



## CONNECTIONS AND CONTENT: REFLECTIONS ON NETWORKS AND THE HISTORY OF CARTOGRAPHY

By Mark Monmonier

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**Review by:** Marissa Wood, International Mapping

IN *Connections and Content*, Mark Monmonier provides a historical analysis of the evolution of modern cartography through an exploration of the development of “networks,” which he defines as the “indispensable geometric framework[s]” (1) from which maps are derived. Starting from this purposefully broad and vague definition, he goes on to examine the build-out of such networks—from the days of early United States coastal and topographic mapping efforts through to modern-day election mapping—focusing on both the challenges posed and possibilities afforded by the technologies of the day.

The book contains seven chapters, each related to a broad technological development and the corresponding evolution it prompted in the mapping sciences: transportation infrastructure with topographic maps in Chapter 4, for example, and the telegraph with weather mapping in Chapter 5. The book moves through these developments chronologically, and is focused primarily on United States history and cartography. The paired topics in the other chapters include: baselines with early survey networks (Chapter 1); methods of deriving location, from early astronomical techniques to the Geocentric Datum of Australia 2020 (Chapter 2); the evolution of topographic map symbols for canals and railroads (Chapter 3); computers and mapping technology (Chapter 6), and lastly, a thoughtful discussion of the influences of cartographic manipulation on daily life (Chapter 7).

Monmonier’s primary aim is to present a view of historical cartography in the United States that is predicated

upon the establishment and widespread use of reliable geometric frameworks (his “networks”), and to show that without those frameworks, in whatever form they took, cartography could not have developed as it did. He proposes, for example, that it was the early nineteenth century networks created for detailed and precise mapping of the eastern coast of the United States that led to the networks later created by the United States Geographical Survey (USGS) to map, albeit with less accuracy and more artistry, the entire interior of the country. The USGS surveys then led to the westward march of rail and telegraph lines, which spurred development of the first geodetic datums, which in turn formed the base network underlying early American topographic mapping. It was the infrastructure networks of rails, telegraphs, and survey fabrics that made possible the mapping of the west to east movement of storms across the continental United States, an activity that matured into the most prolific of all cartographic genres: meteorology and weather maps. Today, computer technology facilitates map manipulation for political control, and there remains the potential for still greater influence of maps—for better or worse—on our daily lives as technology relentlessly pushes forward.

Overall, the case the author puts forward is convincing, but his argumentation is at times over-strenuous. For example, in the first two chapters—“Baselines” and “Geometry,” respectively—Monmonier describes the painstaking process of developing triangulated networks anchored on precisely measured baselines. He dwells for pages on end on how early surveyors struggled with minutiae like the tiny but



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accumulating errors caused by the thermal expansion of their metal measuring tubes, but the author fails to justify the necessity of the repetitive extent of these details. In fact, Monmonier emphasizes his relentless perusal of particulars in the opening of the second chapter with the warning that “if you’re put off by details, you might hate” his painstaking review of the mathematical calculations for latitude and longitude. Thirty pages into *Connections and Content*, the reader has been warned.

There is a fair amount of overlap between Chapters 3 and 4—“Symbols” and “Infrastructure.” The first concerns topographic map symbols and their relation to infrastructure, and the second relates infrastructure to topographic maps. More specifically, both chapters focus on canals and railroads, with the first describing mapping the features and the other discussing the use of maps to plan and construct the features. Similar to Chapters 1 and 2, beautifully constructed sentences that manage to convey nothing at all abound. A fine example appears on page 108: “Because extensive transport networks of all types typically evolve step by step, maps have always had a role in advocacy, news reporting, and historical narratives,” which comes after the reader has already worked through pages and pages on the subject.

Despite these problems, Monmonier offers in these first four chapters, and throughout the book, an incredible amount of interesting information on the history of map-making in the United States. While I was familiar with the process of astronomical cartography, I had never before considered how the telegraph, in providing precise details and timings of known astronomical events, could be used to determine location. Monmonier describes the process of observing a celestial event at a known location and comparing the timing of the same event elsewhere and using the difference in time to calculate latitude. He then directs the reader to “sketch an example or two on paper, to make certain you understand the principle,” just in case his ill-prepared reader misunderstood the details of the science and math (34). As technology improved and allowed the area of the Earth occupied by the United States to be better and more precisely defined by, among other things, these astronomical observations, features on all of the old topographic maps had to be shifted to fit the new, more accurate, datum (51).

Somewhere in the middle of Chapter 4—after the author is at last ready to move on from canals and railroads—it

starts to become more clear just how the linkages between networks and cartography illuminate the role of maps in modern society and how they have contributed to, and benefited from, the development of science and technology. The fifth chapter, “Telecommunications” offers a beautiful narrative of the progressive development of telegraph infrastructure in tandem with weather science. It includes examples of early live maps, such as one managed by the Smithsonian Institution in the late 1850s, which was updated daily with hanging cards representing weather patterns from across the continent (136). Monmonier also points out the impact the Civil War had on the development of meteorological sciences, describing how civilian telegraph lines, which were formerly transmitting weather data multiple times a day across the country, were co-opted by military authorities or had their activities disrupted (139). For example, after the withdrawal of the Confederate south from the United States, southern telegraph stations stopped communicating weather data to the Smithsonian Institution and other contemporary meteorology hubs in the north, gravely reducing the accuracy of storm movement predictions.

Chapters 6 (“Topology”) and 7 (“Control”) recount the development of computer mapping technology and look ahead to project future possibilities in the field. Monmonier describes digitization efforts at the United States Census Bureau—which began as early as 1890—and how their Topologically Integrated Geographic Encoding and Referencing (TIGER) base map files lent themselves to partisan gerrymandering by those seeking to maintain political power (202). Finally, he imagines maps in a world where “Social Media meets the Driverless Car” (189). It is introduced with an anecdote about his own difficulties as a driver deviating from a GPS-prescribed route to do some sightseeing.

*Connections and Content* is illustrated with a multitude of figures—some by Monmonier himself—and historical maps and drawings enlarged for clarity or reduced to fit the page. The figures relate to, and help clarify, various points, such as the depiction of valleys and ridges on contour maps (Figure 3.3), and the evolution of the Internet (Figures 7.1 through 7.5). All of the illustrations are in black and white, a curious choice in view of the fact that the book’s pages are bordered in full color, with snippets of a different historical map for each chapter. It is especially odd when color itself is the topic under consideration, such as the discussion in Chapter 3 of the colored

symbols used in USGS topographic maps, where he refers to “heavy Prussian blue’, . . . India ink, . . . and burnt sienna” (64). Throughout, Monmonier offers readers constant reminders that he has, for example, converted a color map to greyscale before he “manipulated the relative darkness of shades of grey to emphasize some features more than others” (70). The book is peppered throughout with editorial evaluations of its illustrations—those the author drew and others he chose to include. Among the comments are such insights as: “indeed, its lack of precision is an enigma” (132) and “most cartographic purists would excuse the rounded coastlines” (198). He spends an entire page in Chapter 4 reviewing his own two-panel Erie Canal map (Figure 4.1), which he quite proudly calls “a graphic paragraph of sorts” (101). I found these frequent, and sometimes lengthy, asides jarring digressions from the book’s primary, historical focus.

The final chapter covers the symbiosis of cartography with networks of control, such as in the case of maps used to manipulate electoral outcomes. This chapter contains a series of bold statements about the 2016 Presidential election that, while based in fact, may generate some controversy in the current political climate. For example, Monmonier sums up the role of the Russian government’s use of social media to influence the election outcome with, “Clinton was strongly disliked by Russian president Vladimir Putin, who apparently believed that pejorative posts and forwarded fabrications would benefit her opponent, Donald Trump. . . .” On page 200, Monmonier provides a proposal of his own for fixing the broken electoral college system—one that involves awarding electoral votes proportionally,

based on the popular vote count in each state, rather than the current winner-take-all system. But he also notes that until the problem of widespread partisan gerrymandering is addressed, even this bold and progressive voting system reform will not solve the underlying problems. I have to agree with Monmonier that this is an “awkward” place to end the book (206).

Although the author is largely successful in presenting his thesis, it never becomes clear just who Monmonier sees as the intended audience for *Connections and Content*. Much of the book delves deeply, perhaps unnecessarily so, into specific examples and invitations for you to “try it yourself” (13) as if you were a student in a network-focused cartographic history class. The first two, math-heavy chapters were interesting but something of a chore to get through, and most of the next two chapters get a bit bogged down with steel rails and water-filled ditches. *Connections and Content* is an interesting and informative read but might have had a broader appeal as a series of essays, commenting on cartographic history, development, and the current problems in mapmaking. The use of the broad idea of “networks” to string the various essays together has instead led to too much awkward overlap between sections. This book has an identity crisis. Is it for surveyors interested in the historical development of mapping technology? Is it for students whose eyes are on the future role of cartography in daily life? It is surely not for the average reader casually interested in the history of mapping in the United States, unless they can appreciate quite a bit of obscure math and a deep dive into cartographic/communication design analysis.

