systemic approach to data criticisms" that focuses on big data, their seven points for a critical approach to data are pertinent to LIS. They are paraphrased and listed below:

1. Data are situated in time and space: Data have historical antecedents and are embedded in social processes.
2. Technology is inherently political: What has been included in the datasets and what has been excluded? Who benefits? Who does not?
3. Data does not exist in a vacuum: It shapes and is shaped by broader social processes and inherent power relations.
4. Data is never "raw" nor objective: Quantification cannot fully model or describe reality.
5. Data will not replace, but rather complement, other ways of knowing.
6. Counter data: Using data in socially progressive ways. What approaches can be taken to use data in liberating ways? In what ways can data be used that challenge dominant discourses and narratives?
7. Examine opportunities for critical engagement with data through praxis[44] (In the case of LIS, this would apply to both academics and practitioners).

The rest of this literature review takes Dalton and Thatcher's seven points of data criticisms to explore areas of commonality and application in LIS.

LIS AND CRITICAL DATA STUDIES

LIS researchers and practitioners have much to contribute to critical data studies because the conceptualizations of data, information, and knowledge, the challenges of

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[43] Kitchin, Rob, and Tracey P. Lauriault, "Towards Critical Data Studies: Charting and Unpacking Data Assemblages and Their Work." *Social Science Research Network: Tomorrow's Research Today.* 2014. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2474112. ("The Programmable City Working Paper 2"); pre-print version of chapter to be published in Eckert, J., Shears, A. and Thatcher, J. eds., *Geoweb and Big Data* (University of Nebraska Press. Forthcoming), 5.

[44] Dalton and Thatcher, "What Does."

building digital infrastructure, and the exploration of socio-political context in which data are embedded, are at the very heart of the discipline. Shilton, for example, points out that personal participatory data is an important area of inquiry for LIS in terms of information policy, information access and equity, and data curation and preservation.[45] In addition, empirical and theoretical work on metadata demonstrates how it can be constrained or liberated by institutional and technological structure and how it can be used in both emancipatory and nefarious ways such as surveillance.[46]

  While Dalton and Thatcher focus explicitly on big data, throughout this section I refer to data more broadly conceived, which includes, but is not limited to, big data.

1. Data are situated in time and space: Data have historical antecedents and are embedded in social processes.

  Dalton and Thatcher claim that big data is an epiphenomenon because data have always been big. "Big data" are not a moment that stands outside of history. From an LIS perspective data have always been both big and small. Borgman argues that even in the sciences which are commonly perceived as being big data intensive (that rely on data from telescopes, colliders, and digital data); most of the scholarly work being done today is carried out by small research teams with minimal funding and a local focus.[47] Others argue that big data is not solely the purview of the sciences (e.g., digital humanities), nor is big data always digital with archives, documents, libraries, photos, and books as examples of big data in the humanities.[48] In terms of personal data, the development of the Internet has not heralded a new era of self-monitoring. Human beings have always "kept track" using tally sticks, diaries, record keeping, and calendars to monitor personal, business, and other affairs.[49] Furthermore, the entire field of Social Informatics, for example, is devoted to understanding the sociotechnical aspects of and social movements involving computerization, and more recently data analysis.[50] The

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[45]Shilton, "Participatory Sensing."

[46] David Lyon, "Surveillance, Snowden, and Big Data: Capacities, Consequences, Critique," *Big Data & Society* 20, (2014): 1-13.

[47] Borgman, "*Big Data,*" 10.

[48] Amalia S. Levi, "Humanities 'Big Data': Myths, Challenges, and Lessons." Paper presented at the annual conference of the IEEE International Conference on Big Data, October 6-9, 2013, Santa Clara, California.

[49] Phillipe Lejeune, *On Diary,* eds. by Jeremy D. Popkin and Julie Rak, (Manoa, Hawaii: University of Hawaii Press, 2016.

[50] Michael Marcinkowski, "Data, Ideology, and the Developing Critical Program of Social Informatics," *Journal of the Association for Information Science and Technology* 67, no. 5 (2016): 1266-1275.

social processes in which data are embedded have historically and continue to be a concern in LIS. The perspective that is sorely needed, however, is one that is critical.

2. Technology is inherently political: What has been included in the datasets and what has been excluded? Who benefits? Who does not?

In this criticism Dalton and Thatcher argue that 'big data' are a technology that is not neutral. Because big data are shaped by and reshape us in a contested cultural context, Dalton and Thatcher rightfully question the effects of quantification on the human experience. A specific example of this process comes from Banner in her work on a networked patient support group. Banner analyzes how self-tracking and sharing personal data transforms affect into data, advances a process of "informatics subjecthood" by which a person comes to view herself as an ongoing potential source of data, which is then gifted to "the health commons."[51] Banner argues that through the process of transformation from subject to information, subjecthood and identity are conferred through participation in data discourses. Similarly, while Lanier is concerned about how big data shapes human experience, he points out that not only is human identity obfuscated by big data algorithms, but so is human effort through the processes of repackaging, anonymizing, and not compensating people for their contributions that make networks valuable in the first place.[52]

Concerns about how personal data is used by corporations and governments for cheap, hidden, mass, and ubiquitous surveillance, how datafication of human experience affects privacy and consciousness, how secure personal data are, and secondary use of data have been explored.[53] Other critical questions about data center upon political economy: Who owns personal data that is often shared in exchange for services? Who controls how the data is used? And, who profits?[54] An LIS perspective encompasses a broad exploration of issues related to providing access to data or information and contents of datasets (exclusion and inclusion), the embeddedness of data in information systems and institutions such as libraries, and how people use data.

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[51] Olivia Banner, "Treat Us Right!" Digital Publics, Emerging Biosocialities, and the Female Complaint," *Identity Technologies: Constructing the Self Online*, eds. Anne Polletti and Julie Rak University of Wisconsin Press, p. 198-216.

[52] Jaron Lanier, *Who Owns the Future?* (New York: Simon & Schuster, 2014).

[53] Schneier, "Data and Goliath"; David McCandless, *Information is Beautiful*. http://www.informationisbeautiful.net/.

[54] Lanier, "*Who Owns.*"

3. Big data does not exist in a vacuum: It shapes and is shaped by broader social processes, economies, identities, biases, and inherent power relations.

   In this criticism, Dalton and Thatcher argue that technology plays a role in social change and is used to fulfill social imperatives "such as accumulating capital" but it does not act alone to determine the form of society. Technology offers affordances—ways in which users can adopt and adapt technology for purposes and audiences it was not originally intended for. In LIS, there are calls for resistance to those aspects of technology that collect user data with impunity. The Library Freedom Project, for example, is a partnership among librarians, technologists, attorneys, and privacy advocates "which aims to address the problems of surveillance by making real the promise of intellectual freedom in libraries" by providing workshops for librarians about digital privacy, classes for library patrons, supporting the library digital privacy pledge, and supporting the use of Tor exit relays in libraries.[55] Hibert suggests that "Privacy is the new oil" and that it is incumbent upon library and information professionals to "repoliticize their identity for safeguarding their users' capacities to cope with literacy demands of the 21st century," particularly in terms of privacy.[56]

   Finally, librarians and information professionals provide access to, and information about, open data. It is naïve to suggest that providing access to open data will de-politicize the use of data because data can reinforce power relations and injustice as much as it can alleviate them. Johnson points out three often overlooked aspects of the open data movement: "the embedding of social privilege in datasets as the data is constructed, the differential capabilities of data users (especially between citizens and 'enterprise' users), and the norms that data systems impose through their function as disciplinary systems."[57] The open data movement brings to the fore important questions for LIS about what Johnson dubs "information justice" and the development of information justice theory which have important implications for LIS research, education, and practice.

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[55] Library Freedom Project, "Home," (2016): https://libraryfreedomproject.org/.

[56] Mario Hibert, "Loss of the Social, Return of the Private: Compromising Public Failures in the Age of Boudoir Surplus," Around the World Conference, Edmonton, AB, Canada, May 11, 2016. http://aroundtheworld.ualberta.ca/portfolio/mario-hibert/

[57] Jeffrey Johnson, "From Open Data to Information Justice," *Ethics and Information Technology* 16, (2014): 263-274.

4. Data is never "raw" nor objective: Quantification cannot fully model or describe reality.

This criticism deals with infrastructure and with social context: "The data's format and content have been structured in a certain way for an explicit purpose." As noted above, all data are partial representations. The foundation of empirical work (whether quantitative, qualitative or textual) is the process of analyzing "raw" data to represent some phenomenon. All data, then, are "cooked" and this progression is not new, nor inherent to, big data.[58] Markham points out that the very term "data" positions data as something that exists "out-there," that one collects, and which functions as a discrete object. This conceptualization of data obfuscates the processes of conversation, interpretation, and presence inherent in research (particularly in qualitative work).[59] Similarly, Dalton and Thatcher discuss the limitations of data in their example of Facebook likes. A 'like' on Facebook does not tell us about the user's intent or the meanings implied; thick descriptions are needed in order to derive any insight. In addition, concerns have been raised about bias in big datasets, the validity of big data, and epistemological issues in interpreting big data (correlation versus causation).[60]

There are also constraints and limitations involved with data visualizations. Ekbia et al. observe two trends in their section "Aesthetic Dilemmas": that modeling and mapping are increasingly important when dealing with large datasets, and that both the data themselves and the process of visualization are increasingly opaque. There are a number of consequences emanating from this. First, Ekbia et al. argue that in "'mapping' of data points to visualizations, a great deal of translational work is involved, which renders the accuracy of the claims problematic;" that data visualization is a visualization of the conversion rules of "mapping" first and foremost; and that any visualization is but one representation out of endless possibilities. People decide what data to represent and how they will represent it. Furthermore, the current trend is to lean more heavily toward aesthetically pleasing visualizations to engage users. Although aesthetically pleasing visualizations and "true" representations of data are not mutually exclusive, there are potential issues with partial representation, and lack of complexity for the sake of brevity, among other issues.[61]

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[58] Robert Hammarberg, "The Cooked and the Raw," *Journal of Information Science* 3, (1981): 261-267.
[59] Annette Markham, "Undermining 'Data': A Critical Examination of a Core Term in Scientific Inquiry," *First Monday* 18, no. 10 (2013). firstmonday.org/ojs/index.php/fm/article/view/4868/3749
[60] Mayer-Schonberger and Cukier, "*Big Data.*"
[61] Ekbia et al., "Big Data," 1532.

5. Big data will not replace, but rather complement, other ways of knowing.

Dalton and Thatcher dismiss the claim that big data will cause the "end of theory."[62] Rather, they suggest that big data and small data are complementary and when combined can produce interesting approaches to research. In her analysis of trends in information behavior, Greifender argues that while social media and online data are active areas of inquiry in the field, big data and big data analytics cannot answer many research questions of interest. Exploratory data, qualitative data and mixed methods approaches are warranted.[63] Furthermore, a significant contribution that information behavior scholars can make to critical data studies is to focus on how contexts constrain, empower, discipline, or control how people, including ordinary people, researchers, and educators, use, re-use, or do not use data as well as examining knowledge production and practice of data scientists themselves.[64]

While there is a growing body of literature in LIS that focuses on the data turn in the academy, government, corporations, and in public consciousness, often this work lacks a critical perspective. However, a wide variety of methodological approaches to scholarship have been used in LIS that can potentially be fruitful for engaging in critical data studies. Examples include Foucauldian discourse analysis,[65] critical discourse analysis,[66] ethnography, practice studies, and the use of participatory design (particularly in user studies) to name but a few.

Kitchin and Lauriault advocate analyzing and critiquing data assemblages as a critical approach to data studies.[67] Markas and Saka describe assemblage as "a sort of anti-structural concept that permits the researcher to speak of emergence, heterogeneity, the decentered and the ephemeral in nonetheless ordered social life."[68] In LIS, a number of researchers have used the concept of assemblages to develop a

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[62] Chris Anderson, "The End of Theory: The Data Deluge Makes the Scientific Method Obsolete," *Wired*, June 23, 2008. http://www.wired.com/2008/06/pb-theory/.

[63] Elke Greifender, "Trends in Information Behavior Research," In *Proceedings of ISIC, the Information Behavior Conference, Leeds, 2-5 September, 2014: Part 1*, (paper isic13). Retrieved from http://InformationR.net/ir/19-4/isic/isic13.html

[64] Christine Borgman, "The Conundrum of Sharing Research Data," *Journal of the American Society for Information Science* 63, no. 6 (2011): 1059-1058.

[65] John Budd, "Discourse Analysis and the Study of Communication in LIS." *Library Trends* 55, no. 1 (2006): 65–82; Bernd Frohmann, "Discourse Analysis as a Research Method in Library and Information Science. *Library & Information Science Research, 16*, no. 2 (1994): 119–138.

[66] Siobhan Stevenson, "The Rise and Decline of State-funded Community Centres: A Textually-oriented Discourse. *The Canadian Journal of Library & Information Science* 26, no. 2–3 (2001): 51–75.

[67] Kitchin and Lauriault. "Towards Critical."

[68] Markas, George E., and Ekran Sakas. "Assemblage." *Theory, Culture & Society* 23, no. 2–3 (2006): 101–109.

theory of institutions such as the library,[69] government and website assemblages,[70] to advance theorizing on the influences of ICTs in reshaping work,[71] and to investigate questions about collections, categorization, and research infrastructure.[72] This approach can be applied to theoretical work on data assemblages from an LIS perspective.

6. Counter data: Using data in socially progressive ways. What approaches can be taken to use data in liberating ways? In what ways can data be used that challenge dominant discourses and narratives?

Dalton and Thatcher's sixth criticism focuses on how data can be used in socially progressive ways and for the public good. In LIS, the rise of hackathons, providing access to and opportunities to use open data, development of data literacy programs, and the use and critical analysis of data analytics software are all ways in which library and information professionals can assist people in using data for the public good. However, as previously mentioned, data can just as easily be used to reinforce power relations and marginalization as it can be used for public benefit. Providing access to datasets is not enough. Librarians and information professionals can politicize or re-politicize their practice in order to support "counter data" by drawing upon LIS's social justice orientation and information ethics.

Social justice has been defined as "a society in which individuals and groups are treated fairly and receive an equitable share of all the benefits of society."[73] John Rawls writes that social institutions assign rights and duties and "define the appropriate distribution benefits and burdens of social co-operation."[74] While libraries are not

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[69] Natasha Gerolami. "The Library Assemblage: Creative Institutions in an Information Society." *Journal of Documentation* 71, no. 1 (2015): 165–174.

[70] Lucia Liste and Knut H. Sorenson. "Consumer, Client, or Citizen? How Norwegian Local Governments Domesticate Website Technology and Configure Their Users." *Information, Communication & Society,* 18, no. 7 (2015): 733–746.

[71] Steve Sawyer, Kevin Crowston, and Rolf Wigand, "Digital Assemblages: Evidence and Theorizing from the Computerization of the US Residential Real Estate Industry." *New Technology, Work, and Employment* 29, no. 1 (2014): 4015–4040.

[72] Cheryl Klimaszewski, "Third-Party Classification: Exposing Likeness between Satellites Dishes, Troll Figurines and Mass-Produced Bedspreads in a Romanian Local Museum." *Journal of Documentation* 72, no. 1 (2016): 156–171; Lisa Nathan, Elizabeth Shaffer, and Maggie Castor, "Stewarding Collections of Trauma: Plurality, Responsibility, and Questions of Action." *Archivaria* 80 (2015): 89–115.

[73] Bharat Mehra, Kevin S. Rioux., and Kendra S. Albright, "Social Justice in Library and Information Science." In *Encyclopedia of Library and Information Sciences*, 4820–4836. Los Angeles: Taylor & Francis, 2010, p. 4820.

[74] John Rawls, *A Theory of Justice*. Cambridge, MA: Harvard University Press, 1971.

explicitly mentioned by Rawls, let alone data, the application of this idea is self-evident. In addition, as more aspects of human life (and our data) move online, the mission of libraries as social institutions that support social justice become increasingly important. For example, Unsworth, who calls for data policies that "align with emancipatory politics," has carried out research on the relationship between big data and the social contract.[75] In LIS, "counter-data" is a recent phenomenon and LIS's social justice orientation can provide a framework to critique big data, open data, and contents of datasets.

Finally, Day eloquently articulates the importance of critical theory in LIS as "counter-information" that enables us to critique ideology:

> classification, metadata, and visualization techniques, or even in the practices of science as a posteriori method—*needs* critical theory and deep reading; not as a modern sense of information, but as counter-information. Critical theory intervenes in our customs of thought and practices, in our use of representations, in order to raise issues about power, production, representation, judgment, justice, and the direction of society and culture generally. Critical theory provides a necessary and critical contrary—a deep reading—to the surface readings that we routinely do in our everyday lives. One deploys critical theory not in order to reproduce the already popular ideological order, but in order to engage and try to understand, and if necessary critique it.[76]

7. Examine opportunities for critical engagement with data through praxis (in the case of LIS, this would apply to both academics and practitioners).

There are many opportunities and reasons for LIS practitioners to critically engage with data. LIS has a long and contested history of theorizing data, information, and knowledge; exploring how people and information systems interact with data; organizing and providing access to data; and examining the power relations and the economic, cultural, and social contexts in which data are created, transformed, and analyzed. Drawing from the emergent multidisciplinary field of critical information studies which considers "the ways in which culture and information are regulated by their relationships to commerce, creativity, and other human affairs,"[77] LIS practitioners

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[75] Kristene Unsworth, "The Social Contract and Big Data," *Journal of Information Ethics* 25, no. 1 (2016): 83-97.

[76] Day, "*Indexing It,*" p. 144.

[77] Siva Vaidhyanathan, "Afterword: Critical Information Studies," *Cultural Studies* 20, no. 23 (2006): 292-315.

can take a critical approach to data studies. While critical information studies interrogates copyright, intellectual property, and the structure, functions, and habits that guide the global flow of information, an LIS approach to critical data studies can frame work on privacy, knowledge production, policy, data visualization, people as generators and users of data, metadata, and access to and information about, data, using critical theory.

Dalton and Thatcher do not specifically mention ethics in their big data criticisms but Metcalf and Crawford point out that "[critical data studies] faces a substantial challenge: as the practice of data science surges ahead, we lack a strong and rigorous sense of ethical parameters for scientific research."[78] While Metcalf and Crawford discuss ethics as they relate to scientific research, LIS education and practice is guided by the American Library Association's commitment to core values of librarianship such as privacy, confidentiality, intellectual freedom, social responsibility, the public good, preservation, service, democracy, and access (among other core values).[79] LIS as a field has struggled with issues of diversity; however, discussions about advocacy, ethics, values, diversity, marginalization, and information as a human right are ongoing.[80] In LIS practice and education, these discussions about the philosophy, values, and ethics that underpin LIS can be extended to critical data studies.

In a time of great social inequality, information glut, and the data deluge, where critique is turned in on itself as simply another narrative competing among many, it is imperative that LIS researchers, educators, and practitioners critically interrogate the economic, social, and political power relations embedded in data and data assemblages. LIS can contribute to critical data studies by developing and applying critical social theory to data studies, extending professional values and ethical approaches to data and data services, incorporating a range of ethnographic and participatory research approaches to explore how people interact with data, and articulating concerns regarding how data can be used in empowering and emancipatory ways and for the public good. There is an immediate need for empirical work on critical data studies in LIS.

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[78] Jacob Metcalf and Kate Crawford, "Where are Human Subjects in Big Data Research? The Emerging Ethics Divide," *Big Data and Society* 3, no. 1 (2016): 1-14.

[79] ALA Council, "B1. Core Values, Ethics, and Core Competencies," American Library Association, accessed June 23, 2016. http://www.ala.org/advocacy/intfreedom/statementspols/corevalues

[80] Shiraz Durrani, Information and Liberation: Writings on the Politics of Information and Librarianship. Duluth, Minnesota: Library Juice Press, 2008; Mehra, Rioux, and Albright, "Social Justice"; Paul T. Jaeger, Nicole A. Cooke, Cecilia Feltis, Michelle Hamiel, Fiona Jardine, and Katie Shilton, "The Virtuous Circle Revisited: Injecting Diversity, Inclusion, Rights, Justice, and Equity into LIS Education to Advocacy." The Library Quarterly 85, no. 2 (2015): 150–171.

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