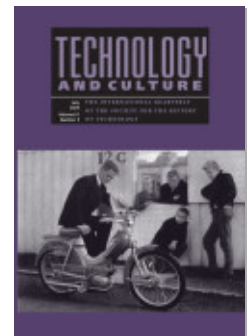*The Stuff of Bits: An Essay on the Materialities of Information* by Paul Dourish (review)

Marlene Manoff

tending the comparison to cities with different political regimes such as in the Low Countries (say Antwerp, or Ghent) or in Northern Italy.

KAREL DAVIDS

Karel Davids is professor emeritus of economic and social history at Vrije Universiteit Amsterdam. He is the author of *The Rise and Decline of Dutch Technological Leadership. Technology, Economy and Culture in the Netherlands, 1350-1800* (Brill, 2008).

The Stuff of Bits: An Essay on the Materialities of Information

By Paul Dourish. Cambridge, MA: MIT Press, 2017.

In *The Stuff of Bits*, Paul Dourish surveys the material turn across a range of disciplines with particular attention to what he calls "the materialities of information." He highlights the imperative to work across traditional scholarly boundaries in order to address the entanglement of social, cultural, and material factors involved in the transmission of information. Whereas most materialist analyses of the digital environment tend to focus on hardware and large-scale computer infrastructure, Dourish concentrates his analysis on software design and development. He acknowledges that software is more malleable than metal or plastic, but maintains that developers nevertheless must contend with multiple material constraints which this volume proceeds to elaborate.

Dourish is particularly concerned with the ways in which the digital representations that encode so much of contemporary life are constrained by aspects of their materiality. He provides four case studies that address emulation, spreadsheets, databases, and network protocols from the perspective of how they function as mechanisms for representation. The first case study, devoted to processes of digital emulation, attempts to explode the notion of the immateriality of the virtual. Dourish builds an interesting case for virtualization as rematerialization. He explains how we might understand emulation as not so much "a move away from the material, . . . but rather a new material foundation for digital experience" (p. 68).

The second case study describes what Dourish calls "spreadsheet events" in order to analyze how the materialities of spreadsheets shape the ways in which people work with them. He discusses the granularity and transportability of spreadsheet grids and describes how and why some things are manipulable by spreadsheet and others not. He provides insight into the ways in which spreadsheet formats come with "commitments to particular structures that create not only a way of seeing data but also a way of working with them" (p. 100). I read this as a prelude to what I expected to be an elaboration of the larger implications of institutional reliance upon spreadsheets, or a discussion of how spreadsheets shape organizational thinking or how they help to promote certain kinds of evidence gathering and solutions. But

the emphasis in this volume is on describing the evolution and specific materialities of technical processes, rather than on illuminating the ways in which dependence upon these materialities shapes larger social arrangements.

The third case study provides a detailed accounting of what databases are and how they work. As databases, even more than spreadsheets, underpin much of contemporary life, Dourish is concerned with the evolution of database structures that ultimately determine who and what gets to be represented. Dourish covers database formats and the relational model, alternatives to the relational model, the materiality of relational data processing, and the move to big data. He describes the properties that "are significant in the rise of NoSQL databases and related new approaches" including "granularity, associativity, multiplicity, and convergence" (p. 128).

The fourth case study traces the history and materialization of internet routing protocols and network topologies. This enables Dourish to show that network centralization or decentralization is a function of the entanglement of material and institutional factors. In so doing, he provides insight into how the "politics of network address space allocation and the dynamics of routing table growth and exchange are dual aspects of the same material configurations" (p. 155). He makes a convincing case for seeing the Internet as "not so much a network of networks as a network of institutions" (p. 152).

The wealth of technical detail Dourish provides raises two important questions. What does it mean for a computer scientist to write himself into the interdisciplinary materialist literature? And what kind of technical expertise is required to opine on digital technology? In a volume that describes itself as an attempt "to bridge" the domains of cultural practice and technological operation (p. 205), not much text is devoted to teasing out the social and cultural impacts of densely described technological processes. Thus, while Dourish reflects at some length upon what it means to describe the Internet as decentralized, he does not discuss the implications of a more or less decentralized Internet. Nevertheless, Dourish convincingly argues that the interdisciplinary materialist literature often demonstrates a failure "to take technology seriously, not just in its uses but also in its specifics" (p. 203): "understanding actual technological capacities requires at times a tedious degree of technical detail" (p. 204). Dourish's close reading of the kinds of issues that confront developers and designers of technical systems is meant to open up a space for a broader, more sophisticated conversation. So, while this work would have been strengthened by the inclusion of more social and cultural analysis, it brings important technical knowledge to bear on our understanding of the materialities of information. It will be useful for anyone wishing to better understand the digital foundation of contemporary society.

MARLENE MANOFF

Marlene Manoff is an independent scholar and former Senior Collections Strategist at the MIT Libraries.