Engines of Order: A Mechanology of Algorithmic Techniques. Bernhard Rieder. Amsterdam: Amsterdam University Press, 2020. 352 pp. € 115,00 (hardcover). (ISBN 9789462986190). € 0,00 (PDF). (ISBN 9789048537419).

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The algorithmic ordering of information—indexing, selecting, ranking and recommending— pervades contemporary life. Techniques originating in the efforts of information scientists to efficiently sift through research literature are now used for finding everything from abusive behavior to effective medical treatments to romantic partners. This proliferation of applications has been accompanied by both hype and, increasingly, concern. Reflection on the broader social consequences of algorithmic information ordering, once confined to "critical" margins of information studies, has entered the mainstream of academic and industrial research in information science and computer science, and beyond. Social scientists seek ways to assess the potential negative impacts of algorithmic information ordering on vulnerable populations, machine learning researchers attempt to design fairer algorithms, and schools of informatics and data science wrestle with how to train their graduates to practice ethically. In law schools and think tanks, policy wonks weigh the benefits of regulation, or even outright bans, of particular techniques or applications of algorithmic information ordering. Information retrieval and recommendation algorithms are now suitable topics for campaign speeches and *New York Times* op-eds.

Yet while the attention paid to critical reflection upon algorithmic information ordering may be new, the contours of the popular debates are familiar from the history of technology studies. At one pole is technological determinism, most clearly at work in the rhetoric of those who speak of technological "waves," or new economic "rules" dictated by technological imperatives. Technological determinism is often boosterism—extolling the virtues of new ways of doing things while warning that we must adapt to the inevitable—but it is also evident to some extent in concerns about computerization leading to a world dominated by instrumental rationality, with no place for human judgment. At the other pole is social constructionism, which counters that social effects result not from some inherent quality of a technology, but from the ends to which it is put, ends that reflect social interests. Social constructionism calls our attention away from technology itself toward a focus on "social forces" such as the drive for capitalist accumulation or demands for democratic control. Both positions are often expressed implicitly by preferred remedies for perceived harms: technological determinism by demands for restrictions on or capitulations to certain technologies, social constructionism by calls for ethical codes and incentive reform.

Bernhard Rieder's *Engines of Order: A Mechanology of Algorithmic Techniques* attempts to push the debates about algorithmic information ordering out of the basins of attraction formed by these two poles.

Moving beyond crude technological determinism and social constructionism has been the goal of much theorizing among scholars of information and technology over the past forty years, most influentially in the form of actor-network theory (ANT). *Engines of Order* builds not on ANT but on the "mechanology" of French philosopher Gilbert Simondon. Simondon's mechanology or "sociology of machines" (Rieder 2020, p. 16) resembles ANT in that both eschew theorizing about technological essences or social forces, instead emphasizing careful attention to the ways that specific technological and social systems are connected together. But where ANT foregrounds the variety of things that must be connected in order for them to have some effect in the world, mechanology distinguishes a way of being connected that is specific to the technological. It posits that the specific ways that bits of functionality are connected into working technologies gives them—contrary to social constructionism—a certain independence from social systems. That independence constrains how technologies can be put to use, but—contrary to technological determinism—these constraints depend on specific historical developments in the operations of technical ensembles and are subject to change.

While Simondon developed his mechanology through meditations upon various hardware devices, *Engines of Order* is "an attempt to develop a mechanological perspective on software and to apply it to the engines of order that increasingly adjudicate (digital) life" (Rieder 2020, p. 16). The perspective that Rieder takes on software is not the formal analysis of computer science, but rather the perspective of the "software maker." Software makers, like any makers of technology, must orient themselves in and find their way through a world of functional possibilities that has been cumulatively organized by technical work in the past. Programming is a process of coming to understand the various bits of functionality provided by programming languages, software libraries, and development tools and how they might be assembled into a piece of working software. These bits of functionality, combined with software makers' understandings of them, are what Rieder calls *algorithmic techniques*. Algorithmic techniques constitute a "vocabulary of possible function" that can be drawn on to express working software (Rieder 2020, p. 91).

Algorithmic techniques cannot be identified with formal units of programming knowledge, published descriptions of algorithms, or specific concrete implementations. An algorithmic technique can only be identified retrospectively, through a historical analysis of what is held in common across some trajectory of technological development.[1] Rieder's method is therefore historical, and the specific history that he engages with is the history of information science. Rieder freely admits that information scientists may be "appalled" by his history, as he tells it "not as an information scientist invested in paradigmatic coherence, nor a historian of science retracing the emergence of a discipline" but—in keeping with the approach outlined above—by tracing algorithmic techniques of information ordering across technological trajectories beginning in postwar attempts to solve "library problems" and ending up in the pervasive application of these techniques today (Rieder 2020, p. 329). He aims to show both that these technological trajectories progress through significant changes in the kinds of applications envisioned and

that, at any particular point in time, the current state of progress along these trajectories shapes what applications *can be* envisioned.

Rieder argues that early efforts to build information retrieval systems that could discern "aboutness" or "relevance" marked the first attempts to create software that could carry out tasks seemingly "cultural" or "intelligent" in nature. He calls attention to how addressing such tasks requires coordination between, on the one hand, ways of formatting data called for by the algorithmic techniques employed and, on the other, the ambiguous, culturally-inflected categories that the data will be taken to "stand for" in some specific application. As the case of "relevance" exemplifies, this coordination typically cannot be justified on a theoretical basis, but only through pragmatic appeals to what "works" in operational systems. Rieder points out that this provides an opening for the kind of ad hoc, "intuitive" rationalizations often found at the root of problems caused by systems for algorithmic information ordering. While more attention is now being paid to the provenance of the data that feeds such systems, there has been much less examination of the "intermediate forms" into which data must be transformed in order for algorithmic techniques to be applied. As Rieder observes, because the number of such forms is relatively small compared to the huge range of potential data sources and possible applications, they may be more effective points of leverage for critique and the imagining of alternatives.

Engines of Order is part of the Recursions book series from Amsterdam University Press. The books published in this series focus on the material aspects of communication and the cultural ramifications of media technologies. In addition to *Engines of Order*, the series has published a number of other books of interest to scholars in information studies, including works on digital archives and social memory, the cultural history of list-making, and the cataloging of images as a form of knowledge production. Several of these, including *Engines of Order*, have been made available as open-access PDFs through JSTOR. Both *Engines of Order* and the Recursions series are examples of how some of the most interesting recent work in information studies is being published under the heading of "media studies." That this should be the case is unsurprising, given that there is no longer any meaningful distinction between a "media platform" and an "information system." But cross-pollination between the media studies and information studies literatures is still relatively rare. Hopefully more work like Rieder's will change that.

Rieder's own career bridges the two fields. He is currently Associate Professor of New Media and Digital Culture at the University of Amsterdam, but he received his PhD in Information and Communication Sciences at Paris 8 University, where he first encountered the information retrieval research that eventually led to this book. His interest in "software-making" is not simply as an object of study: he is the author of several research tools for studying social media platforms, including Netvizz, a popular tool for studying Facebook—until Facebook shut off access to the interfaces that it relied on (Rieder 2013). His background in both information science and media studies enable him to smoothly tack back and forth

between cultural theory and technical explanation in *Engines of Order*. His explanations of Simondon's ideas are exceptionally clear. Simondon's work has been quite generative for cultural studies of technology in recent years, yet many humanities scholars struggle to explain his examples involving thermionic diodes and heat transfer in engines. Rieder also exhibits an impressive command of the historical literature of information retrieval, which he engages with to a degree rarely seen outside of information science journals—or inside them, for that matter.

The historiographical portion of *Engines of Order*—which constitutes Part II of the book after the theoretical development in Part I—begins with in postwar US "documentation centers," where figures like Calvin Mooers and Mortimer Taube were beginning to define a field of "information retrieval" in opposition to traditional library practice. Rieder zeroes in on the development of postcoordinated indexing as a decisive break with earlier techniques of librarianship. He argues that the disassembly of precoordinated subject headings into atomic concepts, to be re-synthesized through Boolean logic, established atomization and recombination as foundational logics of algorithmic information ordering. From there he moves on to a further degree of atomization and recombination: the decomposition of texts into lists of term frequency counts, now to be reassembled through statistical techniques. Rieder observes an epistemological shift in the move from structuring an information space by imposing a Boolean grid on top of it, to structuring it from the bottom up using seemingly "natural" units. He traces a line of development from these early lists of frequency counts to the "feature vector" ubiquitous in present-day machine learning.

Next come Bill Maron's early experiments with automatic indexing using a naïve Bayesian classifier, in which Rieder locates the origins of supervised machine learning. He presents Bayesian classification as a paradigmatic example of the "interested reading" of data. While statistical methods are often characterized as revealing some "signal" intrinsic to but hidden within a mass of data, Rieder argues that these methods can only make data signify in relation to some pre-existing need to draw distinctions. In Maron's case, this was the need to differentiate between established subject categories of technical literature; today it might be the need to allocate scarce spaces in a doctoral program while avoiding tedious admissions work (Burke 2020). The ultimate form of differentiation is ranking, where every individual in some set is ordered along a spectrum of value. Rieder's history of algorithmic information ordering ends with the conceptual roots of Google's PageRank algorithm. Many readers will be aware of citation analysis as a precursor of Google's ranking algorithm, but Rieder digs deep into separate but related work by social scientists interested in the mathematical representation of social structure. That history provides the background for a fascinating analysis of the role played by the "damping factor," an ad hoc parameter that plays a key role in the calculation of PageRank.

Much of Rieder's history of information retrieval will be familiar to information scientists, especially those with an interest in the history and foundations of their field. But his focus on telling it as a history of algorithmic techniques enables us to see it from a fresh perspective. Throughout this history Rieder emphasizes the role of the intermediate forms that became obligatory ways for system designers to look at the world. The matrix of binary variables, the feature vector, and the graph emerge as members of a finite set of forms capable of infinite recombination into working systems. Another recurring theme is the priority of getting things to work over theorizing about why they do. Information retrieval researchers have often lamented the lack of explanatory theory in their field and downplayed its engineering-oriented aspects. But Rieder (2020, p. 335) makes a strong case that "sensitivity to technicity" and willingness to work without explicit theories have historically been strengths of information retrieval research, even if they also present certain risks. He suggests that rather than continuing to try to become a "science," a better way forward for research in algorithmic information ordering might be to fully embrace that engagement with technicity, while simultaneously pursuing more meaningful interchange with the social settings into which that technicity is embedded.

Indeed, a major strength of *Engines of Order* is its insistence on a constructive and not solely critical attitude toward technical systems. Rieder avoids the trap of demanding that critical work must always have "implications for design" (Dourish 2006), while persuasively arguing that it nevertheless should not "confine itself to a reactive position that thinks exclusively in terms of freedom from, not freedom to" (Rieder 2020, p. 338). Our collective technical inheritance undoubtedly constrains what it is possible to do, but a lesson that Rieder draws from Simondon's philosophy of technology is that these constraints are also essential to the imagining of new possibilities. Rieder is hardly the first to suggest that critique be complemented by composition (Latour 2010), but his command of, and evident respect for, the languages of both philosophy and engineering give his argument added authority. For those researchers who still believe in the liberatory potential of speculative system-building but are dismayed at its annexation by commercial concerns, Rieder's message is a welcome one. As he puts it, it would be dispiriting to believe that "we can hope for little more than to detect and (maybe) correct the practical or moral 'mistakes' of all-powerful companies and institutions" (Rieder 2020, p. 337).

Engines of Order provides useful tools for thinking about about two things in particular. The first is "data science." A common but incorrect understanding of data science is that it is a new science, born of a union between statistics and computer science. A more accurate description of data science is that it is, as Rieder (2020, p. 258) puts it, "a 'trading zone,' where statistics and other areas of mathematics intermingle with ideas about language, information, and knowledge as well as computing machinery, systems design, and the concrete and imaginary requirements of 'knowledge workers' and 'decision-makers.'" This more accurate description of data science is important because the common but incorrect view elides forms of expertise that are neither "stats and CS" nor "domain expertise." "Application" of data science becomes

solely a problem of how to cast a "domain" in mathematical terms amenable to computation. But as Rieder shows, the selection of an appropriate algorithmic technique is just one of many decisions that must be made for a data science project to come to fruition. Collectively these decisions amount to the specification of how a data "text" will be generated by various sociotechnical systems *and* the establishment of a shared understanding of how to properly interpret that text.

This observation leads to the second thing that *Engines of Order* is useful for thinking about, which is the relationship between what Patrick Wilson (1996, p. 323) called "the two sides of our field." One side is a field of engineering research and development, the history of which is so thoughtfully documented in *Engines of Order*. The other side is a field of social and humanistic study, exemplified by the theories and methods that Rieder employs. Wilson feared that the latter side would find it increasingly difficult to justify its close association with the former. One development he anticipated was the diminishing of social and humanistic study into an adjunct to technical education, equipping data scientists with "creativity" and "ethics." But he held out for a more expansive role, inspired by Donald McKenzie's (1999) "sociology of texts," dealing "not only with verbal texts but visual, oral and numerical data of all kinds … with the entire field of the production, transmission and reception of texts and with their technical and social dynamics" (Wilson 1996, p. 322). The "sociology of machines" envisioned in *Engines of Order* suggests how a field so conceived might join with engineering R&D as full partner, rather than handmaiden.

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[1] An algorithmic technique is thus an *ideal type*, a continuous trace perceived by a historian through some discontinuous series of things (Shaw 2013).

References

Burke, L. (2020). The death and life of an admissions algorithm. *Inside Higher Ed*. https://www.insidehighered.com/admissions/article/2020/12/14/u-texas-will-stop-using-controversial-algorithm-evaluate-phd

Dourish, P. (2006). Implications for design. *CHI '06: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 541. https://doi.org/10.1145/1124772.1124855

Latour, B. (2010). An attempt at a "compositionist manifesto." *New Literary History*, 41(3), 471–490.

McKenzie, D. F. (1999). *Bibliography and the sociology of texts.* Cambridge University Press. https://doi.org/10.1017/CBO9780511483226

Rieder, B. (2013). Studying Facebook via data extraction. *WebSci '13: Proceedings of the 5th Annual ACM Web Science Conference*, 346–355. https://doi.org/10.1145/2464464.2464475

Rieder, B. (2020). *Engines of order: A mechanology of algorithmic techniques*. Amsterdam University Press. https://doi.org/10.5117/9789462986190

Shaw, R. (2013). Information organization and the philosophy of history. *Journal of the American Society for Information Science and Technology*, 64(6), 1092–1103. https://doi.org/10.1002/asi.22843

Wilson, P. (1996). The future of research in our field. In J. Olaisen, E. Munch-Petersen, & P. Wilson (Eds.), *Information science: From the development of the discipline to social interaction* (pp. 319–323). Scandinavian University Press.