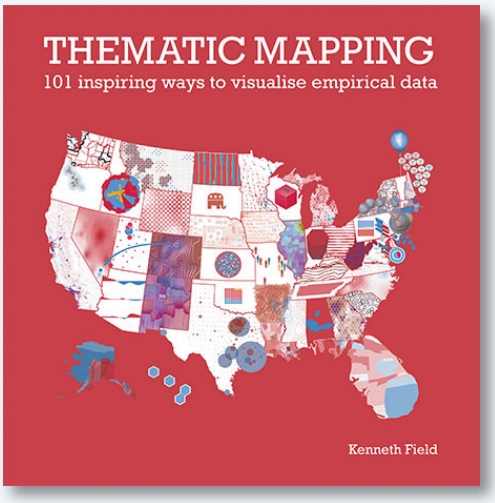

THEMATIC MAPPING: 101 INSPIRING WAYS TO VISUALISE EMPIRICAL DATA

By Kenneth Field

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273 pages, maps, diagrams, charts

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Review by: Daniel G. Cole, Smithsonian Institution

This book starts with a foreword by Alberto Cairo, who states: "Most of the maps in *Thematic Mapping* are indeed clear, enabling insights and permitting exploration of data, but others are playful or quirky experiments, and they aren't lesser works because of that; they are experimental wanderings" (xi). Following that, Field notes in his preface that he considers his work to be complimentary to, and an update of, that of Cuff and Mattson (*Thematic Maps* 1982), Monkhouse and Wilkinson (*Maps and Diagrams* 1971), Dent et al. (*Thematic Map Design* 2008), and Bertin (*Semiology of Graphics* 2010). Further, Field states that "this book focuses more on portrayals that apply to data of different types. . . . The intent is not to set out detailed layout, design and production content," as those will vary due to software constraints and different tastes (xii). He provides one hundred and one cartographic examples in the hope "that this book will support not only everyday mapmakers . . . but [that] it also might be useful to those specifically making political maps" (xiii). This review will evaluate whether he succeeds in this goal.

In the eight page "Prologue," Field presents a contemporary and historical cartographic overview wherein he warns that "Maps are designed to make lies appear truthful, misinformation respectable, and to give an appearance of fact to pure illusion" (xv). His first illustration, the choropleth map Donald Trump used to show how decisively he had won the (then recent) 2016 election, serves as a case in point. It's not that the data was incorrect, but that its aggregation (by county) implied that voting was by acreage rather than by suffrage. That is followed by discussions on thirty-six small-multiple maps of spatial data by E. P. Herman (*Maps and Sales Visualization* 1922; some of these Herman himself identified as examples of what not to do); a further sixteen small-multiples of statistical data by Jacques Bertin in 1983; a Census Bureau choropleth map of the 1890 presidential popular vote election results; an 1895 cartogram of election results in the British Isles; and finishes with eighteen of Field's own maps dealing with the 2016 election, as a preview to the rest of the book. All of these maps are given as examples of different ways to visualize a given dataset.

Chapter 1, "Preparation," concerns the base map, and how choices of projection, color palette, typeface, page layout, etc., affects a map's message. In an unsurprising move, Field rejects the use of the Mercator projection for "any small- or medium-scale thematic map" (2), and instead advocates the use of equal-area projections; however, the one that he chooses to use is not identified. Although he recognizes that projections exist that preserve other properties, Field deems that "the property you must preserve for thematic mapping is area" (4). While he doesn't draw much attention to them, the author has made a whole set of such standardizing decisions for the maps in this book. For example, the book's maps are uniformly scaled at 1:13 million, and his decisions on the generalization of the linework, standardization of the color schemes, and the

uniformity of typefaces and type sizes makes for a recognizably consistent map series design despite the widely varied individual maps.

In order to illustrate fair versus unfair representation, and to make the point that redistricting is not necessarily the same as gerrymandering, Field uses both the real-world example of the 4th Congressional District of Illinois and an abstract redistricting example. He notes that coloring political maps like these, at least in the US, almost invariably involves the use of red/blue divergent schemes, and that such schemes can cause problems for readers with color vision deficiencies. For example, viewers unable to see green will perceive a red/blue color range as brown/blue instead. The related symbol dimensions of contrast and transparency are considered next, and Field provides four examples of how they affect detail on maps, showing, for example, that adding transparency to the thematic layer of the sample map only lowers the overall contrast, muddying identification of the data classes, and it is rightly labeled a poor choice. It is better, we are told, to dispense with transparency for the thematic data. Conversely, hard knock-out halos on feature labels (such as state names) can be harsh and jarring, and softening these non-data masks with transparency is tipped as being a best solution for print—and maybe for a web map too, with the addition of scale-sensitive labeling. The author ends the chapter describing static (print) versus dynamic (web) maps, with the latter allowing the display of state- and/or county-level data when zooming in or on mouse roll-over.

With a few exceptions, Chapter 2, "Area maps," deals with choropleth maps. There are seventeen large maps that spread across the binding gutter, as well as two sets of small multiples. One set presents a single dataset (the Republican vote share from the 2016 presidential election) using different classing systems (23), and the other set shows presidential vote counts for elections from 1920 to 2016 (48–49). Overall, some of the chapter's maps deal with state-wide statistics, while others present county-level data; some deal with the popular vote and others present the electoral college votes. Most of these maps are reasonably straightforward and easy to read with red (Republican) and blue (Democratic) diverging color schemes, or blended schemes resulting in shades of purple. One value-by-alpha choropleth map successfully de-emphasizes the land mass by using the alpha channel of the thematic image to provide a color saturation dimension symbolizing population (30–31). Occasionally, Field adds an extra feature—such as what he calls shaded-relief, but which is really a pseudo-raised choropleth, for counties that have higher population density (32–33)—that likely would confuse the map reader, but in most cases he is doing it to show that tactic's shortcomings. His "All the colours" map on pages 42–43, for example, is an unclassed trivariate choropleth of turnout, population, and margin of victory, and although he does remark that this map is "a challenge for the map reader to relate colours from the legend to areas on the map," that is clearly a bit of an understatement. Furthermore, Field does not mention that unclassed trivariates are best suited for showing the variation of continuous values over space, as opposed to identifying specific values, even when classed or binned. The next map (44–45), one with vertical bar fills, is where I have to disagree with Field, who says in bold type that "it's interesting, and makes you stop and look." On the contrary, it makes me want to look away.

Chapter 3, "Point maps," consists of sixteen maps with a variety of both conventional and novel symbol schemes, ranging from dot maps to proportional and graduated symbols. Most of these maps are relatively easy to read, with some exceptions: the paint splat symbol map on "Painting the town red" (60–61) may be informative, but it's ugly and confusing—why, for example, did he randomly rotate the splatter symbols? Curiously, Field notes only that the symbols are "more attractive and engaging relative to the more conventional symbol treatment but they are harder to read." A few pages later, the author is more critical of this sort of information overload when discussing a multivariate proportional symbol map (64–65). Later, on, he demonstrates a map that combines a choropleth with colored dots (74–75), and remarks on how this particular combination addresses a problem of misinterpreted population maps. Field ends the chapter with several examples of what not to do: on pages 76–79, he presents a pair of maps with a six-by-six legend (share of votes vs. relative number of voters) using equal-area, binned gridded symbols—one with a hole and the other without—both of which made my eyes vibrate. Similarly, the map of numbers on pages 82–83 ("Let the data speak for itself") is a good example of when a table works better than a map, and, lastly, the "map stack" example (84–85) of two maps in one (proportional white line circles over a 10-class choropleth) proves that sometimes two maps are better than one.

There are nine maps in Chapter 4, "Line maps," the first three of which are contour maps: simple lines ("Data as a fluid surface"), filled contours ("Colouring between the lines"), and shaded contours ("Throwing shade"). After those, Field illustrates an "alpha-blended" boundary line map for counties that constitute voting enclaves, with color showing the winning party and opacity indicating the vote margin in neighboring counties. Next are two maps peppered with directional arrows, one with the arrows all pointing in southerly directions, and the other with left- and right-facing proportional arrows. While both indicate political swings, the latter map is a bit more convincing. A flow map of Clinton and Trump campaign trips graphically displays the portions of the country that were important to either or both, as well as the twenty-two states that were simply fly-overs. The last two maps include a strip map of (the historic path of) Route 66 showing which roadside counties favored which candidate, and a map with nineteen transect cross-sectional graph lines indicative of vote share; the author states that this last one would look very different had it shown vote totals, which may have been a good idea for him to show.

The nine cartograms in Chapter 5 include a non-contiguous state map; a hard to read county-level map that equalizes population density; a tessellated hexagon map of electoral votes with margin of victory; a non-contiguous hexagon map of electoral votes; a Dorling cartogram of counties with proportional circles of victory margins; a Demers cartogram with proportional squares for states; a pseudo-3D hexagonal mosaic; a compromise map in which the number of dots for each state simply equals the number of electoral votes; and another Dorling cartogram, this time showing states with embedded pie charts. This last one requires lots of study. The idiomatic *faux pas* on the non-contiguous cartogram that refers to Montana as lying in the "northern Midwest" (108) should be noted, if only as an aside.

Unsurprisingly, Chapter 6, "Graphs, charts, and plots," begins with a table of popular and electoral votes, "Let[ting] the numbers tell the story" (130–131) of Trump's loss of the former while winning the latter. This is followed by a pair of horizontal bar charts of votes: one with stacked bars and a smaller one with centered bars. Unfortunately, the small chart is also centered in the book's binding, thus rendering it practically unreadable. Several informative graphics inhabit the right-hand page: a scatter plot of counties won by each candidate; pie charts of popular and electoral votes; and a line graph of election swings from the 2012 to 2016 elections. On the following ten pages are a variety of data visualizations that are playful, but provide questionable information value: repeatable pictures in an Isotype style chart; a sinuous line graph, two tree maps; violin and beeswarm plots of counties won with voter turnouts; and balloons of electoral votes. The chapter ends with histograms of Obama's and Trump's electoral votes, followed by a confusing series of space-time cubes of electoral trends from 1920–2020.

Like the previous chapter, Chapter 7, "Chartmaps," focuses on data at the expense of topology. The series begins with a vote count waffle grid by state, and continues with five-by-five waffles of pie charts, and another of unique values. In the next examples, charting votes over the past twenty-five election cycles, the fifty squares are filled with line graphs and with stacked bar charts. Small Sankey diagrams for each state appear next, and although Field draws a parallel between these and Minard's flow map of Napoleon's Russian campaign of 1812, his Sankeys are much harder to decipher than Minard's flow map. At least the author admits that "it is up to the reader to interpret any relationship among the lines" (160). The next three maps, still all on the states-as-square-blocks base and using the 1920–2016 results, include radar charts, polar area charts, and tree-ring charts. The final four maps of this chapter include Chernoff(-esque) caricature faces (with four variables); a Chernoff face Dorling cartogram in which Field admits that "it's almost impossible to disentangle the data from the symbol to work out exactly what's going on" (170); minimalist sparklines; and dials as a Dorling cartogram.

Chapter 8, "3D Maps," rounds up all sorts of three-dimensional margin-of-victory visualizations. Included in the grab bag are: extruded prism on a digital globe (which the author does not recommend); extruded prisms on a flat surface (that, he notes, has problems with occlusion); extruded prisms in an axonometric view (which lessens the occlusion); extruded filled contours; a 3D block diagram with a draped surface; a triangulated irregular network of the states (that probably would have worked better if he had used the same county data as was used for the previous maps); chromastereoscopic color encoding (the sort of 3D that requires prismatic glasses, not the more common red/blue anaglyph type); illuminated transparent 3D columns by number of votes; stacked poker chips of electoral votes; dasymetrically distributed 3D people (although the

random rotations Field applies to the figures are likely to confuse the map reader); an extruded waffle grid for percentage share of the vote over twenty-five election cycles (which is too hard to decipher); stratified areal space-time cubes (an approach that is admittedly more useful in an interactive digital environment); data spikes (which makes the Trump win look like a landslide); and a 3D gridded chartmap over twenty-four election years (which is best viewed one state at a time). One statement that Field makes in this chapter caused me to sit up and take notice: "The whole purpose of this book is to showcase the good—and ignore the bad and ugly" (202). Really? My impression is that, while much that is good is showcased, the bad and the ugly gets a great deal of sympathetic notice as well.

Chapter 9, "Curiosities," includes a dozen map examples that may or may not be worthwhile. The first—a pair of US maps, one solidly red and the other solidly blue, labelled "Winner" and "Loser," respectively—is a bit too simplistic. The next map, with its hard-to-distinguish pattern fills, goes against basic map design principles and is just ugly. The third is a map of bipartisan county "islands" scattered across the page in their correct relative geographic positions, but without even an outline to provide locational context. The islands are depicted using satellite imagery and surrounded with a light blue vignette suggesting a sea (of partisanship?), but this tactic, given the scale of the map, is largely wasted because nearly all these islands are too small to see the details. The "Pop art carte" map employs a grid of semi-transparent red and blue size-graduated dots that coalesce in populated areas to show how purple the country is. A multivariate symbol landscape follows with lightly toned red/blue states and use of a circumflex-like mountain symbol (^) in red or blue, in different sizes and thicknesses based on votes. The next map is a joy plot (a graph type named, apparently, after the cover Peter Saville designed for Joy Division's 1979 album *Unknown Pleasures*) of lines stretching across the country that vary in hue by majority party, by apparent height for vote share, and in opacity for voter density. It can be compared with the basically similar map that follows; this one of stark horizontal lines with thicknesses proportional to vote share. A dot density Dorling cartogram follows; and while on this map it is easy to see differences between the states, patterns within any one are indistinguishable. The next exhibit is an abstract, tessellated cartogram (or "Presidential puzzle") that playfully makes use of Escheresque interlocking blue Clinton and red Trump cartoon figures. Once again, hues indicate party and saturation shows vote share. "Requiring study" is an alternative name that I would give to Field's gridded cartogram using dark brown hexagonal cells emulating steam (punk) pressure gauges with very thin needles to indicate voter participation and a closeness ratio of victory margin—plus a little badge with a tiny (winning) party logo. Next is a value-by-alpha dasymetrically equalized hexagon map meant to be compared to the value-by-alpha choropleth map on pages 30–31. The chapter finishes with a modified pictorial map of Trump in the Oval Office overlaid by white counties that Clinton won.

Field's "Epilogue" discuses a nation-wide dasymetric dot density map that should have been displayed at a larger scale, although it is available for download at esriurl.com/election2016. With over 128 million dots, it's worth comparing to the map on pages 68–69: while they appear different due to scale and dot size, they are essentially the same. The author also points out the differences between, and advantages of using, either choropleth or dasymetric dot density for the two political parties.

He then has "One more map" illustrating Biden's win over Trump via a ring chartmap with ring sizes being defined by the number of votes. The winner's votes define the outer edge of the ring and the loser's votes the inner edge, to create a variable ring thickness.

Field finishes the book with "Prior Carte," a cartographic glossary with sixty-nine verbal descriptions (and cross-references to items in the book) and forty-eight historical visual examples of different map types.

It is unfortunate that the page size and layout of this book do not do justice to its contents, with so many maps spread across the binding gutter, and so much map that gets lost down there. Many of the maps deserve, or at times need, to be viewed more closely than the printing allows; though some are available online at the aforementioned URL, *all* of the maps really should be offered online in one easily accessed place. Another issue is that the time-series maps are not consistent in date span: most are 1920–2020 but some are 1920–2016. Hopefully, a second edition of this book will take care of these minor problems.

Overall, although I would encourage cartographers to be more critical than Field in their choice of visualizations, this is a very good book illustrating a wide range

of ways to approach one spatial dataset. It is a useful text but not a complete one. As noted above, Field himself remarks in his "Preface" that he sees this book as a complement to various other thematic cartography textbooks. I note that the fourth edition of *Thematic Cartography and Geovisualization* (Slocum et al. 2022) came out from CRC Press in August, and I predict that book will be the prime candidate, with books like Field's serving as extra reading along with peer-reviewed articles.

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