



# Cartographic Perspectives

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## ABOUT THE COVER



The cover of this issue features "Madison Area Dog Parks," a collaboration between cartographer Stephen Kennedy of [LATLONG.SHOP](http://latlong.shop) and illustrator Megan Stout. This piece reimagines Madison's canine recreational geography with whimsical, hand-drawn character. Different breeds denote each dog park, with smaller pups specifically indicating parks with areas reserved for small dogs. See more of Kennedy's maps of Madison and the Midwest at [www.latlong.shop](http://www.latlong.shop).



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## LETTER FROM THE EDITOR

Greetings, dear readers, and welcome to the (semi-belated) one hundred and eighth issue of *Cartographic Perspectives*.

First, let me apologize for the delay and assure you that we will still be publishing three issues this year (in fact, you can go to our website, click the “Archives” tab, and check out our upcoming issues already in development!). Second, allow me to briefly explain the content of this issue. This is our guest edited, topically focused issue for 2026, and has been organized and shepherded through the publication process by Will B. Payne and Evangeline McGlynn. Their introduction will follow and lay out the history, motivations, and contents of this issue in greater detail; but, I would like to emphasize that it reflects the “big tent” view of cartography that I firmly believe *Cartographic Perspectives* exists to support.

If you’re reading the introductory letter to an issue of *CP*, you are already interested in cartography (or, perhaps, you are lost, in which case I hope I can *convince you* to become interested in cartography). But, what exactly constitutes cartography is, and I hope remains, a subject for debate. We can disagree with one another—as many of our authors have over the years—as to what constitutes a map and mapmaking, we may even disagree as to what we find interesting or important in the field of cartography; but, what I hope that we can all agree upon is that *Cartographic Perspectives* offers the space for those discussions to occur—for wide ranging philosophical expositions on the nature of mapping in history *and* detailed, technical examinations of maps across their many forms.

The book reviews for this issue, which are not part of the guest edited content, reflect that view. We have a wonderful review by Lisa Gaetjens of Krygier and Wood’s new edition of *Making Maps*. John Pickles gives an insightful review of Rossetto and Lo Presti’s new *Routledge Handbook of Cartographic Humanities* calling it an “important contribution to furthering the hopes of Friday Harbor” (76) while Debbie Gibbons reviews Carroll’s new book on place-based narratives finding a “useful guidance for a first-time user of ArcGIS StoryMaps” (80). Gareth Baldrice-Franklin reviews a new entry in the “in 50 maps” series, this one focusing on the Great Lakes. Venturing further afield—into that wider tent that encompasses cartography writ large—Arden Benner reviews Cheshire’s *The Library of Lost Maps: An Archive of a World in Progress* finding “not so much a book documenting a miscellaneous bunch of maps” (81) but rather “a journey through almost two centuries of cartography, with something in it for everyone” (83). Finally, Zhaoxu Sui reviews Li’s *Body Maps: Improvising Meridians and Nerves in Global Chinese Medicine* a book on a topic I

would not have considered *cartographic* on its face, but which reveals itself to be through a “challenging but fruitful” read (91).

This breadth (and depth) reflects the strength of our shared passion and the importance of *Cartographic Perspectives*, and NACIS, to it. Where else can you read about maps—in all their forms—with such precision, clarity, and care? On that note, and I promise it is my final one, I’d encourage you all to consider attending the [NACIS Annual Meeting](#) this (or any) year, and I urge you to share your own thoughts on maps with the broader community either at the conference or in our pages here. I look forward to it.

As always, your devoted editor,

*Jim Thatcher*



## A Letter from the Guest Editors

### “COUNTER-GIS” AS COLLABORATIVE PRACTICE: GROUNDED EXPERIMENTS IN DIGITAL MAPPING



Over the past several decades, digital maps have increasingly become a part of the lives of non-specialists, be it through quotidian reliance on GPS-enabled mobile maps for navigation, or by the influence of digital platforms with spatially indexed shops and restaurants on our real world choices. With all of this common usage, comes common aesthetics and expectations of a certain map “look.” On the development end, with the proliferation of powerful spatial libraries in JavaScript and Python, generating spatial visualizations without traditional GIS is also becoming more and more prevalent. However, even when using web programming and specialized open-source tools, the typical logics of GIS software (usually Esri-flavored, but including QGIS and popular spatial programming libraries) are still pervasive in the way we represent space: Cartesian coordinates, standard projections and basemaps (Wilmott and Wood 2024), and smoothly gliding Web Mercator “experiences” are the norm. What about cartograms? Non-linear distance transformations? Discontinuous spaces? Non-linear distance scales? Mental and perceptual spaces (see Crandall-Oral 2024 on “deep mapping”)? Pictorial maps? “Glitchy” or disorienting spatialities (Leszczynski and Elwood 2022)? Who is pushing back against the “slippy map” (digital maps with pan and zoom functionality, a la Google Maps) and its slippery universalism, and with what tools?

In the papers gathered here, we aim to showcase experiments in spatial representation beyond place markers and polygons on maps, from demos of new tools and historical reclamations of pre-GIS representation techniques, to theoretical engagement with the ontology of mapping and representation itself. This special issue first emerged from a series of paper sessions at the 2023 Denver AAG Annual Meeting entitled “Experimental Digital Mapping // Back to the Future,” and has since grown to encompass scholarship by additional authors. While situating ourselves as scholars and practitioners within the tradition of Critical GIS (Thatcher et al. 2016, Bergmann and O’Sullivan 2018), this issue is specifically devoted to pushing beyond traditional geographic information systems, toward, in the words of Bergmann and Lally (2021), “geographical *imagination* systems” (emphasis added).

As pointed out by Dalton and Thatcher (2019) in their introduction to [a previous special issue](#) of *Cartographic Perspectives*, some of the critical aspects of the study of geovisualization resided for a long time within an orthodox variant of critical cartography, a field that itself has evolved to engage the practice of mapping as much as its interpretation. We place ourselves within the interlocking canon of Critical GIS in part because of our explicit interest in tools-making—and tools-breaking—as a means of analysis and theoretical intervention. By invoking “Counter-GIS” we are flagging our intent to not only think through new

ways of visualizing space, but also reclaim visual vernaculars that have fallen by the wayside (Bunge 1962, Forer 1978, Hägerstrand 1957).

In “Mapping Up,” Eric Robsky Huntley and Asya Aizman open their piece reflecting on early surficial representational experiments from Harvard’s Center for Geographic Analysis. “Mapping up,” in their view, is an extension of anthropologists’ interest in “studying up” and aiming disciplinary tools at the powerful, as applied in larger projects of feminist data science (D’Ignazio and Klein 2020, Kelly and Bosse 2022). They argue for an epistemological register that studies not just the *effects* of exploitation, but the exploiters themselves, in service of instigating systemic change. In addition to discussing mapping projects related to housing rights and Indigenous land theft, they return to Howard Fisher’s surfaces by producing their own engine of surface creation. The unknownpleasur package, named for the iconic vector cover art of Joy Division’s 1979 album *Unknown Pleasures*, link renter and landlord, precarity and enclosure, into the same surface. Mapping up, they say, is “able to accommodate a range of practitioners united by no shared program except the urgency that comes from a world on fire.”

In our own piece, we discuss the Relational Reprojection Platform (RRP), an interactive tool we built to create custom azimuthal reprojections of spatial data with non-linear distance transformations (see also Payne and McGlynn 2024). Building on mid-twentieth-century efforts by Torsten Hägerstrand, Waldo Tobler, and William Bunge, as well as more recent digital experiments (Lally 2022), we show the myriad ways in which this kind of counter-GIS tool can enable new kinds of cartographic thinking. We conclude with a rallying cry for more experimental tools to challenge our established notions of visual spatial vernacular, while still remaining committed to rigorous, reproducible data analysis.

The Practical Cartographer’s Corner for this issue happily illustrates some of the same values we hope to gird to “Counter-GIS.” David O’Sullivan and Luke Bergmann present *MapWeaver*, a web application that they built to better visualize multi-dimensional data. By taking the tile and the basket weave as both physical and mathematical analogies to their visualization problem, O’Sullivan and Bergmann describe a sophisticated tool that creates an unfamiliar—though immediately intuitive—new visual vernacular for complex landscapes. They go into great detail about visual effects that make the resulting maps not merely more pleasurable to look at, but easier to understand. The authors’ attention to scaling and skewing, for example, is a telling reminder that worlds of possibility are opened by pushing tools beyond the most programmatically efficient defaults.

While O’Sullivan and Bergmann employ a textile-inspired method to weave digital maps, Theresa Quill and Leanne Nay’s contribution to cartographic pedagogy, “Maker Maps,” explores the physicalization of maps as learning tools. What is it to illuminate, to embroider, to wear spatial data, and what do those modes of interaction give to students? At first this may seem to have little to do with *digital* mapping, but Quill and Nay’s approaches seek to introduce students to GIS concepts in analogue and hybrid forms (like paper circuit maps with embedded LED stickers), hands-on approaches that, in their words, “help novice students approach new concepts without the burden of also learning a new software.” In an approach guided by embodied experience, curiosity, iteration, and collaboration, their students learn not just how to map, but how to “identify and define problems, select appropriate tools and materials, develop prototypes, and critically reflect on their work.”

An entirely different way of stepping outside the conventions of mapping is to transcend the limits of conventional consciousness itself. In a Visual Fields contribution entitled “The Map Making Game,” Mark Denil proposes a psychedelic toolset to step out of the game of cartography and challenge communication norms in a way that would normally be dismissed as “misreading.” Denil employs the grisly example of the My Lai massacre to illustrate how one could construe all communication as a button-pushing “game,” one with real and tragic results. If all communication—including visual communication like cartography—is a game, it implies that there are agreed-upon rules and norms, some of which might be limiting our perspectives or even underwriting harms. One possible balm to this, Denil argues, is to step out of that very game, “to observe it from outside its self-defined infrastructure of technique and virtuosity; to examine mapicity from a high ground not otherwise accessible.” Quoting extensively from Timothy Leary, Denil suggests radical chemical methods for doing so.

The articles collected in this special issue represent a number of possible responses and paths forward for grounded forms of experimental digital cartography, but the point of drawing this work together is as much about showcasing variegation and freedom as establishing any kind of “counter-GIS canon.” We see broader themes that tie these pieces together, especially around the importance of understanding mapping as a collaborative process, one that can involve different relationships between data points, data producers, map makers, and map readers. Sometimes this takes the shape of pedagogical techniques to render complex geographic concepts tangible to students (as Quill and Nay demonstrate), other times it is made manifest in relatively circumscribed digital mapping applications with big theoretical interventions behind them (unknown pleasure in Huntley and Aizman’s intervention, *MapWeaver* for O’Sullivan and Bergmann, and the Relational Reprojection Platform in our own piece). Finally, for Denil these relationships should be destroyed to better understand them, by stepping out of the “cartographic game” entirely.

There is some irony in trying to lower entry barriers to mapping by making increasingly sophisticated technical tools, however narrow in scope. Nevertheless, this *making* is part of an important ongoing discussion that we are engaged in as both theorists and practitioners. The stated reasons behind Huntley and Aizman’s versus Denil’s respective interventions are different, for example, but putting them in the same issue inspires us to take up Huntley and Aizman’s urgency in a “world on fire” with Denil’s call to be skeptical of the very concept of hegemonic systems by critical “strange-making.” We hope that curious readers can take up these tools and build on these ideas in their own areas of interest, and continue to push cartographic boundaries.

*Evangeline McGlynn*, Harvard University

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# Counter-GIS Experiments in Distance Interpolation with the Relational Reprojection Platform

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*In this paper, we discuss the cartographic genealogy and prospective uses of the Relational Reprojection Platform (RRP), an interactive tool that we built to create custom azimuthal reprojections of spatial datasets with non-linear distance transformations. Building on prior examples of analytically rescaled azimuthal projections in the history of cartography and quantitative geography (from mid-twentieth-century efforts by Torsten Hägerstrand, Waldo Tobler, and William Bunge to more recent digital experiments), we show how our tool brings what were formerly custom artisanal projects into the reach of non-specialist cartographers. In order to illustrate the utility of this method, we highlight recent use cases for the RRP across multiple disciplines and subject areas. These use cases show the myriad ways in which a counter-GIS tool can enable new kinds of cartographic thinking, from visualizing relational spaces within a single context to other kinds of provocation, like presenting changes over time and bringing different relational spaces into dialogue with each other. We conclude with a rallying cry to digital geographers to create more experimental tools to challenge our established notions of visual spatial vernacular while still remaining committed to rigorous, reproducible data analysis.*

## INTRODUCTION

THE MUCH-VAUNTED “DEMOCRATIZATION OF CARTOGRAPHY” (see Crampton 2010; and Byrne and Pickard 2016 for critical perspectives on this trend) over the past fifteen to twenty years has made the production of technically competent maps within reach for many people not previously engaged with geographic visualization. As result, digital maps and map literacy have become a part of everyday life in ways not previously seen. While digital maps can now be found used in endless contexts, they are largely the same *kinds* of maps, produced with a small variety of geographic information system (GIS) software programs (e.g., Esri, QGIS) and websites (e.g., Google MyMaps, MapBox). Especially stark in web and mobile space, these “slippy maps” (Turner 2006) are generally yoked to the same web Mercator projection (Monmonier 2004), and thus the same kind of naïve representation of absolute space. The ubiquity of such maps is increasingly confounding, given the contemporary technical environment, full of powerful tools (the JavaScript libraries D3 and Proj4, to name two prominent examples) capable of projecting spatial data in myriad complex ways.

The **Relational Reprojection Platform (RRP)** is a small computational tool that we have been working on since

2018 to help draw users out of Euclidean space in order to consider the insights that can be drawn from examining data in *relational space*. Following David Harvey (1973) and his tripartite division of concepts of space into *absolute*, *relative*, and *relational*, we consider our platform as offering the opportunity to operationalize a move from absolute space to relative and relational space: relative since all of our data points are considered in their distance and bearing relative to a central point, and relational because the platform is used to convey the strength of relationships between places and the nature and scalar structure of that connection. Whereas a merely *relative* projection tool would only record different kinds of distances (for example, substituting time, travel cost, or other metrics for Euclidean distance) still in a linear fashion, it is this *relational* perspective that pushes the representation beyond what is possible with a linear distance scale.

In setting out to build what we refer to as a “counter-GIS” platform to take an approach to relative distance into the digital realm, we produced a computationally precise tool for heuristically exploring spatial relationships in point data sets. We do not use the term “counter” to signal a struggle *against* GIS, but rather as a *balance* of alternative



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approaches, like a counterweight to the inertia behind dominant mapping and spatial analysis logics codified into commercial software. While we dive into the computational mechanics of the RRP elsewhere (Payne and McGlynn 2024), the purpose of this piece is to illustrate the ways in which the RRP can change how we think about spatial data. There have also been several improvements made to RRP since the previous piece, most strikingly the ability to include polygon or line layers for contextual “basemap” purposes that are subjected to the same non-linear transformations as the main point data layers, which we illustrate through example data sets below.

## BACKGROUND

---

THE RRP WAS DEVELOPED AS A PART OF A WORKSHOP on “geographic imagination systems” hosted by David O’Sullivan and Luke Bergmann in 2018 (see also Bergmann and Lally 2021; Lally 2022a; Lally 2022b). Though we initially posed a version of the RRP method to solve a representational problem in showing qualitatively linked but physically distant data points, we were quickly confronted with the reality that mapping strategies from the pre-GIS era would have made this kind of experimentation easier. Our starting case was research on commercial gentrification in American cities, where one of this article’s authors aimed to represent connections between distant urban neighborhoods that nonetheless had common qualities and linkages, like parts of Oakland, California and Brooklyn, New York. A traditional cartographic visualization with a standard projection would have thousands of miles of negative space between these two cities, and a network map would present their relationality in data space only, without considering physical location at all. What began as a visualization problem became an endeavor to build a rigorous analytical tool.

We approach RRP’s conceptual lineage through pre-GIS computational cartography and time geography, inspired by geographical researchers who created analytical graphics featuring non-linear distance scales that are deceptively difficult to produce with contemporary tools (Tobler 1976; Tobler 1987). Among the key works we’ve looked to during RRP’s development, we have identified a collective emphasis on mobility and migration as the thematic ground on which distance experimentation is operationalized as a uniting thread, which in turn is reflected in our case studies. This attention to movement shows through

In the following section, we sketch out our framework for thinking about GIS logic in cartography, which guided our approach to the RRP’s development, lightly historicizing similar approaches in pre-GIS computational cartography. Following that, we present three contemporary case studies in which the RRP allowed us to illustrate relationships otherwise difficult to communicate in Euclidean space. Finally, we close the article with discussion about future directions for the RRP and more generally, the value of new tools with more capacious approaches to space.

in early representations of time geography, be it plotting the migration flows of residents of a small town in Sweden (Hägerstrand 1957) or warping the street grid of Seattle to reflect travel time from a central point rather than Euclidean distance (Bunge 1966). Bunge continues to use relative distance to dramatic effect in more explicitly political experiments, mapping the increasing “nearness” of a military nuclear catastrophe (Bunge 1988). Further, transport geographers have illustrated the time-space compression that goes along with different travel infrastructures through creative visualization of changing airline flight schedules in New Zealand (Forer 1978) or road construction in Venezuela (Marchand 1973) and South Africa (Pirie 1977). Critically engaging with movement and mobility enables broader thinking about distance, especially in the way that human movement patterns encode varying spatiotemporal scales, in which the probability of moving between places does not scale linearly with the distance between them (Alessandretti et al. 2020). Movement across space and time is thus a fruitful place to reckon with representing relative and relational space, as we demonstrate in our case studies in the next section.

The RRP is one contribution among multiple concurrent efforts toward breaking the over-determined Euclidean habits imprinted on us by GIS logic, and bringing disparate threads of geographic thought and practice together (Wilmott 2024; O’Sullivan 2024). Approaching RRP as a tool for both rigorous attention to uncertainty (Westerveld and Knowles 2021) while still maintaining what Nick Lally (2022b) calls the “expressive” character of the tool allows for playful exploration of spatial data, while explicitly breaking Euclidian standards (see also Hogräfer

et al. 2020 on “map-like visualization”). Endeavors into time geography in the past few decades notwithstanding (L’Hostis 2009; Schwanen and Kwan 2012), the warping of space relative to travel time remains a task more easily accomplished without GIS, though easier now due to advances in software tools. We orient the RRP as part of the recent constellation of alternative tools built to challenge hegemonic logics.

Of course, de-emphasizing fidelity to linear distance scales in order to convey relationships is not new to cartography, nor is it scarce in our contemporary cartographic lives. Commonly seen specimens of relative distance in cartographic representation include tourism maps or public transit schematics. For example, a map of an amusement park or the downtown of a heavily touristed area prioritizes attractions rather than path length, while still

giving a visitor ample information to navigate the park based on approximate bearing, milestones, and other “nodes” and “landmarks,” in Kevin Lynch’s framework from *The Image of the City*, that bear meaning in peoples’ lived experience (Lynch 1960). Conversely, many subway and commuter rail maps explicitly attach a price to distance (through concentric fare zones) while simultaneously abstracting out the variation of Euclidean distance within those zones. However, for all the common literacy of these alternative distance representations and for their relatively common presence in our lives, relative distance in general has been left out of the cartographic democratization project. If you want a (beautiful, thoughtful) pin map, now anyone can do it; if you want a more complex approach to space, hire a professional cartographer, or just as likely a graphic designer working outside traditional digital mapping workflows.

## WORKFLOW

THE RELATIONAL REPROJECTION PLATFORM IS AN interactive application built using the Shiny framework for the R programming language. Upon opening the application (see Figure 1 for a screenshot of the interface), users can upload their own point dataset containing one

or more quantitative variables that relate back to a central point, specified in the dataset using an “Is\_CTR” field, effectively creating a customizable azimuthal projection. Using the RRP is then a reflexive process for considering the way that places relate to each other, and selecting an

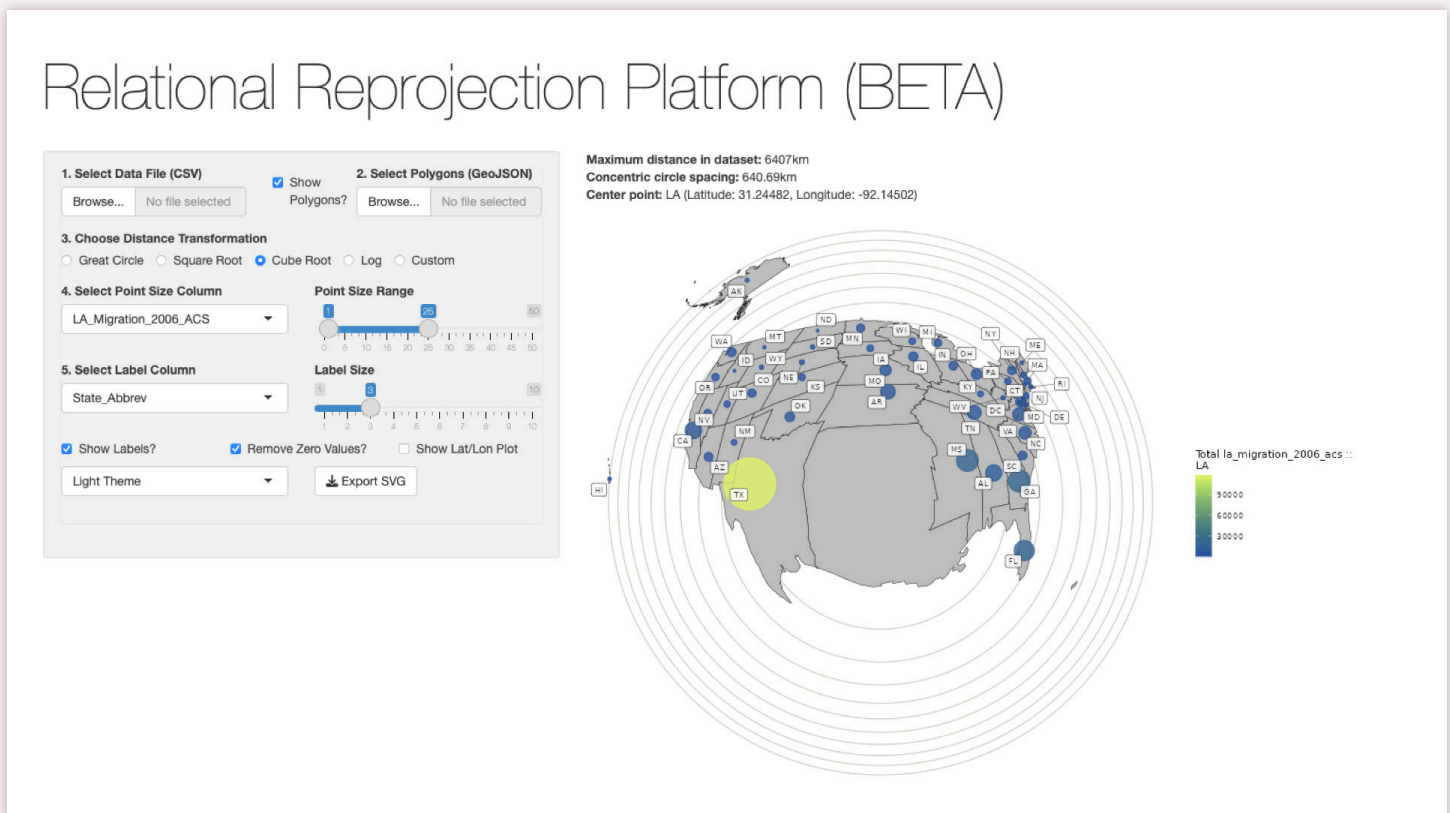


Figure 1. RRP workflow screenshot.

appropriate distance decay function for the phenomenon in question. For some uses, like international migration or tourist patterns, a simple linear or perhaps a square root distance decay are appropriate, but for mapping phenomena that have different underlying spatial logics, more extreme decays are required. A paradigmatic example of a situation lending itself to a logarithmic decay would be a classic from economic geography: the location of customers for a general retail business like a supermarket or a gym. Most customers for establishments like this are located very close to the business, with a quick drop-off in probability as you get farther away, but outliers from

other cities/states/countries (e.g. tourists, visiting family members, people on business trips) will appear at the margins. Dropping a spreadsheet of customer locations into a standard GIS software suite would default to a projection that visually emphasizes the thousands of miles of negative space between a visiting Californian and a business in Boston, rather than showing the tightly focused underlying spatial pattern, the signal behind the noise of the pin map approach. The RRP's workflow allows users to start with this tightly focused approach, fine-tuning the results by modifying both distance and symbol interpolation settings (Figure 1).

## CASE STUDIES

TO ILLUSTRATE A VARIETY OF POSSIBLE USE CASES for RRP, this section will present three case studies, each of which demonstrates a different kind of comparison that this technique makes possible. First, we reproject American Community Survey (ACS) data on where Hurricane Katrina victims moved to, using our RRP version to show the advantages of a non-linear distance transformation in showing relational geographies across scales. Second, we look at migration data from the International Organization on Migration (IOM) over the course of several years to show how RRP allows for comparison of spatial relationships over time. Finally, we present a more speculative use of the software, based on a collaboration that aims to shed light on the importance of scarce water resources to coffee's global commodity chain.

### CASE STUDY 1: NON-LINEAR RELATIONAL GEOGRAPHIES

Making landfall in 2005, Hurricane Katrina was one of the deadliest and most costly natural disasters in American history. In the years since, many maps and visualizations of the storm's damage have been produced, including some that take a relational approach, showing how the impact of this event was felt far beyond the Gulf Coast that was the hardest hit region. Originally produced for an article in *Smithsonian Magazine*, the Smithsonian Institution in partnership with Esri gathered ACS data from 2006 about state-to-state migration in the wake of Katrina, representing the movement pattern through proportional symbols atop a choropleth map of number of migrants per state (see Figure 2). While the map effectively communicates the mass movement the disaster instigated, it does little

to contextualize the differences in regional impact of such movement. It also commits the cardinal cartographic sin of representing raw counts on a choropleth map, though the proportional circle overlay of the same information is a more appropriate choice.

To show how RRP can address some of these limitations, we have recreated the map using the same data (Figure 1 shows the dataset loaded into the RRP; see Figure 3 for a cleaned-up version based on the SVG export from RRP). One limitation of the existing map is that only the lower 48 states are shown in the default view; while map users can scroll around and zoom in and out to see Alaska and Hawaii, there is no guarantee that they will. This may seem unimportant for something like migration after a disaster, since a reasonable first assumption would be that neither state received many Katrina migrants given their vast geographic distance from Louisiana. On

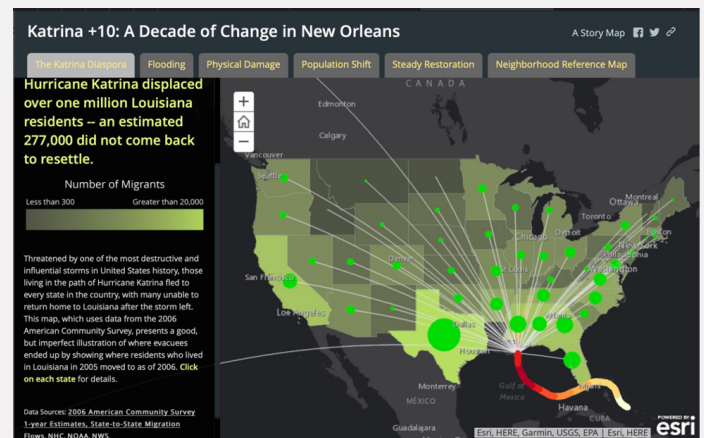
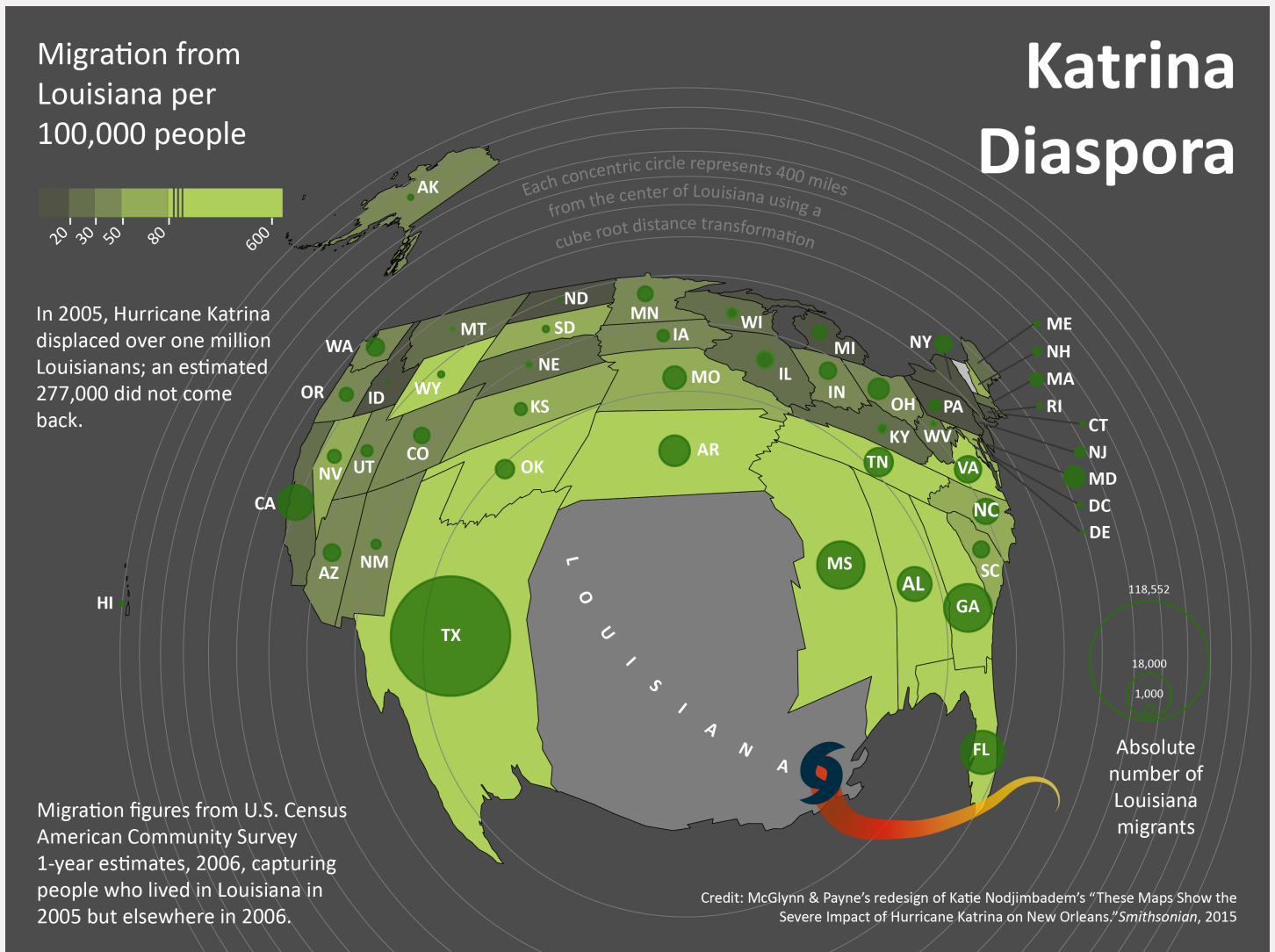


Figure 2. The **Katrina Diaspora webmap**, by Esri and Katie Nodjimbadem, 2015.



**Figure 3.** Our version of the same dataset using RRP.

inspecting the data, however, Alaska in particular had a sizable migration number for its population, with a tally of 50 ex-Louisianans per 100,000 state residents, higher than the proportion, 29/100,000, in California, and even higher than many densely populated Northeastern states like Massachusetts (24 per 100K), New York (13), New Jersey (12), or Pennsylvania (10). One potential reason for this discrepancy is the prominence of the fossil fuel sector and other extractive industries in both Louisiana and Alaska; displaced residents with work experience in oil and gas may have taken jobs on the fields of the North Slope instead of offshore in the Gulf. For the same reasons related to the fossil fuel sector, Wyoming stands out on our map (but not on the original map, due to its lack of relative comparisons) compared to its neighbors, with a proportion of 85 ex-Louisianans for every 100,000 state residents, almost as high as Florida's rate of 90 per 100,000. Clearly

proximity on the Gulf Coast and total population matter in terms of post-Katrina migration patterns, but they are not the whole story.

In the RRP version, we have also normalized the raw number of migrants per hundred thousand people in the receiving state. We did this in order to bring out the regional relationship further, supplementing the raw numbers in the proportional symbols with normalized data represented as quintiles on a choropleth. In our version of the map, the influence of the disaster on large population states like California and Texas are tempered by the normalization. California's importance fades while the importance of Texas as a receiver state is still emphasized. Similarly, smaller Gulf-adjacent states like Arkansas emerge as important host communities, accepting many more disaster migrants relative to their population than

larger population centers. Though these initial observations are in part an argument for better normalization practice in cartography, we contend that the greater regional focus provided by our RRP map of migration out of Louisiana makes it especially important to consider relative, not absolute, rates of emigration.

## CASE STUDY 2: TIME COMPARISONS

This case study extends the concept behind the first example, migration mapping. Whereas in the Katrina example, the main focus was the spatial pattern of the disaster diaspora in a single moment of time, the second case study is a comparative case meant to investigate the impact of a different disaster, the COVID-19 pandemic, on migration into Italy.

In 2015, more than a million people crossed into the European Union (EU) with the intention of petitioning for asylum. The bump in migration to the region was instigated by not only the worsening Syrian war, but also many other instances of localized political and economic instability across the world. Following this so-called “migration crisis,” various EU countries made serious changes to their migration policy, tightening control of both land and sea borders, resulting in a severe drop of arrival figures initially, but one that has been steadily rising again each year since. In parallel, the United Nations IOM began tracking mixed migration to the EU through major receiver countries. Mixed migration flows, by their definition, are made up of people “travelling together, generally in an irregular manner, using the same routes and means of transport, but for different reasons,” including “asylum seekers, refugees, trafficked persons, unaccompanied/separated children, and migrants in an irregular situation” (IOM 2019, 141–2). Chief among these arrival countries is Italy, a country with many islands adjacent to North Africa, making informal entry by boat more feasible than many other EU countries.

This case study proved an exercise in data exploration as well as time comparison. Initially setting out to compare migration pre- and post-COVID-19, the dampening effect of the pandemic on migration was belied by a larger story of Italian internal politics and changing migration policy. Whereas COVID-19 border closures make less difference on mixed migration flows, dependent on informal modes of arrival, Italy’s changing policies toward Mediterranean ships are more visible through RRP.

Comparing between time slices, mixed migration arrivals to Italy in 2018 (as recorded by IOM) are greater than in 2022, and only from a handful of countries—mostly in North Africa, and particularly Italy’s nearest Mediterranean neighbor, Tunisia. There is a precipitous drop in numbers from individual countries’ arrivals not during the COVID-19 peak but the year before, where the large North African figures plummet and single-digit numbers of arrivals from other farther-flung countries emerge. This pattern change is almost certainly illustrative of the 2018 closure of Italy’s ports and then Minister of the Interior Matteo Salvini’s drastic attempts to shun Mediterranean rescue boats. Further, in 2020, while arrivals to Italy were still representing a variety of countries in small numbers, the resurgence of Tunisia is significant: migration from countries where several land borders would have to be crossed (not an easy proposition in the pandemic era) before taking a boat did not have a resurgence until later. However, for those in Tunisia the route to Italy was more straightforward, though still more dangerous. In the context of mixed migration, whether the Italian border was closed meant less than the number of additional places migrants might have to pass through. In the post-COVID-19 moment, the migration story is one of a diversifying immigrant population to Italy, more willing to cross land borders before approaching Italy by sea.

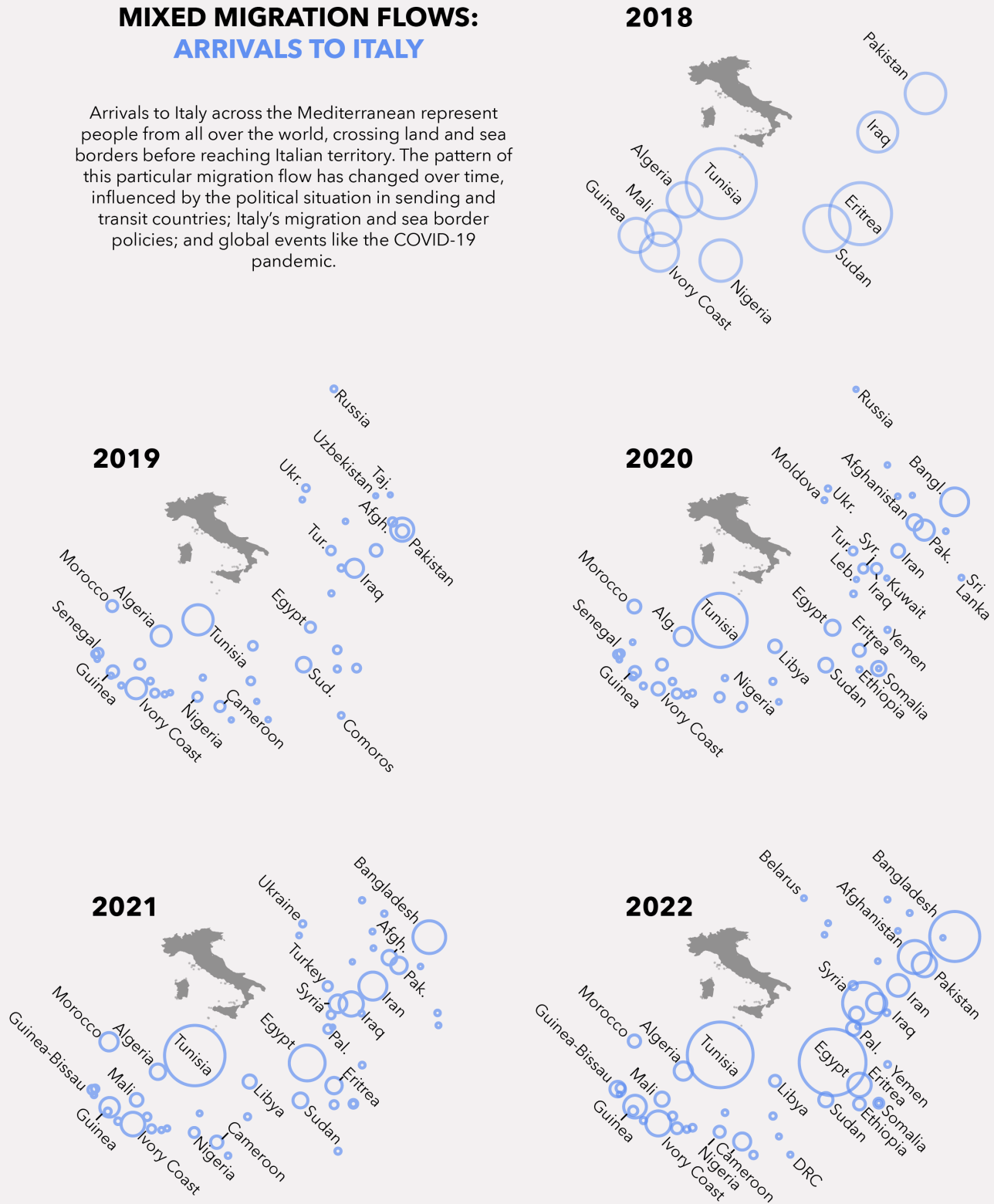
The square root distance interpolation allows us to keep far flung places like Bangladesh and Russia in the narrative without losing sight of the importance of the enduring relationship between Italy and North Africa. While it’s possible to add the country outlines to this graphic, we opted not to, in order to instead lay bare the widening impact of an increasingly cloistered Italy in what could be a borderless world. To build a more polished illustration to go with our observations, we used the size controls for the proportional symbols to standardize symbol size across time slices based on the peak arrival figures (2018). RRP’s export function then provided an SVG with all of the adjusted proportional symbols, ready to edit into a custom graphic (Figure 4). More effectively than iterating through choropleth maps on the same data, RRP allows for an exploratory analysis of a data set revealing the unevenness of mixed migration flows over time.

## CASE STUDY 3: CONTEXT COMPARISONS

The final case study we present draws from a University of California, Berkeley research project that we used RRP to assist on. The researcher, Berkeley professor of New Media

## MIXED MIGRATION FLOWS: ARRIVALS TO ITALY

Arrivals to Italy across the Mediterranean represent people from all over the world, crossing land and sea borders before reaching Italian territory. The pattern of this particular migration flow has changed over time, influenced by the political situation in sending and transit countries; Italy's migration and sea border policies; and global events like the COVID-19 pandemic.



Source:  
UN International Organization on Migration's databank.  
Symbol size reflects the number of arrivals to Italy per country of origin in Q3 (July-Sept) for 2018-2022.

**Figure 4.** Our visualization of mixed migration flows to Italy.

Greg Niemeyer, was doing preliminary work for a project on hydrocolonialism in the context of the massive in-progress Thwake dam project in Kenya that will displace large numbers of regional farmers. Niemeyer wanted to make a visualization showing the locations of all Starbucks locations in San Francisco compared to all of the water boreholes in the same amount of land in Makueni County, Kenya, a region affected by the dam project. The dam, meant to serve both agricultural and domestic use, exists in an agricultural zone that also experiences poor water access. By overlaying the boreholes—three of which have already run dry—the map shows how much farther people in Makueni County have to travel for drinking water than someone on the street in San Francisco craving an expensive cup of coffee. The juxtaposition is meant to highlight the disparities underwritten by such a water-intensive crop as coffee. This visualization set the stage for a more engaged projected on the futures of the Makueni region in light of a huge infrastructural change (Niemeyer 2023).

In this case, we decided to keep the distance decay linear, rather than transform distance in a non-linear fashion, so the main contribution of RRP was in quickly being able to create point layers around a central location. Because the “custom” option for distance calculation is actually a

stepwise function of three linear decay functions, reproducibly creating the same customized distance decay on multiple data sets is possible with RRP. The resulting graphic (Figure 5), tells a small but powerful story about water access and privilege.

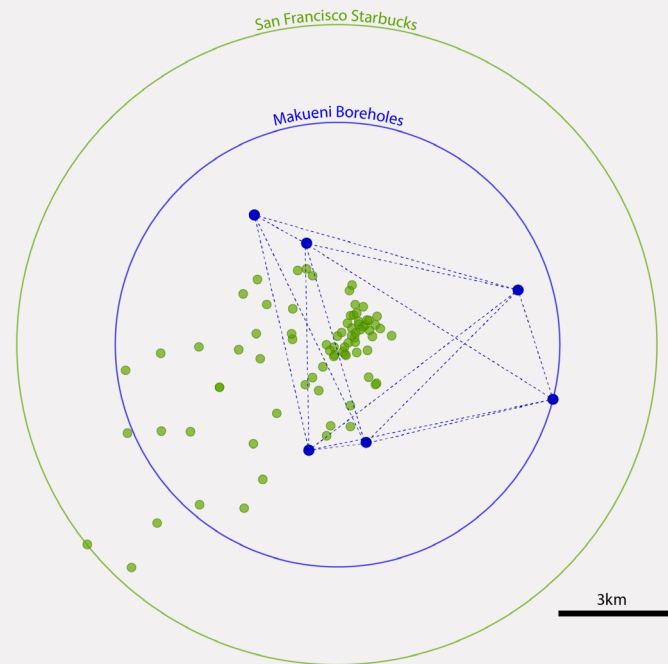


Figure 5. Our visualization in support of Greg Niemeyer’s project.

## DISCUSSION

THE ABOVE EXAMPLES HAVE SHOWN SOME OF THE potential we believe that the RRP has to facilitate the creation of the kinds of non-linear distance scales and relational maps that have seldom been seen since the early days of computational geography. While we were sure to present examples where RRP output contributed to a polished product, we also see RRP as a contribution to exploratory data analysis workflows, wherein RRP is a tool for thinking through the spatial relationships in a data set. There are likely many other uses for this technique that we have not identified, and our hope is that by providing this as free and open-source software (FOSS), cartographers will be empowered to use this tool in unexpected ways.

In a more general sense, RRP represents the quiet power of small tools. While at heart RRP is a simple tool for customizing an azimuthal projection, as we’ve explained above, that one function can be used in sophisticated ways to learn more about data sets and to tell complex stories about them. In presenting case studies of RRP with different datasets, we are advocating for adoption of a program we find useful. Alongside our own tool, we hope to rally our colleagues across cartography and digital geography to continue to temper contemporary over-determined spatial vernacular by building still more counter-GIS tools to analyze spatial data and to change the way eager map readers see the world by changing how it is represented.

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# Mapping Up: Repositioning Critical Cartographic Practice

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*This article considers the methodological stance of critical cartography, proposing “mapping up” as a form of critical cartographic practice. Beginning with reflections on cartography in the first issue of *Antipode* and the posthumous work of Howard Fisher, we consider how cartography has figured the relationship between colonizer and colonized, the colony and the metropole, the ground and the surface. Building on these reflections, we respond to a recent resurgence of interest in the work of the anthropologist Laura Nader, thinking through how her arguments for “studying up” pertain to persistent debates in both critical cartography and the social sciences more broadly. We argue that critical cartography has often taken an epistemic shortcut to a positional question: who is the mapmaker to the mapped? By too consistently focusing on the power of the map (and assuming the power of the mapmaker), we have narrowed our methodological focus and developed few resources for theorizing mappings of relative elites by mapmakers in relatively less powerful positions. We examine this contention in the context of work that “maps up”: tenant solidarity projects by Mutual Aid Medford and Somerville, the Anti-Eviction Mapping Project, and JustFix.nyc, as well as High Country News’s “Land Grab U.” Finally, we share recent work on a cartographic R package, `unknownpleasur`, that is indebted to the work of Fisher, but also oriented towards the simultaneous representation of systems of oppression alongside their effects.*

**KEYWORDS:** mapping up; critical cartography; counter mapping; critical GIS; methodology

## INTRODUCTION

THE FIRST ISSUE OF *ANTIPODE* CONTAINS A SINGLE, solitary map (Thompson and Emerson 1969, 16). A little over a dozen pages into the journal, the reader is greeted by the planet in stark mimeograph, its implied lines of latitude bending away from the equator in a Lambert azimuthal equal-area projection (see Figure 1). The eastern hemisphere is shaded with a white dot matrix pattern in a figure-ground relationship with an inverted, shadowy western hemisphere. The antipodes, the furthest possible distances from each point on the Earth’s surface, are brought close through superimposition. This is not so unusual; as a method of representing antipodal points, it is even conventional, so much so that this style of map is used to illustrate the “[Antipodes](#)” Wikipedia article at the time of this writing.

However, here, it is reproduced alongside the words of an academic discipline’s radicalizing wing. It sits between articles by James Morris Blaut on disciplinary imperialism (1969) and Fred Donaldson on the anti-Black racism implicit in the geographic enterprise (1969; see also Kobayashi 2019).<sup>1</sup> The map’s task, in this context, is not to remind us of a rote geographic fact, but to spur a relational geographical imagination. Thompson and Emerson leave no question: the fates of the ends of our earth are intertwined; the metropole is not so far from the periphery; “up” is always relative to “down.” Like the well-known “blue marble” photograph that NASA would reveal a few years later, this world image is part of an ideological project (Cosgrove 1994; 2001). However, where the blue marble became a symbol for the liberal one-worldism of the environmental movement’s first wave, *Antipode*’s planet

1. It merits saying that geography’s radicalism was complicated with regards to gender and feminist politics (see, e.g., Huber et al. 2019). We also note the precursory work of Donaldson following contemporary Black geographies’ forceful rearticulation of the urgency of centering Black life in geographic thought (Bledsoe and Wright 2019; Noxolo 2022; Moulton and Salo 2022; Eaves 2017; Hawthorne 2019; McKittrick 2011).



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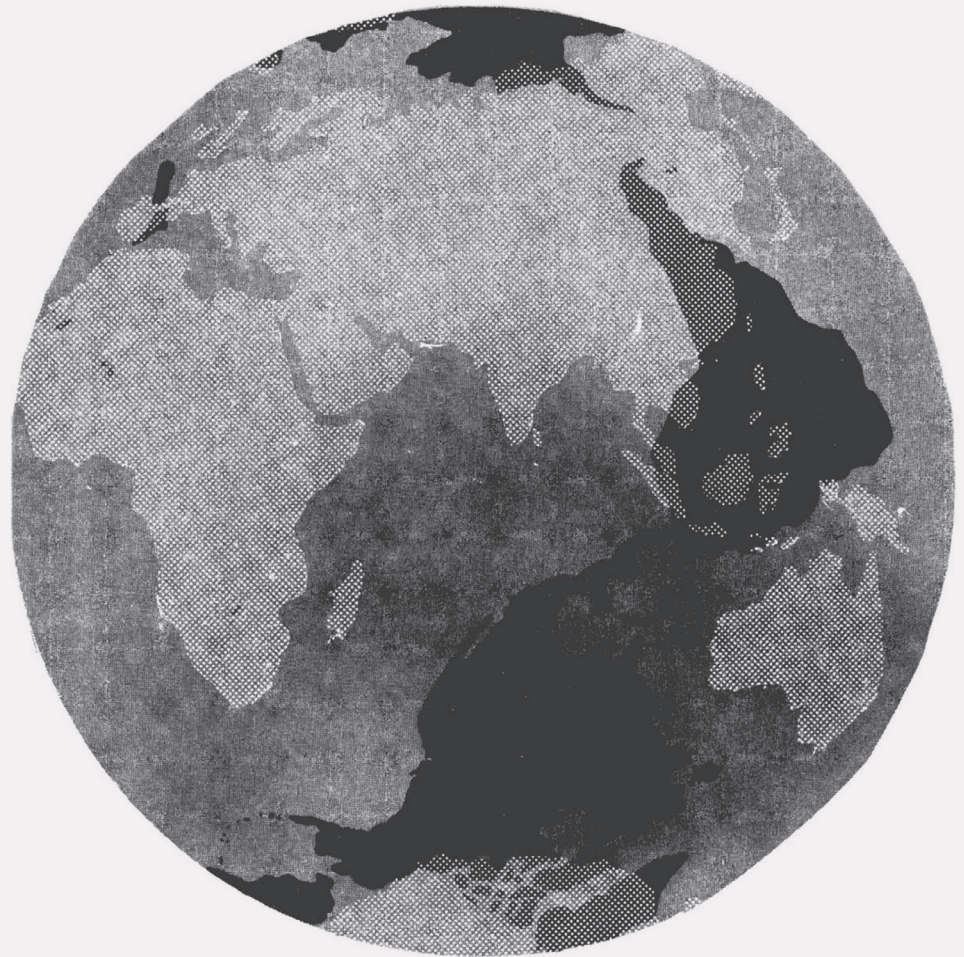
## UNIVERSAL ANTIPODE PROJECTION

suggests something else: the simultaneous conflict and connectedness of a decolonizing world, the difference between, and mutual constitution of, “up” and “down.”

We offer another episode in the recent history of mapping, this time drawn digitally. Howard Fisher’s posthumously published *Mapping Information: The Graphic Display of Quantitative Information* (1982)<sup>2</sup> was his attempt to synthesize his thinking on thematic map design, following a career in which he had served as, among other things, Director of the Laboratory for Computer Graphics and Spatial Analysis at Harvard University (Wilson 2017).

In the text, Fisher exhibits the Lab’s signature interest in surficial representation (Huntley 2023; McHaffie 2000; Hessler 2009; Chrisman 2006), moving rapidly between contour maps and oblique views of elevated section cuts. The discussion in the book is frankly dry and based primarily on assertion (e.g., “While overall comprehension is usually excellent with this system and each value is shown, it is difficult to relate the values to positions in the base plane” [Fisher 1982, 82]). However, the proliferation of forms stands, to some extent, as its own form of argumentation. This is restless cartographic production, as interested in volume and relief as it is in the ground plane. Lines fly up, down, and around in a manner which we take as a challenge to contemporary cartographic practice (Figure 2).

The ground exerts a particular pull upon cartographers. As adherents to an orthographic view of the world, the surfaces that we draw tend to lie flat, to presume a view from above, to suggest that relations between things are relations between layers, each drawn as a horizontal plane,



Compiled by: K. Thompson  
B. Emerson

Figure 1. Universal Antipode Projection, K. Thompson and B. Emerson in *Antipode* (1969).

rather than relations between entities. We don’t mean to overstate the case: Fisher’s maps, as much as any, are invested in the reduction and simplification of planetary phenomena and in their flattening. However, in iterating through perspectives, conventions, and views, they offer a way to imagine maps as interested in depth—which is to say, the relationship between below and above—as in extent.

We are grateful to the organizers of this issue for giving us cause to start from the archives. The organizing theme of this issue, “Back to the Future,” asserts the value of past

2. While the text is attributed to Fisher alone, it is also worth noting that, in Brian Berry’s estimation, the 25% of the “intellectual effort” remaining on the book at the time of Fisher’s death was invested by Jacqueline Cohen and Eliza McClennen, the latter of whom drew many of its graphics (Berry 1982, xix).

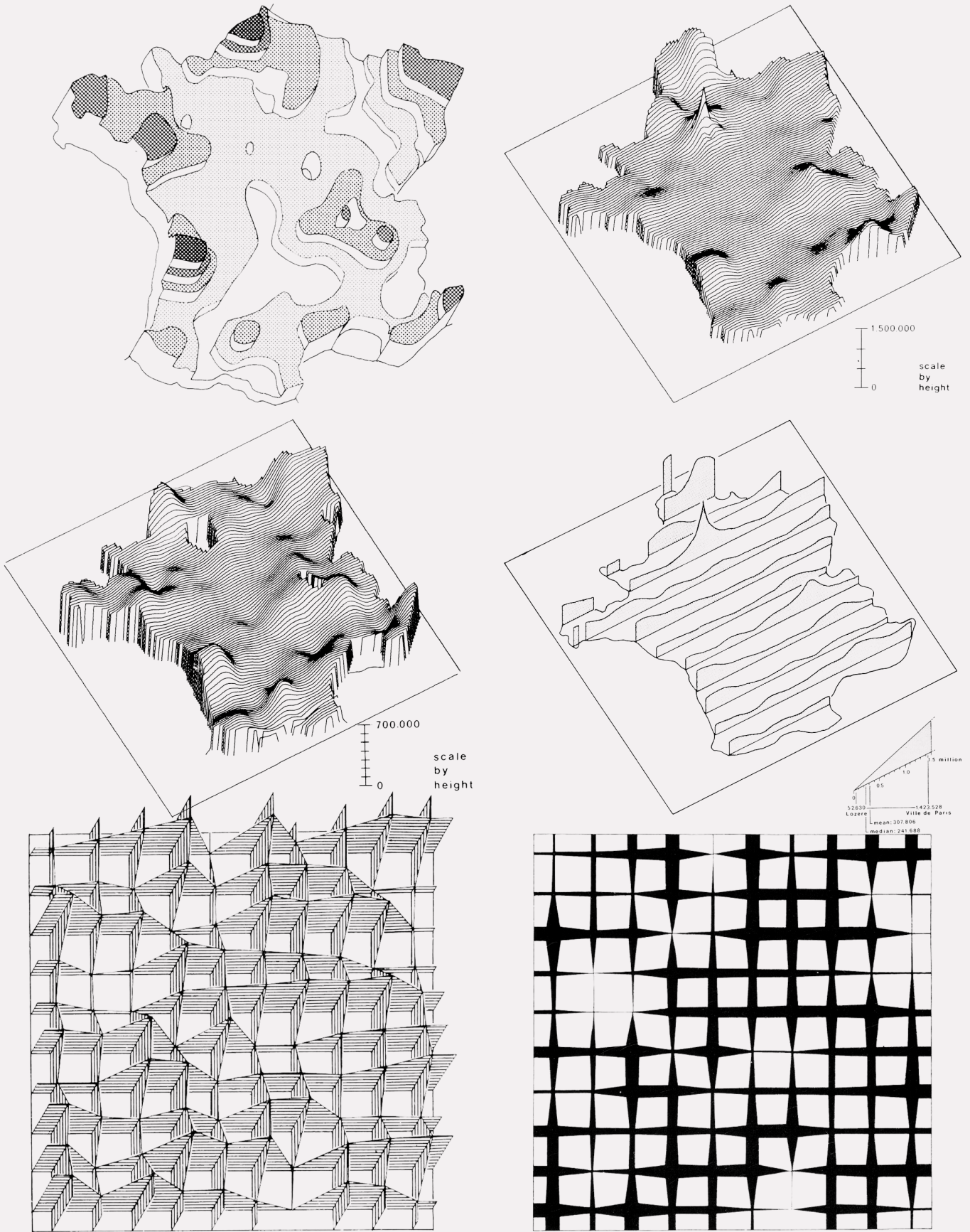


Figure 2. Experiments in thematic mapping from *Mapping Information*.

practice and insists that there are threads to pull on in the productive tensions therein. These two cartographic moments that we elevate have very little in common in the domain of politics, either material or epistemic. However, placed together, we take them to imply that mapping can do more to articulate the relatedness of “down” to “up” and that many of our mappings, adhering as they do to an implied perspective from on high, map *down*. We take this opportunity to expand on “mapping up” as a critical mapping methodology interested in drawing lines: from colonizer to colonized, mineral pit to corporate digger, evicted tenant to evicting landlord. This is a thread that Eric began pulling on in several prior publications (Huntley 2022; Alton et al. 2022), and we understand it as a methodology that encourages serious cartographic consideration of *both* the damage done and those systems responsible for the damage. Like the first issue of *Antipode*’s “Universal Antipode Projection,” mapping up takes seriously the charge to map, and map again, the relations setting the world on fire.

## STUDYING UP

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IN THINKING ABOUT “MAPPING UP” (AND DOWN, AND around) we should identify the help that we’re enlisting. We’re invoking the work of Laura Nader, a UC-Berkeley anthropologist (and sister of consumer advocate Ralph Nader) who wrote that anthropologists had been too slow to take up their anthropological tools to study the powerful—in other words, to “study up.” As Nader puts it:

What if . . . anthropologists were to study the colonizers rather than the colonized, the culture of power rather than the culture of the powerless, the culture of affluence rather than the culture of poverty?

If . . . we were principally studying the most powerful strata of urban society . . . we would study the banks and the insurance industry that mark out areas of the city to which they will not sell insurance or extend credit. We would study the landlord class that ‘pays off’ or ‘influences’ enforcement or municipal officials so that building codes are not enforced. [Slums] might be called by another name which would indicate that they were the results of white-collar crime. (1972, 289–90)

We proceed as follows: we begin by situating our call for mapping up within existing literatures. We then gesture towards a recent resurgence of interest in Laura Nader’s (1972) work on what she called “studying up,” particularly in critical data studies, and use it to offer a clarification to recent debates in critical GIS. In particular, we focus in the counter cartography tradition and Taylor Shelton’s very useful recent intervention into critical mapping practice (2022), arguing that these give us ground for justifying critical mapping practice on positional rather than epistemic grounds. In making this argument, we point towards several recent influential critical mapping projects that deploy data-scientific techniques to levy a critique of the political economies of housing and settler-colonial expropriation. We close by introducing some recent cartographic experiments in which we’ve been engaged, particularly our [unknownpleasur](#) R library, which supports multivariate mapping of Fisher-indebted surfaces: one of many cartographic possibilities that might follow from a commitment to mapping up.

This is a powerful argument, and one that we hear echoed in [our ongoing work](#) on housing and institutional landlordism. By emphasizing the study of people who have been made marginal, social scientists perpetuate deficit narratives (D’Ignazio and Klein 2020), identifying marginality as its own problem rather than drawing our empirical eye to those engines and agents of exploitation that *produce* that marginality.

By focusing on the *effects* of exploitation, we are studying a phenomenon-once-removed and creating the conditions for policies that treat the symptom rather than the cause. This echoes widely across multiple subfields wrestling with their methodological orientations towards matters of justice, which may explain the recent resurgence of interest in Nader’s work in, for example, critical data studies. Chelsea Barabas and co-authors have argued that “studying up” could provide a useful corrective as researchers in algorithmic fairness turn from questions of procedural fairness to questions of substantive justice (2020). In their words:

Data science projects that “study up” could lay the foundation for more robust forms of accountability and a deeper understanding of the structural

factors that produce undesirable social outcomes via algorithmic systems. (2020, 168)

Similarly, Milagros Miceli and colleagues identify the friction quite directly in their 2022 paper, asking in its title, “why talk about bias when we mean power?” (Miceli et al. 2022). They argue that addressing the questions raised by algorithmic systems requires

a relational view on the power dynamics and the economic imperatives that drive machine learning, i.e., considering that biases do not occur in a vacuum but are fundamentally entangled with naturalized ways of doing things within the organizations where datasets and models are developed. (Miceli et al 2022, 34:3)

In this way, the resurgence of interest in Nader’s methodological stance emphasizes that “studying up” and, for us, “mapping up” are not only about generating more complete or accurate knowledge of how power functions. They also tie knowledge explicitly to those systems that

are “doing things,” suggesting a mapping practice that extends beyond description and towards fundamentally political questions of accountability and redress. They also center the positionality of the researcher and its directional situatedness along the lines drawn by power. It is this dimension of the argument to which we now turn. Nader says that

we would sooner or later need to study down as well. We aren’t dealing with an either/or proposition; we need simply to realize when it is useful or crucial in terms of the problem to extend the domain of study up, down, or sideways. (1972, 292)

Here, it becomes clear that in addition to the relational dimensions of Nader’s claim, it is also intrinsically positional and pluralistic. “Up,” “down,” and “sideways” speak to the rather complicated positionality of the contemporary mapmaker—often, though not always, privileged along many intersecting axes of identity, but nevertheless not uniformly powerful.

## MAPPING UP

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TO SPEAK OF MAPPING AND POWER, WE MUST, OF course, begin from the fact that critical mapping has benefited from a series of major interventions by human geographers and critical GIScientists. We benefit from a discipline that has given sustained and critical attention to those questions of power/empowerment, expertise/knowledge, and exploitation/liberation that tend to co-occur when mapping meets the ground. This work has, of course, traveled under many banners within and adjacent to geography. A non-exhaustive list would include (Public) Participatory GIS (Sieber 2006; Kwaku Kyem 2004; Elwood 2006), participatory action mapping (Boll-Bosse and Hankins 2018), community geography (Shannon et al. 2020), critical GIS (Wilson 2017; Thatcher et al. 2016; Schuurman 1999), counter mapping (Peluso 1995; Counter Cartographies Collective et al. 2012; Bélanger and Arroyo 2016; Alton et al. 2022; Maharawal and McElroy 2018), and feminist mapping (Kelly 2019; Kwan 2002). These traditions are in many ways quite distinct. They draw on divergent bodies of theory and articulate divergent forms of practice. However, in general, they advance a strong epistemic critique of mapping alongside advocacy for a democratized knowledge politics. Underlying

these arguments is a negotiation between the positionality of the relatively privileged mapmaker documenting forms of oppression and that of oppressed folks who are involved, ideally, as collaborators or co-designers.

We argue that, for the most part, these interventions have conflated two separate, albeit related, concerns: the positionality of the mapmaker, and the epistemology of the map. It is taken as given that because mapping invokes a system of abstracting, objectifying conventions; because its techniques emerge from and often reinforce military, racist, and colonial knowledges; and because it is reliant on absolutizing Cartesian techniques that have long been suspect amongst feminist and decolonial scholars; maps are always in danger of grasping for totality, reinforcing phallogocentric logics, and reproducing colonial ways of knowing. In other words, the assumption is that the power of maps inheres in the mapping, regardless of the mapmaker, regardless of the mapped. We follow the thinking of Catherine D’Ignazio, who has recently argued against a deterministic view of a given technology’s epistemic and political potential: “Just because technology is birthed from war and militarism and colonial violence doesn’t

mean that it cannot be employed toward serving as resistance to and liberation from the same” (2024, 16). We see “mapping up” as one way, among many, to place mapping technology in the service of liberatory research.

As Rebecca Warne Peters and Claire Wendland have argued, “studying up” does not rely on power relationships that are absolute or fully durable (2016). Instead, “up” indicates the relation of the mapmaker to the mapped, requiring attention to what Edward Said calls the “relative upper hand” (2014). At the very least, what this suggests is that to absolutely locate the power of the map within the epistemology of the map discards a robust analysis of the many, intersectional axes along which social power operates. In critical cartography, we argue, we have too thoroughly generalized what Emily Tilton calls the “strong epistemic disadvantage thesis,” or the notion that “dominant social positions impose strong, substantive limits on what the socially dominant can know about the oppressions of others” (2024, 1). Framed differently, cartographers have relied on what Olúfẹ́mi O. Táíwò calls “differential politics,” in which ceding authority is seen as the guarantor of liberatory politics (Táíwò 2022). As Táíwò argues, this is a good idea and a necessary first step, but an inadequate basis for liberatory change that requires what he calls “constructive politics.” As Gillian Rose has argued, it is just as untenable to insist on the researcher’s (and, we can add, the mapmaker’s) ability to write power from an absolutely identified position of knowledge as it is to make absolute, a-positional knowledge claims—what she calls the “goddess trick” (1997). As Haraway reminds us, “there is good reason to believe vision is better from below the brilliant space platforms of the powerful” (Haraway 1988, 583). But who are “the powerful” and who is capable of speaking “from below”? These are questions that, as Eric has said elsewhere, involve “a change in the angle of the head, a change in the position of the eyes, and an adjustment of their focal depth” (Huntley 2022, 78). They are contingent, intersectional, and, ultimately, relational, questions having to do with both politics and epistemic tensions within critical mapping practice.

## COUNTER-CARTOGRAPHY

We understand “mapping up” as sitting within the multiple traditions of counter cartography. Counter cartography has been claimed by varied practitioners, with diverse empirical and theoretical orientations. Within the literatures

of geography, Nancy Peluso was the first to use the term and applied it to the work of NGOs and expatriate social scientists in Indonesia attempting to “appropriate the state’s techniques and manner of representation to bolster the legitimacy of ‘customary’ claims” to forests (Peluso 1995, 384). Within this thread of counter-cartography, the “counter” in question refers to a contestation of state claims on and management of land and resources, often, though not always, by or with Indigenous communities (Louis et al. 2012; Wainwright and Bryan 2009; Hunt and Stevenson 2017; Pearce and Hornsby 2020; Guldi 2022; Harris and Hazen 2005).

A wider range of differently oriented counter-cartographies have also emerged, claiming the mantle in order to suggest a broadly adversarial approach to cartographic research. Some take specific interest in practice that works to produce new solidarities and subject positions. The Counter Cartographies Collective (3Cs), for example (Counter Cartographies Collective et al. 2012) does so within an autonomist tradition of “militant research.” The [Anti-Eviction Mapping Project](#) has framed some of its work similarly, seeking to build knowledge of sites of memory and struggle within anti-gentrification movements (Maharawal and McElroy 2018), as well as to situate the many compromises of software development within what they call “grounded relationalities,” following Byrd et al. (2018; McElroy 2022). Others take the label to primarily imply an adversarial stance towards the mapped, with a more ambivalent relationship to mapper subjectivity (Alton et al. 2022; Bélanger and Arroyo 2016). All of these orientations appear as well in the life that “counter-“ practices have found within critical data studies (D’Ignazio 2024; Dalton and Stallmann 2018; Meng and DiSalvo 2018).

We understand our intervention to be different. Whereas counter mapping emphasizes mapping practice that counters authoritative knowledge, “mapping up” is broader and inclusive of cases where the map may not counter dominant forms of knowledge. This, of course, always carries a risk; even counter-maps can reinforce the logics they oppose (Iralu 2021). We nevertheless remain compelled by knowledge that is oriented towards accountability and redress of actors who hold Said’s “relative upper hand,” even when these are based on conventionally authoritative data sources.

## CRITICAL GIS

We also understand “mapping up” in a manner informed by recent literatures in and around critical GIS, which has always placed the power-laden tensions felt by the mapping subject near the center of its concerns. Pavlovskaya and St. Martin (2007), Schuurman and Pratt (2002), and Wilson (2009, 2018) give us generative frameworks for feminist mapping work that is both invested in the practice of mapping and dedicated to destabilizing its masculinist epistemologies and assumptions. More recently, D’Ignazio and Klein (2020), and Kelly and Bosse (2022) however, considerations of power are often difficult to represent in the map and fail to include considerations of power tied to the mapmaker. As such, we invite mapmakers of all backgrounds and skill sets to “press pause” on traditional workflows to incorporate feminist considerations and representations of power and position. We begin by reviewing reflexivity and exploring the ways it enables deep engagement with systems of privilege and oppression. We then situate reflexivity as the foundation of a feminist toolkit for “doing” feminist mapping, a toolkit that calls mapmakers to explore the multiple planes of the matrix of domination (interpersonal, hegemonic, disciplinary, structural rearticulate feminist subject positions in mapping following the enormous changes in mapping and data science as fields of practice, due to the uptake of mapping technology by non-state actors, and social/political movements in particular. Far from the state and colonial cartographies described by the first generation of critical cartographers—though, of course, at risk of rearticulating their logics—mapping, and now (spatial) data science are now understood as forms of practice subject to interventions by feminist, Black, Indigenous, trans, and queer epistemologies, literatures, and subjectivities (Giesekeing 2018; Bottone 2020; Lucchesi 2018; Walter and Andersen 2013; Rivera 2023; Restar et al. 2023). These mapmaker subjectivities demand a reconsideration of the unidirectional power relations often assumed to inhere in mapping practice.

Many of the tensions that follow from these interventions were recently distilled by Shelton, who offers a useful way of thinking about critical practice (2022). He argues that critical cartographers have tended to think of their work in one of two ways. In the first, they seek to destabilize cartographic knowledge practices, following broadly

post-structural and feminist argumentation. In the second, they strategically leverage the conventions and forms of argument found in empiricist social science to levy urgent critiques of existing injustices, largely leaving aside questions of epistemology. Here, Elvin Wyly’s argument for “strategic positivism” is a common reference (Wyly 2009). Wyly, drawing on Gayatri Spivak’s “strategic essentialism” (Spivak 1999), argues for the strategic necessity of suspending the social scientific left’s skepticism of empiricism if research is to support liberatory politics with all available tools.<sup>3</sup>

The tension between these two strategies—destabilize and strategically leverage—is readily apparent. It is far from obvious how one could coherently and simultaneously destabilize *and* claim the authority of an approach or method. Essentially, Shelton’s argument is that new (or renewed) modes of cartography put towards liberatory ends can do both: destabilize the authority of conventional cartography and make empirically compelling arguments for the persistence of injustice. He argues for a situated mapping practice that, among other things, develops cartographic techniques that sit between these tendencies.

Our argument ultimately builds on Shelton’s, though we note that his argument for “situated mapping” raises some questions that he leaves unanswered. For example: the critique of mapping as one of Donna Haraway’s “God tricks” is ever-present (1988). While the epistemic implications of the trick have been subject to scrutiny within the discipline (and without), the powerful position implied by the God trick has largely been assumed: the mapmaker has a powerful gaze that views the mapped from above. This implies that *to map is almost necessarily to map down*. But this is not necessarily true. Which of the concerns about the perceived authority of a map fall away when a journalist maps malfeasance within the halls of finance? What about when a renter, a tenant, even one privileged along many axes, maps landlords? The power and potential of a situated mapping practice is, yes, to construct cartographic forms that challenge too-stable spatialities, as Shelton argues. But it is also to challenge the notion that the power of the map is epistemic, not material, and itself, limited by the power of a mapmaker relative to the power of the mapped.

3. Our insistence on the language of “empiricism” reflects our strong agreement with Eric Sheppard, who argues that contemporary invocations of “positivism” function more as a social scientific slur, and that what we often call “positivism” is closer to empiricism (2014).

Sarah Elwood writes the closing article in the special issue of *Acme* in which Shelton’s piece appears. She identifies what she calls a “fourth generation” of critical GIS (2022), building on the three previously identified by Schuurman (2000) and elaborated by Wilson (2017). Elwood distinguishes this “generation” with reference to its “extraordinary politics.” By “extraordinary politics,” Elwood means those that “that arise from and point to . . . conceptions

of worlds beyond racial capitalism, settler colonialism, cis-heteronormativity, as interlocking structures and relations that overdetermine white supremacy” (Elwood 2022, 442) and fight against the limits of representational practice. We do not claim “mapping up” as exemplary in this fight, though we hope that it is of use to others who, like us, are striving towards what Elwood calls “liberation ontologies,” as one methodology among many.

## MAPS, UP

WE CAN POINT TO MULTIPLE EXAMPLES OF MAPPINGS that instantiate a practice of “mapping up,” though it is telling that these have often taken the form of tools rather than conventional scholarship. As tools, generally constructed outside of the strictures of academic discourse, they generally maintain an ambivalent, pragmatic epistemology: given the evidence available to us, what are the claims we can make, and how do we make these work? Indeed, recent calls for tool-building in geography and the spatial sciences resonate here (Boeing 2020), as do feminist claims from the early days of critical GIS: that critical scholarship must have a stake in the tools themselves, rather than staging an external evaluation of their epistemic merit (Schuurman and Pratt 2002; Wilson 2009). As Sara Ahmed argues, tools are instruments for “sharpening the edges” of critical work, things that we are obligated to hold onto and not put down (Ahmed 2017).<sup>4</sup>

## TENANT ADVOCACY MAPS

We can see similar dynamics in recent efforts to map landlord-tenant relations, including our own. The Anti-Eviction Mapping Project’s Evictorbook (Figure 3), Mutual Aid Medford and [Somerville’s Tenant Power](#) (which Eric led the development of, Figure 4), and [WhoOwnsWhat.nyc](#) (Figure 5) have similar aims, with similar origins: movements for housing justice fighting for tenants, against landlords, facing down the inscrutability of land records. In brief: identifying owners is an extremely difficult process, due to the legal incentives in place for landlords to operate under multiple LLCs, to isolate the assets tied up in each building from suit by a tenant renting elsewhere. This has been the subject of an exciting body of methodological scholarship in urban data science (Immergluck et al. 2020; Gomory 2022; Hagen and O’Brien 2025; Shelton and Seymour 2024; Preis

2024). But it has also yielded powerful mapping tools, like these above, that use machine learning and network analysis techniques to identify shared ownership, and that emerge from variously institutionalized movement contexts. JustFix, for example, is a 501(c)(3) non-profit, benefiting from a wide range of funding sources, including banks (Capital One, MUFG, Deutsche, M&T, Wells Fargo), foundations (Chain Zuckerberg Initiative, FJC, Robert Wood Johnson, Open Society, Oak, New York Bar, Pershing Square, Awesome), universities (Harvard,

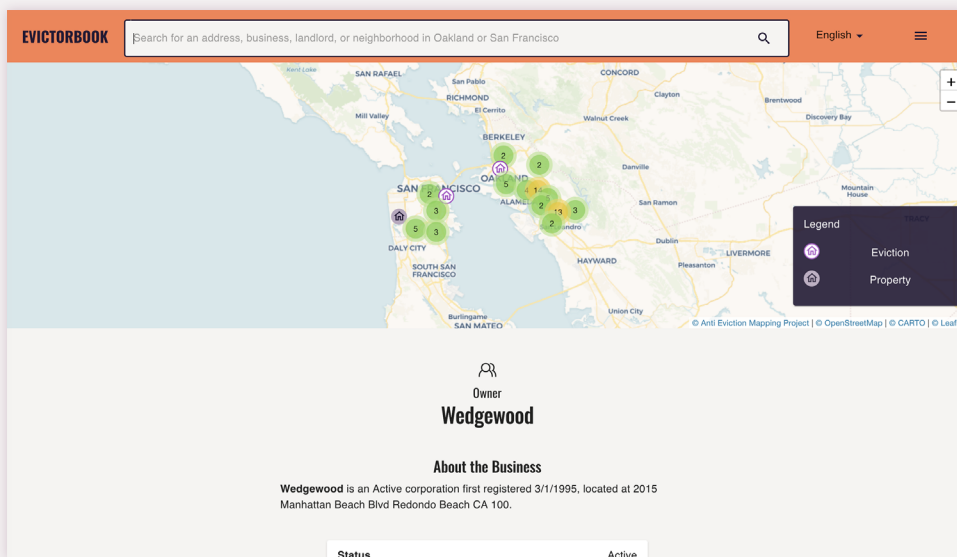


Figure 3. Anti-Eviction Mapping Project’s “Evictorbook”

4. We are grateful to one of our reviewers for reminding us of Ahmed’s thinking on tools—what a delight to place Ahmed in conversation with Boeing, however briefly!

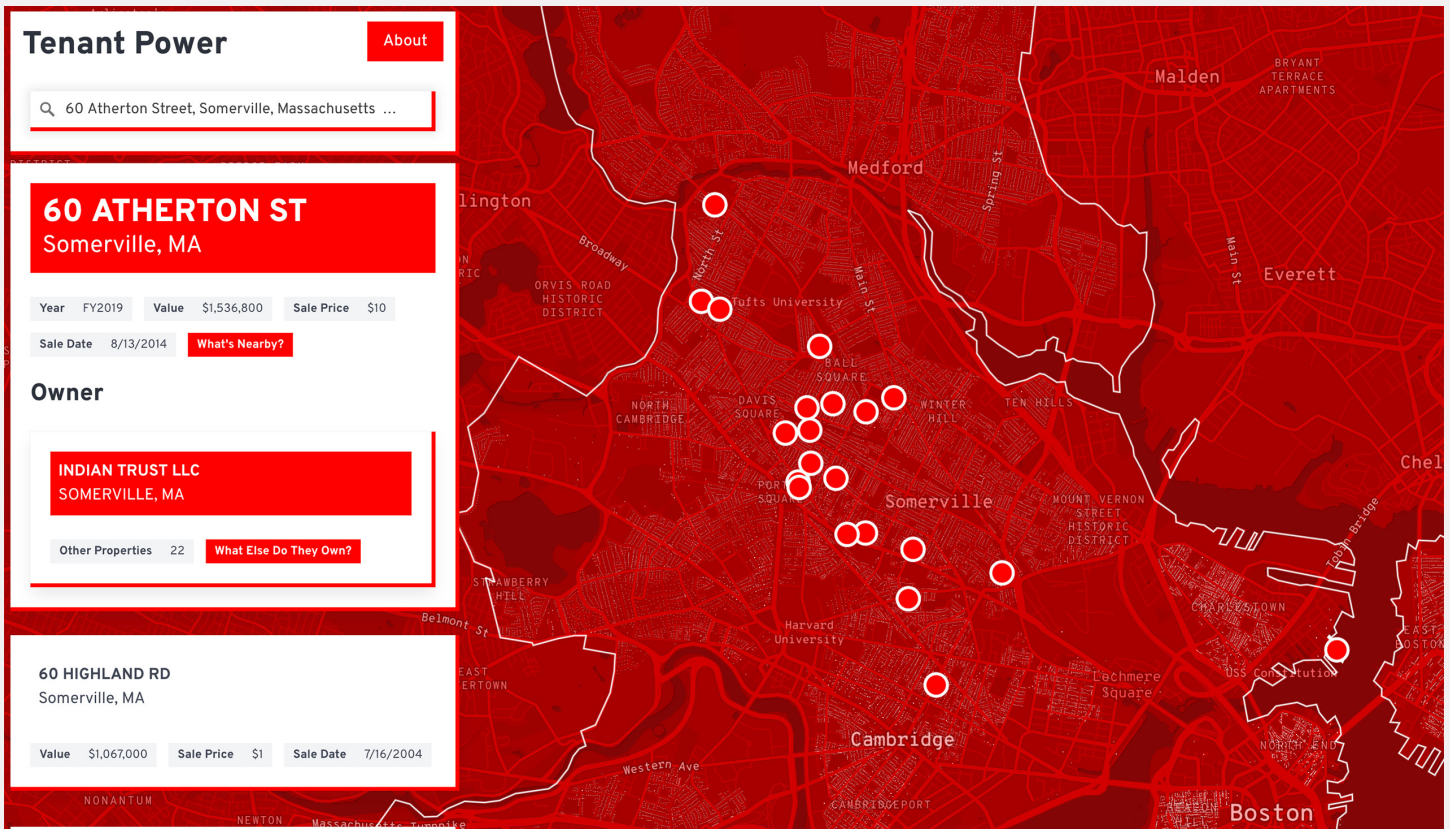


Figure 4. Mutual Aid Medford and Somerville (built by Eric), "Tenant Power."

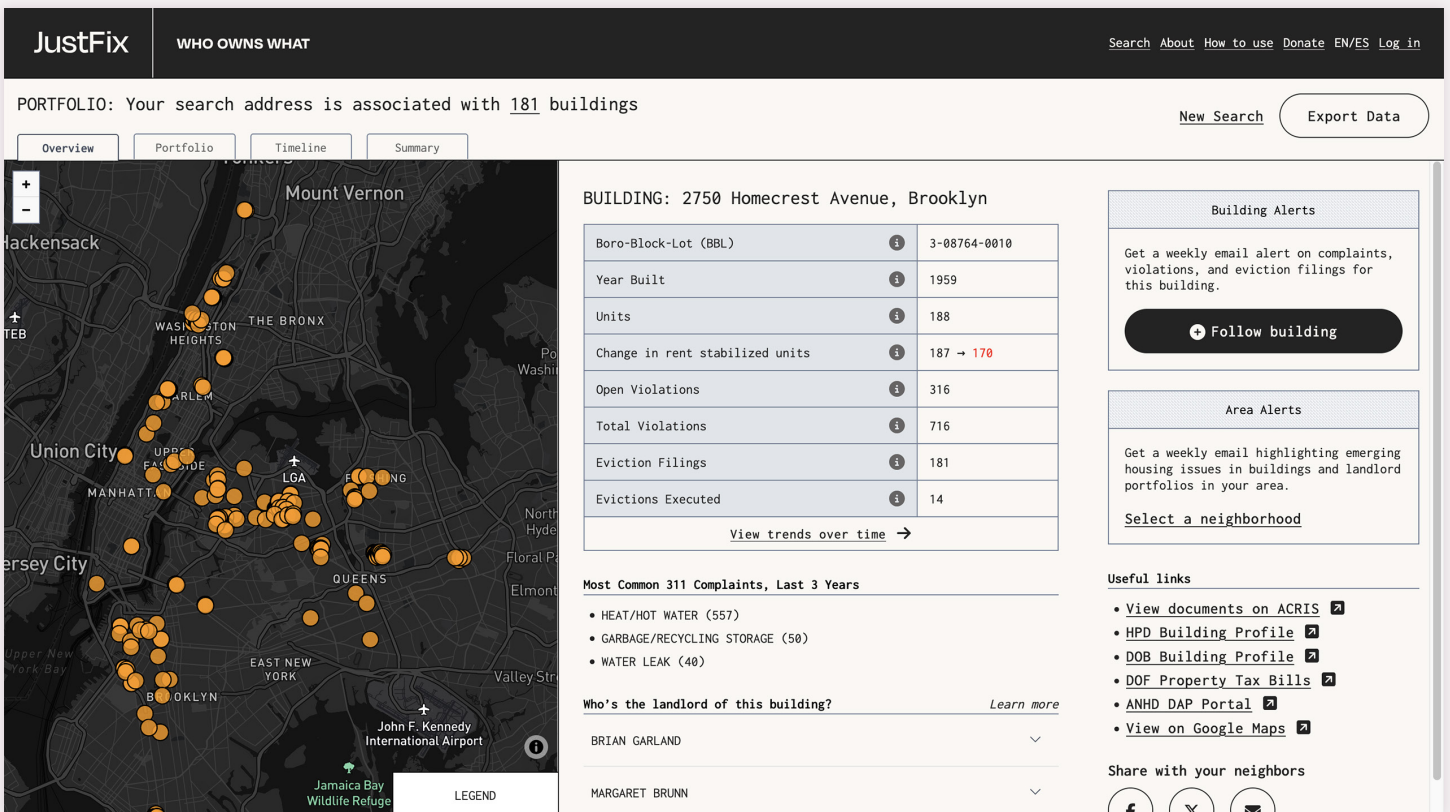


Figure 5. WhoOwnsWhat.nyc, developed by JustFix.

NYU), the New York City mayor's office and council, and Google. The Anti-Eviction Mapping Project is a collective pursuing a range of projects across the Bay Area, Los Angeles, and New York City. Tenant Power was the work of three activists involved in the housing justice working group of Mutual Aid Medford and Somerville that had yet to secure fiscal sponsorship at the time of its development.

These three tools were selected because they suggest the immense range of subject positions occupied by mapmakers working to de-obfuscate landlord relations. This throws some of the old questions of mapping and power on their head, relative to how they have been asked within the critical cartographic literature. What is the relative power of the tenant mapmaker to the landlord mapped? And how does it change the epistemic and material stakes of mapping work to place evidence of housing precarity in the context of their sustaining power structures: property governance regimes that are constructed in favor of property owners, and arrayed against tenants' right to shelter. Even this is an internally multiple question: these tools are developed in organizational contexts that range widely, with associated differences in theories of change, technical sophistication, and the sustainability of software. And, as AEMP's McElroy points out, compromises are involved: Evictorbook relies on AWS servers to host its graph databases (2022). TenantPower is still maintained, but ceased active development in 2021 as Eric, its lead developer, has moved on to expanding the work into a tool, *Who Owns Massachusetts*, that supports state-wide search of deduplicated ownership records—with funding from the Conservation Law Foundation and in collaboration with the Healthy Neighborhood Study.

Ultimately, these projects don't internally pose the epistemic questions they raise. Instead, they raise relational ones: what is the capacity of mapping work to intervene in an unjust system, weighted against tenants? They map up—taking an originating interest in the networks of ownership that characterize contemporary rentier capitalism (Christophers 2022)—while also mapping down—documenting the

relationship between ownership and eviction, code violations, and hardships met by tenants. These maps struggle for new and more just worlds, but to analyze their power in the most easily accessible registers of critical cartographic scholarship falls short: these maps can only claim a small part of the world-making power of the social movements they support.

## LAND GRAB U

Finally, we uplift *High Country News's* “Land Grab Universities” project (Figure 6), which meticulously connects the financing of the US land-grant university system via the 1862 Morrill Act to its material base: land expropriated from Indigenous tribes and offered as speculative holdings to universities, who used its sale to fund their endowments (Lee et al. 2020). In drawing these lines (from land stolen from Indigenous peoples to major research universities), it complicates what Tuck calls “damage-focused research” (2009), or the prevalent social scientific impulse to document disparity and, in doing so, pathologize communities. Instead, the tool spatializes a direct relationship between injustice and injustice's beneficiaries, namely the research institutions in which many of us toil and from which many of us benefit.

Built by a team of both Indigenous and settler cartographers, researchers, and journalists, the map can claim a

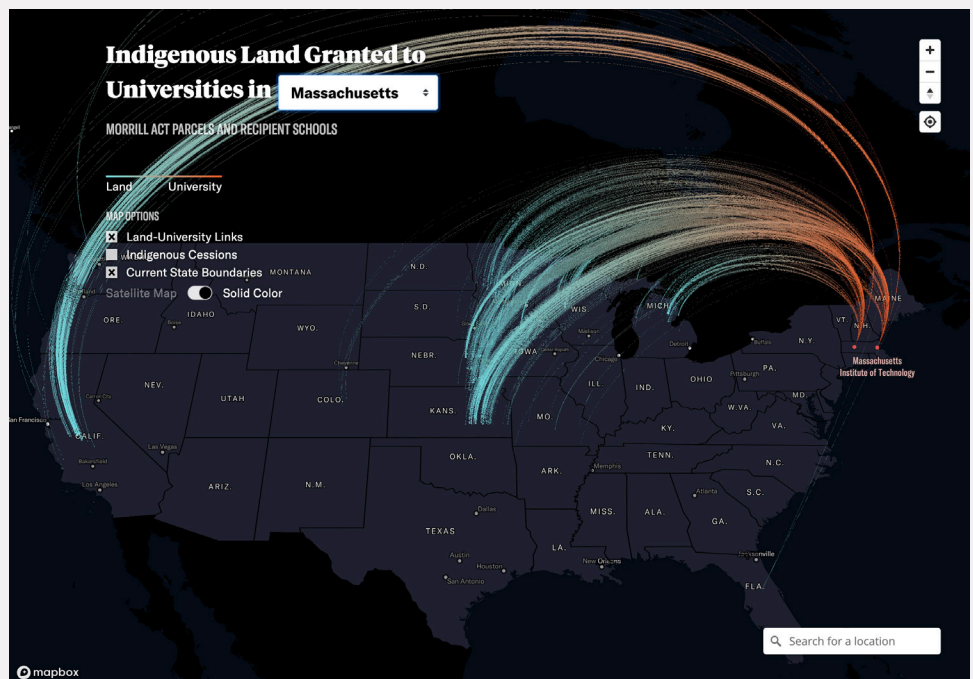


Figure 6. “Land Grab Universities” (High Country News).

positional legitimacy that draws from lived experience, but it also makes direct and strong epistemic claims that identify, quite clearly, the lines from one antipode to the other: from settler institutions to Indigenous land, from US higher education to its material base. The authors could have taken a tack in which they cartographically emphasized the stolen land itself—this would be analogous to the approach taken by, for example, the Mapping Inequality project that made the Homeowners Loan Corporation “redlining” maps available to researchers (Connolly et al. 2018; Krieger et al. 2020; Michney 2022). This would have documented the damage, while absencing the beneficiaries. Instead, the map starkly documents the spidery lines through which land theft traveled into the endowments of the land grant college system, placing the relationship between higher education and settler-colonialism in the United States at the core of the visualization. The project maps up—the universities, their endowments—even as it

maps down and, for some of the project’s authors around—the stolen land, the coercive treaties.

And yet, the line from the map to the world it demands cannot be drawn directly. Our students and colleagues have been demanding a recognition of MIT’s complicity in the theft of Indigenous land, supported by the work of this project; signs hang in our department halls reading “MIT EXISTS because of the theft and sale of CO-YE-TIE LAND Morrill Act 1862.” A student recently asked Eric—and they agreed—to replace their office label with one commemorating the Coast Tribes of Oregon, whose 30,000 stolen acres were sold to raise \$822,967 for the settler state. Work to hold the Institute to make meaningful commitments to repair are ongoing—maps can draw the lines, but Indigenous students, faculty, and allies are following them into the fight.

## UNKNOWNPLEASUR

IN THE NAME OF SHARING CURRENT WORK, WE DIRECT the reader towards [an R library](#), unknownpleasur, maintained by the authors (Figure 7). This library is informed by our reflection on the directionality of the

surficial work of the Howard Fisher, read alongside the antipodal cartography of the “Universal Antipode Projection” in the context of “mapping up.” To be clear: we share this with the most modest of intentions. We



Figure 7. unknownpleasur R Library, developed by the authors.

don't share because we think it is an answer to the question of how cartographic technique might respond to our proposed methodological reorientation. We include it here because it has been one of our ways in to working cartographically with relational power.

The package takes its name from the 1979 Joy Division album *Unknown Pleasures* whose omnipresent cover art comprises a stacked chart of radio signals from the first recorded pulsar, or extremely dense neutron star.<sup>5</sup> We note that one cannot observe a star without looking up, but the name followed from formal resemblance, not conceptual conceit. In building the library, we wanted to retain the volumetric and surficial interest of Fisher, while exploring the simultaneous depiction of geographies of the oppressed and geographies of oppressive systems (with obvious applicability to bivariate visualization more broadly).

We took particular note of Fischer's experimentation with elevations at intervals (Figure 8), a technique used widely in landscape architectural drawing to depict terrain, and wondered about the possibility of setting a second set of elevations orthogonal to the first, with an interval wide

enough that both retained legibility. As an experiment, we map concentration of landlords per housing unit (in green) against concentrations of evictions per rental unit (in magenta). First, each in isolation—up (Figure 9), down

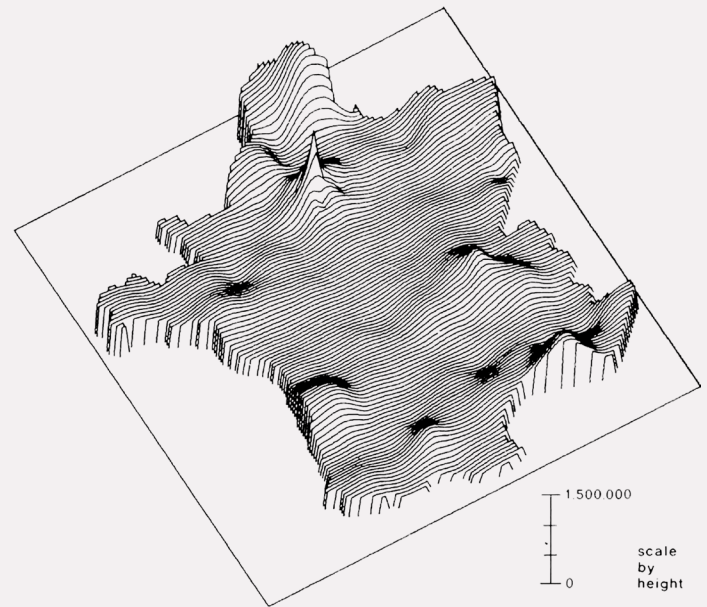


Figure 8. Map from Fisher (1982).

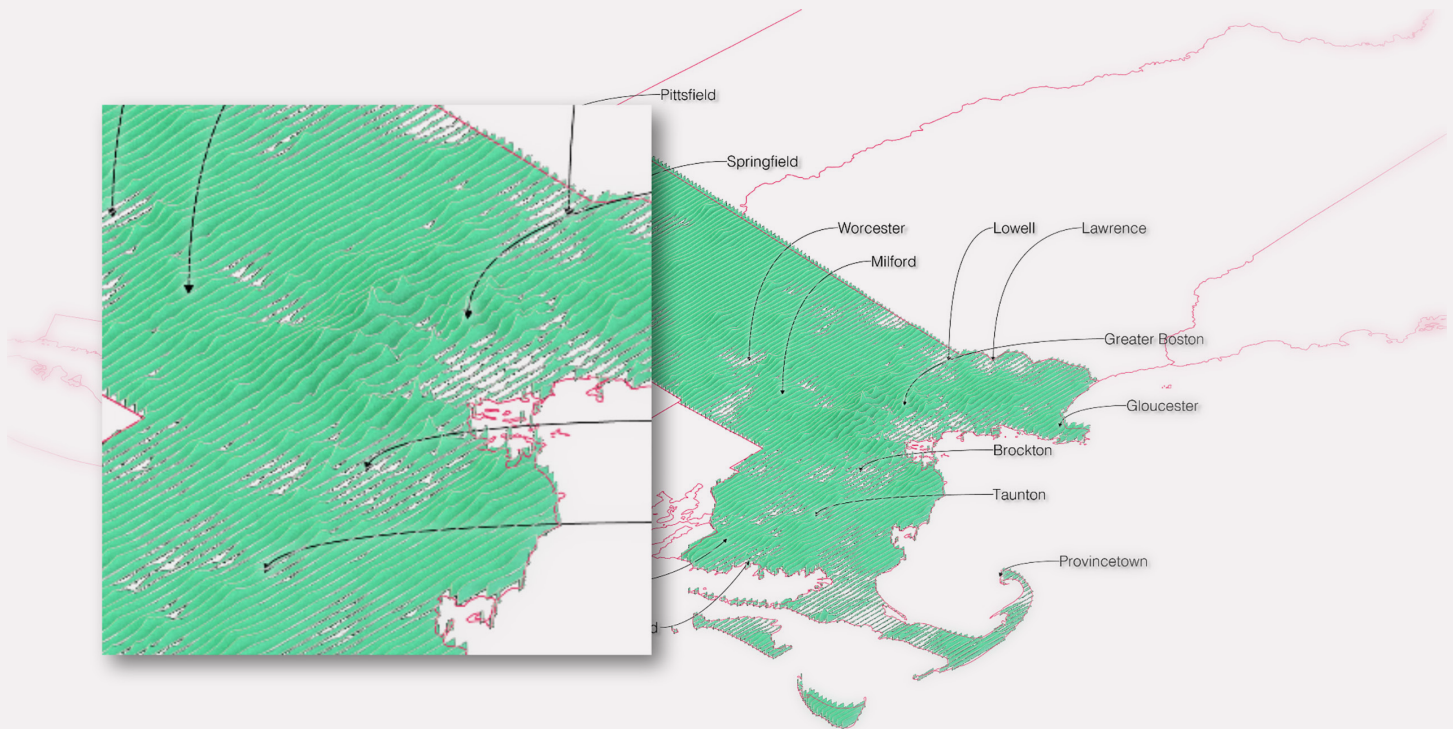
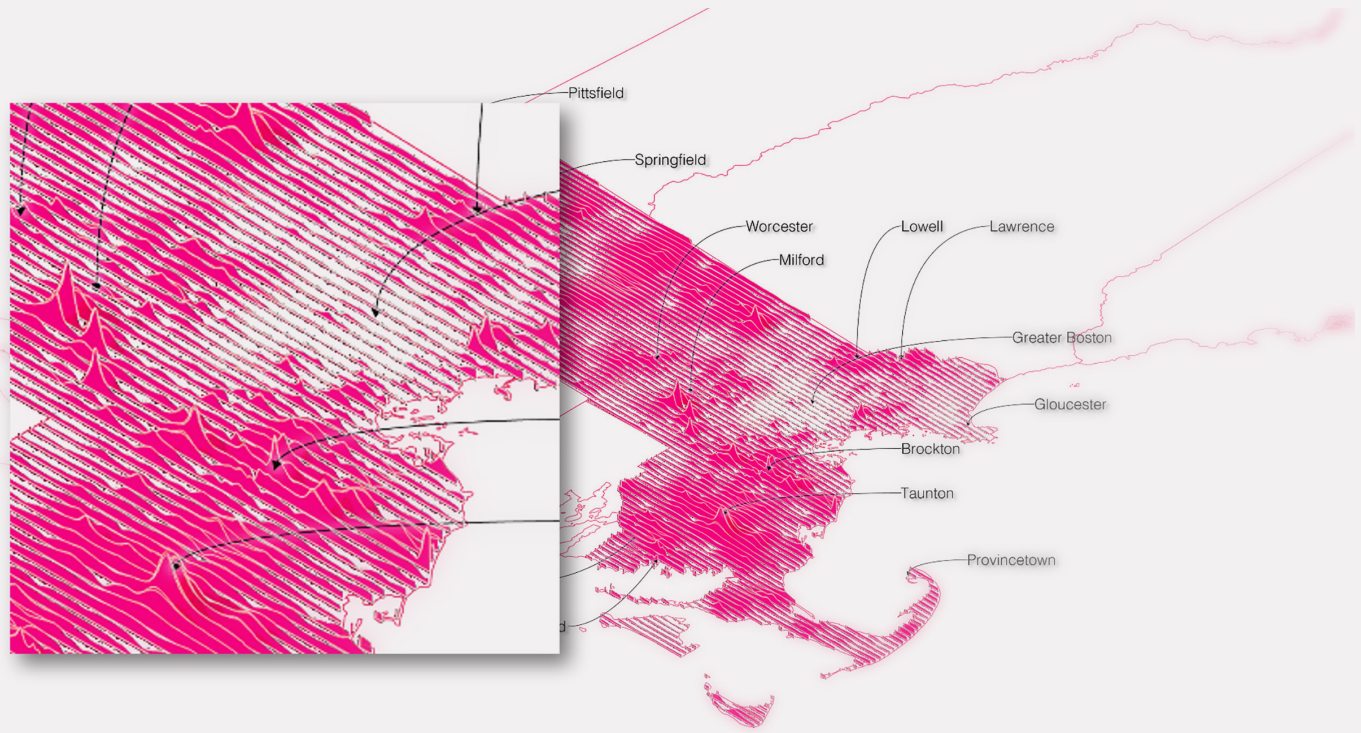
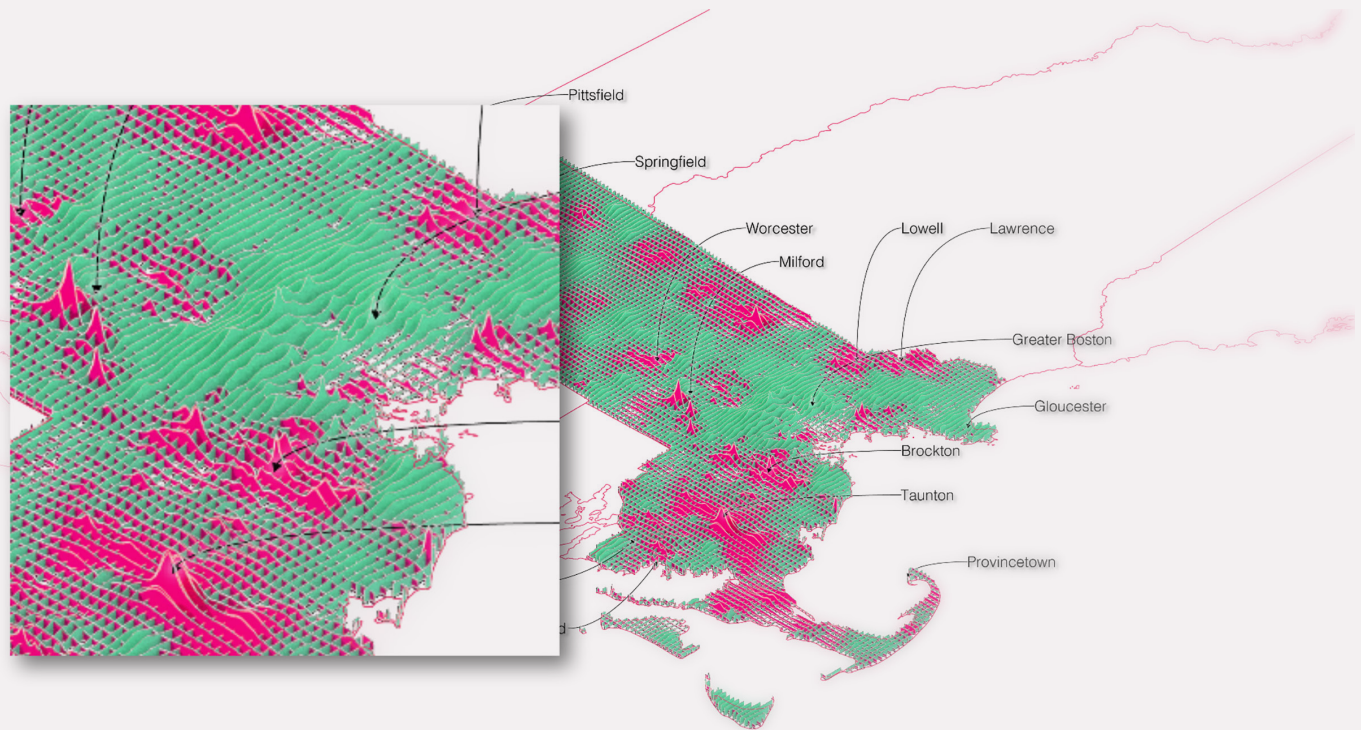


Figure 9. Mapping up, landlord addresses per housing unit in Massachusetts. By the authors.

5. The origins of the graphic have been subject to quite a lot of sleuthing. The band presented the graphic to album designer Peter Seville as it appeared in the *Cambridge Encyclopaedia of Astronomy* (Mitton 1977; see Visualized 2012), though the original graphic appears to have been from a dissertation by Harold D. Craft (1970; see Christiansen 2015a; 2015b).



**Figure 10.** Mapping down, eviction filings per rental unit in Massachusetts. By the authors.



**Figure 11.** Mapping around, bivariate surface map of evictions per rental unit and landlord address per housing unit in Massachusetts. By authors.

(Figure 10)—and, subsequently, as a joint proposition, linking the landscape of housing precarity to the landscape of landlords and ownership (Figure 11).

In some sense, this is a response to the types of mapping that have emerged from critical literature on ownership relations. Shelton, for example, makes extensive use of the spider map, in which lines connect, for example, vacant plots to their owners, resulting in a wild proliferation of lines that speak to the multitude and geographic plurality of ownership relations. However, in the absence of an aggregating unit, those maps are limited in their reading; relations are drawn between the geographies of ownership and the geographies of vacancy, eviction, and otherwise, but the interpretation tends to be one of sheer multiplicity, rather than specific concentration. We instead articulate divergences in concentration between owners and the people they make precarious, depicting both “up” and “down” as analytical directions that are interrelated, but nevertheless subject to concentration along axes of exclusion.

## CONCLUSION

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In closing, and as suggested above, we note that mapping, spatial data science, and all their associated knowledges have thoroughly entered activist practice. Counter-data science and counter mapping are not a rarity but embedded in the reality of many movements. New methodological toolkits could equip those of us embedded in critical cartographic practice to address the radically multiple positionalities of contemporary mapping practitioners.

We argue that “mapping up” is one such framework that could accommodate a far less stable assumed relationship between mapmakers, power, and knowledge. Rather than taking an epistemic shortcut (the “power of the map”) to a positional question (“who is the mapmaker to the mapped?”), we might develop methodologies attentive to the range of positionalities engaged in mapping practice, and the range of powerful actors subject to scrutiny in mapping practice. None of this is to say that “up” was not always a part of feminist praxis, as a knowledge politics that is both directional and adversarial. Sandra Harding, for example, reflects that

Although standpoint methods were to start from women’s lives, they were not to end there; women’s lives were shaped by decisions made elsewhere,

While antipodal charts suggest (or can suggest) the trans-planetary reach of empire, here we are mapping an often, though not always, localized form of oppressive interrelation: evictor to eviction, up to down.

As a final (and minor) technical note, we prioritized functionality to support interoperability with Computer-Aided Drafting (CAD) and 3D-modeling software through, for example, DXF file exports (e.g., Blender, Rhino—the illustrations we provide were rendered in Rhino). Our rationale for this is to draw out a formal parallel between our “mapping up” concept and software better equipped to perform volumetric visualization than traditional GIS software. In addition to offering a new method for bivariate mapping, we take an interest in visualizations that don’t adhere so fixedly to the ground plane, an epistemic constraint that echoes throughout geographic thought (Elden 2013; Bridge 2013). “Up,” vis-à-vis power. “Up,” vis-à-vis cartography.

namely in the elite men’s worlds of public institutions. Standpoint methods were to ‘study up,’ to critically examine the dominant culture, rather than to ‘study down,’ to focus exclusively on the oppressed, as conventional social science projects often did. (2005, 354)

Nader herself argues, implicitly, that changes in the power relations of research practice and practitioners would necessarily change the theories we build and methods we deploy. In speaking of field work, she asks whether anthropologists (and we could extend this to include mapmakers)

might indeed ask themselves whether the entirety of field work does not depend upon a certain power relation in favor of the anthropologist, and whether indeed such dominant-subordinate relationships may not be affecting the kinds of theories we are weaving. (1972, 289)

Devising critical cartographic theories and methods that incorporate the possibility of a far less stable power relationship between mapmaker and mapped is a key challenge for contemporary practitioners.

In an earlier draft of this paper, we included a long section on one long-standing critique of social science: that “more research is needed” is little more than a distraction that creates ambiguity where we, in fact, know all we need to know. Ruha Benjamin, for example, argues in *Race After Technology* that “demanding more data on subjects that we already know much about is, in my estimation, a perversion of knowledge (2019, 116). Such sentiments have a long history, including in geography. David Harvey argues that “mapping even more evidence of man’s patent inhumanity to man . . . is irrelevant” and that we have “all the evidence we need. (1972, 10) Of course, “studying up” is no cure—much as we have “enough information” about inhumanity, we have “enough information” about the systems, their actors, and the incentives to which they respond. As Eve Tuck notes, “it is a powerful idea to think of all of us

as litigators, putting the world on trial, but . . . do the material and political wins come through?” (2009, 415).

Not yet, and not enough. But we are left to note that studying (or mapping) up is one of many necessary changes in mapping practice, able to accommodate a range of practitioners united by no shared program except the urgency that comes from a world on fire. We are inspired by the rapid proliferation of maps that are less interested in absolute and absolutizing claims or their opposite, destabilizing and decentering claims, than they are in practical and political efficacy. The epistemic stakes of mapping, as always, are high. But so too are the strategies, supported by methodically upward-facing mapping practice, that are increasingly embedded in movements demanding justice.

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# Using MapWeaver to Make Tiled and Woven Maps of Multivariate Thematic Data

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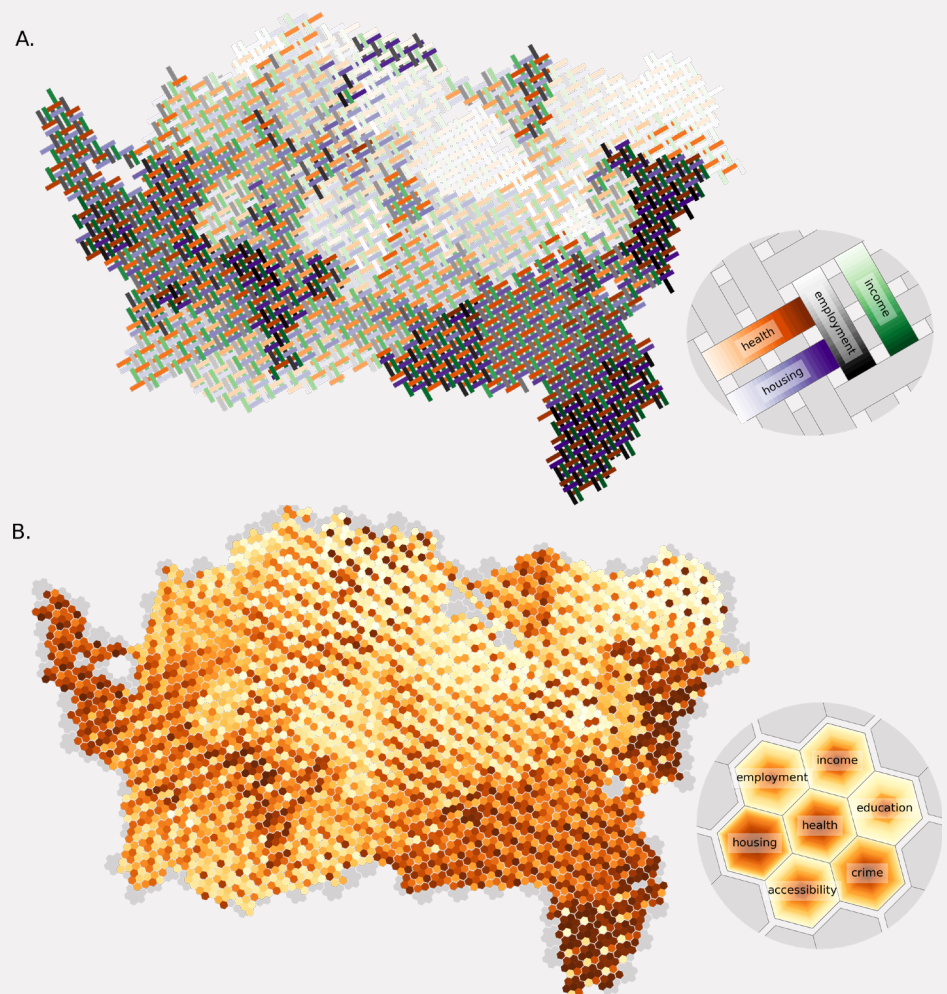
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## INTRODUCTION

MAPPING HIGH-DIMENSIONAL area unit data, so that multivariate patterns across geographical space can be explored and understood, is never easy. In this article, we explain how to use the *MapWeaver* web app to make tiled and woven maps of such multivariate data, as one approach to the problem.

Examples of such maps are shown in Figures 1 and 2. Figure 1A shows four components of an index of deprivation (Exeter et al. 2017) using a “basketweave” pattern. Figure 1B shows the same data set, extended to include a further three indices, and employing a “7-colouring” of hexagonal tiles. In this map, all seven indices are shown on an identical colour ramp, drawing attention to areas where one or more of the indices is out of step with others. Figure 2 shows the technique applied to categorical data and displays anthropogenic biomes (Ellis et al. 2021) at six moments in time from 1760 to 2010 CE, for a section of the northeast of the North American continent.

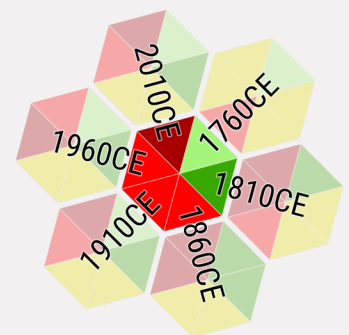
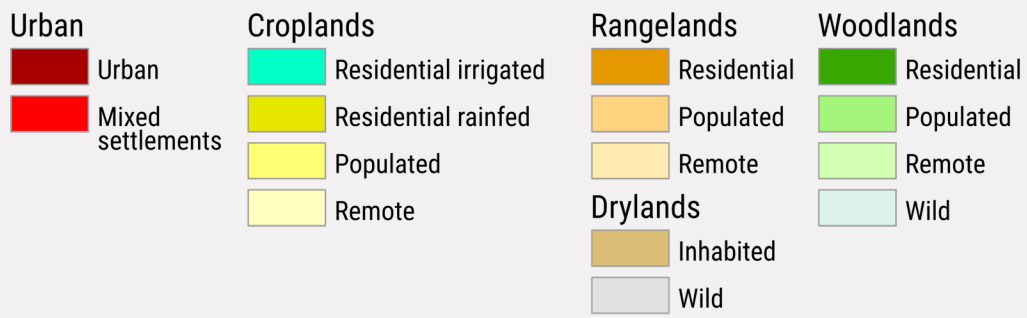
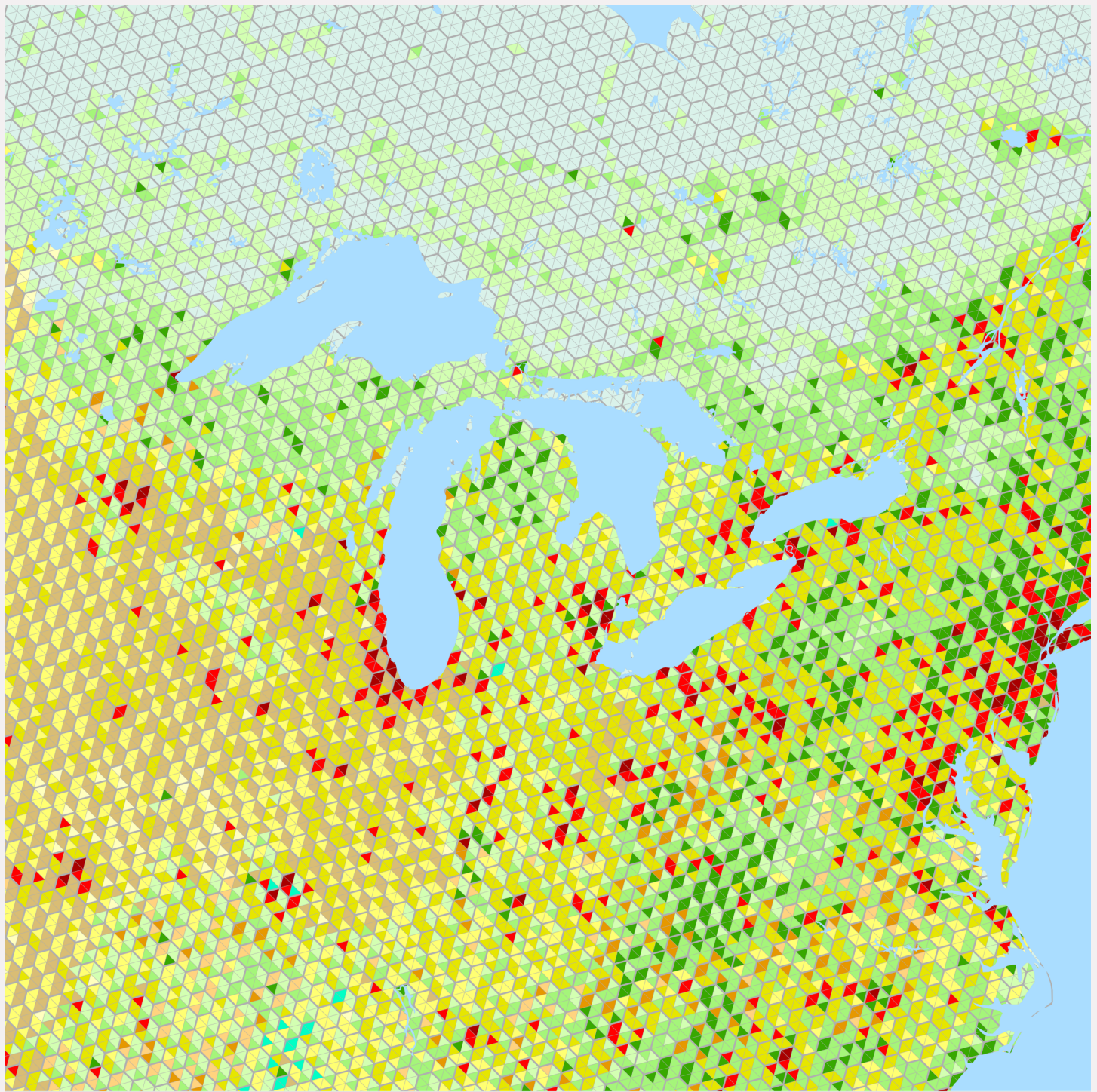
With small to medium numbers of variables—up to about twelve for some patterns—this approach offers a way to visualize complex geographical data that cannot otherwise be easily



**Figure 1.** (A) Four deprivation indices in a basket weave pattern. (B) Seven indices of deprivation in a 7-colouring of hexagons. Both maps cover the centre city area of Auckland, New Zealand. Legends show which elements in the tiling correspond to various aspects of deprivation and the associated colour ramp, from lighter colours for less deprived to darker colours for more deprived.



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**Figure 2.** Anthropogenic biomes mapped at six different moments in time in the northeast of the North American continent. This data and the associated colour categories are from Ellis et al. (2021).

communicated in a single map. This method can accommodate even larger numbers of variables (as many as twenty at the time of writing, and potentially more if you use the associated Python `weavingspace` module<sup>1</sup>). As that number grows, the tiled or woven patterns become more

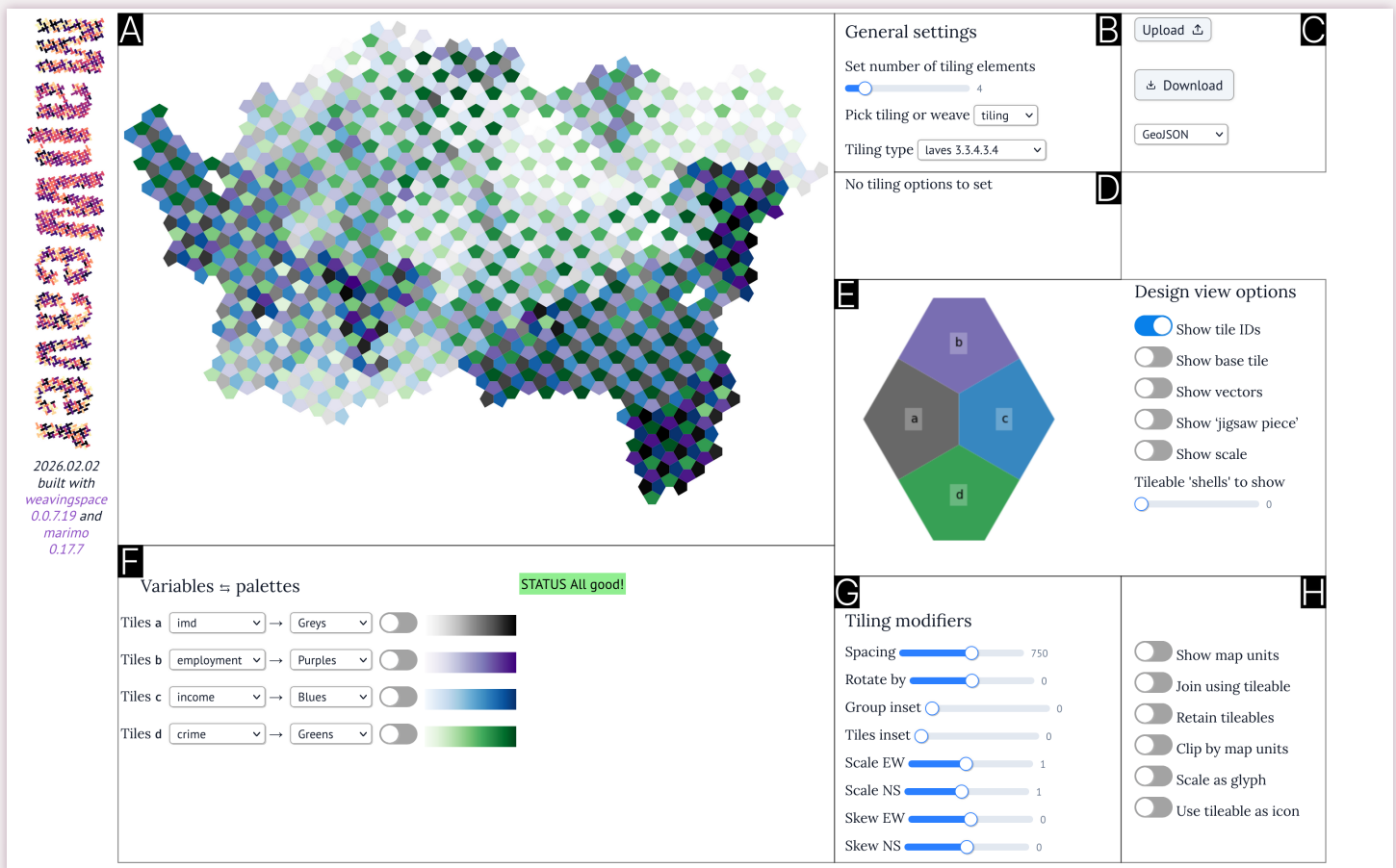
like textures, giving a more impressionistic view of complex geographical patterns. This approach brings thematic mapping into closer conversation with more holistic geographical approaches to the landscape.

## OVERVIEW OF THE APPROACH AND OF THE APP

YOU CAN FIND THE current version of MapWeaver at [geospatialstuff.com/mapweaver/app](https://geospatialstuff.com/mapweaver/app). The app takes a little while to load, during which time a brief explanation is displayed in a splash screen. Links in the splash screen will take you to pages with additional information about the underlying mapping approach. The app interface is shown in Figure 3, with different areas annotated and described in more detail below. While annotated in a left-to-right,

top-to-bottom order on the figure, they are described below in the order in which they are likely to be used in practice.

- **Map view [A]** provides a preview of what a map made with currently chosen settings will look like. If the map is downloaded as a graphical file this is *exactly* what you will get. If you instead opt to download a



**Figure 3.** The MapWeaver web app, with each area of the interface marked: (A) map view, (B) tileable unit setup, (C) upload/download options, (D) tile or weave type specific options, (E) tileable unit design view and options, (F) variable and palettes selection, (G) modifiers controlling the tileable unit, and (H) further options for how tiling overlay should be applied.

1. See [github.com/DOSull/weavingspace](https://github.com/DOSull/weavingspace).

geospatial data file this shows more or less what you will get, subject to differences in the details of how you assign colour ramps to variables or other changes you might make in other software.

- **Upload/download options [C]** allow users to upload their own data set (in GeoJSON format) and download results as an image, or as a geospatial data file (geopackage or GeoJSON).
- The tileable unit **Design view [E]** and options panel displays the current tileable unit (explained below) with any options or modifiers as specified by settings chosen in **B**, **D**, and **G**, and also allows selection of a number of options for how the tileable unit is displayed.
- **General settings [B]** allow you to choose how many variables from the input data you wish to map, and, contingent on that choice, offers a range of tiling or woven pattern choices.
- **Tiling or weave options [D]** are offered depending on the chosen tile or weave type in **B**. Additional options relevant to that choice will be available here (no such options are available for the tiling shown in Figure 3).
- **Tiling modifiers [G]** provides for a number of changes to the tileable unit, such as rotation, scaling or skewing in the east-west and north-south directions,<sup>2</sup> and inseting of the tileable unit and/or its constituent tiles.
- **Variables and palettes [F]** enables configuration of which elements in the tileable unit are to represent which variables in the data, and which colour ramps are to be applied to them.
- **Options for tiling overlay [H]** control how the GIS overlay operation to create the tiled map should be applied.

## THE MAP DESIGN PROCESS

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LIKE ANY OTHER DESIGN PROCESS, CREATING A MAP using MapWeaver is iterative, but broadly the sequence of decisions is to: (1) prepare and upload your data; (2) choose a tiled or woven pattern to work with; (3) adjust the specific and general options associated with that pattern; and, finally (4) make decisions about the colours to be used. The specifics of each of these are set out below. If you want to simply learn the process and get a feel for the possibilities, MapWeaver launches with a default dataset (based on Exeter et al. 2017) containing 30 numeric variables mapped for around 150 areas.

### 1. PREPARE AND UPLOAD YOUR DATA

Once you have a sense of what the app can do, you will want to upload your own data. The app only accepts data in GeoJSON format. MapWeaver does not enforce any restrictions on chosen map projections, so you'll get away with any valid map projection—it's your design after all!

Officially, GeoJSON only supports WGS84 (EPSG 4326) latitude-longitude projected data, but in practice GIS platforms allow projection metadata to be added to GeoJSON data. If your data has projection metadata that MapWeaver recognizes, MapWeaver will treat it as such and all dimensions in the app settings will be denominated in the units of that projection. Otherwise, your geometry data will be treated as if it were expressed in latitude and longitude (WGS84) and MapWeaver will internally reproject the data to Web Mercator (EPSG 3857) for the purpose of giving you mapping parameters with units in meters. Transformation to EPSG 3857 is not an ideal choice for final cartographic products, but is a convenient conformal projection with global coverage that is reasonably applicable to areas of limited regional extent. With these considerations in mind, it is recommended that you prepare your data in the final coordinate system you intend to use.

When your data are loaded, the map view (**A**) will update and show a default map applying the so-called Cairo

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2. Strictly speaking, the scaling and skewing is horizontal and vertical with respect to the map projection.

tiling.<sup>3</sup> At this point, we recommend that you increase the **Spacing** setting in the tileable unit modifiers area (**G**) to its highest value, or a value towards the high end of the available range. This will ensure more rapid updates of the map view (**A**) and tileable unit displays (**E**) while you explore the options and tweak settings on the tileable unit before fine tuning the spacing for the final map.

## 2. CHOOSING A TILED OR WOVEN PATTERN

Central to this method of mapping is the concept of a *tileable unit*.<sup>4</sup> This is the repeating set of tiles which, when tessellated across the map, yield a tiled or woven overall pattern. The current state of the tileable unit based on selected options is shown in the tileable unit design view area (**E**) of the interface. Controls alongside this view allow you to show various aspects of the tileable unit. The **tile IDs** are labels associated with each tile and used to assign variables in your data to specific tiles in the final map pattern. The **base tile**, **vectors**, and **'jigsaw piece'** options may help you understand how the tileable units will fit together to produce a final tiled map. The vectors show the directions and distances which the tileable unit will be copied in to produce the map pattern. You may also optionally switch on a **scale** to see the size (in units of the projected coordinate system) of the tileable unit. Finally, in this part of the interface, you can request to see additional **'shells'** of the tiling—neighbouring iterations of the tileable unit—to get a better sense of the pattern in detail. Of course, at all times the final overall pattern will appear in the map view area (**A**).

MapWeaver offers a wide array of tiled and woven patterns.<sup>5</sup> The single most important determinant of which patterns are available to you is the number of variables you wish to represent in your map. Setting the **number of tiling elements** in the general settings area (**B**) will change the patterns available to you. Under these same settings, you also need to pick either a tiling or a weave pattern. Based on these choices, different options will be available in a **Tiling type** or **Weave type** drop-down list. These have been arranged in what we consider to be an

approximate order of likely usefulness, but we suggest you examine all the options before picking one or two to focus your attention on. It is not difficult to change this choice later, but it can easily become a distraction if you regularly jump around among the options.

### *How Many Variables?*

How many variables you choose to represent is entirely up to you. The options available in the MapWeaver app can accommodate any number between two and twenty, except for seventeen. If you simply *must* map seventeen variables, or even some number greater than twenty, then greater flexibility is available using the Python **weaving-space** module (see “Digging Deeper” below).<sup>6</sup>

### *Tiled or Woven?*

There is no reason to favour either one of the tiled or woven map patterns over the other. We, as developers of this approach, started out favouring woven patterns because that was the genesis of the method, but as we have added options for tiled patterns, we have come to appreciate the potential of both.

Tiled patterns offer some interesting opportunities for further manipulation that don't apply to woven patterns. For example, a tiling consisting only of convex polygons, particularly if the tileable unit itself is also a convex polygon (usually a hexagon or square), can yield what are in effect statistical glyphs by rescaling the elements. These can be placed one per map area as “icons” as an alternative mapping method by switching on the option **Use tileable as icon** in the further options area (**H**).

On the other hand, woven maps can be manipulated to create variations on a cross-hatched map, and they are particularly good at enabling map readers to see connections and relationships between areas widely scattered across the mapped area. Weave patterns are specified by a “strands code” included in the pattern's name in the drop-down list of patterns. For example, “basket ab|cd” specifies a basket weave pattern with two strands in each direction (either

3. Also known as Laves tiling (3<sup>2</sup>.4.3.4), this is the best tiling in the opinion of at least one of the authors. No correspondence will be entered into on this matter, nor will we consider what “best” means in this context.

4. Note that whereas we refer throughout this article to “tileable units,” on the app interface the term “tileable” is used for brevity.

5. This notebook [github.com/DOSull/weavingspace/blob/main/examples/all-the-tiles.ipynb](https://github.com/DOSull/weavingspace/blob/main/examples/all-the-tiles.ipynb) provides an overview of the available tiling options.

6. If you are exploring highly multivariate maps using this method, we'd love to hear from you and would be happy to advise on the possibilities and challenges. Such challenges often motivate new approaches.

side of the ‘|’ symbol) with element identifiers “a” through “d” corresponding to the choices made in the variable and palettes section (F). A “-” symbol in the strands code indicates a strand to be skipped in the pattern, which can be used to make it easier to identify which element is which in the pattern. This is particularly important for twill weave patterns, where it may otherwise be impossible to distinguish elements in the resulting overall pattern (see Figure 4).

### 3. TWEAK SETTINGS OF THE CHOSEN PATTERN

The effects of the controls in the **Tiling modifiers** section (G) of the interface are set out below.

#### Spacing

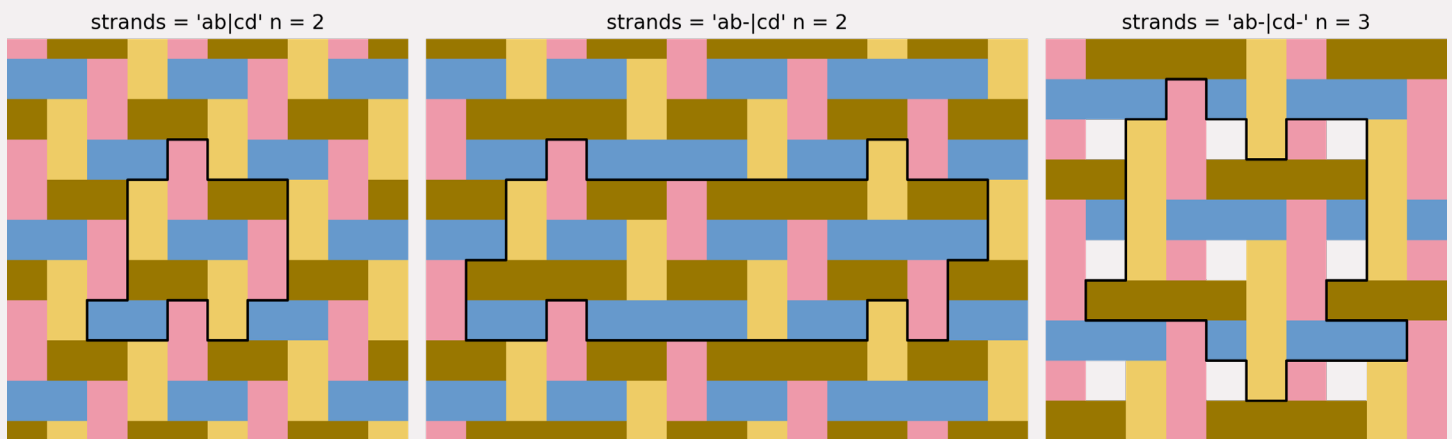
The spacing setting controls the size of the tileable unit expressed in units of your data’s map projection. The interpretation of this setting differs between tilings and weaves. In the former case, it is the distance across the repeating tileable unit. In weave patterns, it is the distance between strands in the pattern, so that the repeat distance of the tileable unit will depend on how many strands are in the pattern. We recommend keeping the spacing setting relatively high while you experiment with other details of your design. This will allow the app to update the map view more quickly in the early stages of the process.

One heuristic for choosing the spacing setting is to have it reflect the typical size of the enumeration unit polygons in the dataset. If polygons are typically 500 metres across, then a spacing setting in a tiling pattern might be chosen

around that value. This would be a compromise between information density and readability. In a weave pattern of (say) four strands (two in each direction) the relevant spacing setting would be around 250 metres. Alternatively, if you absolutely must represent all data attributes in all the mapped area polygons, then the dimensions of the smallest polygons will dictate the maximum spacing you would use. If the size of polygons varies widely, then a compromise setting may mean that some data attributes in the smallest polygons are not represented by any tile in the final map. This is a general difficulty of choropleth mapping when very small areas are mapped alongside much larger ones (e.g., San Francisco County in a choropleth map of California), and is not a weakness particular to tile and weave pattern mapping. Other cartographic considerations may also come into play in making such choices, such as the extent of the final map, its resolution, and its typical viewing distance. Options related to how tiling elements are rendered when they cross data polygon boundaries are considered below in “Further Options” (e.g., **Join using tileable**).

#### Rotation

The **Rotate by** setting changes the orientation of the tileable unit and of the resulting tiled pattern. Experiment with this setting to find an orientation of the pattern that works well in combination with the geographical orientation and alignments in the mapped area. We have found that it is often good to avoid horizontal or vertical pattern alignment when the base tileable unit is square. For example, biaxial weave patterns may be more visually appealing when rotated by anywhere from 15° to 75° from the



**Figure 4.** Three four-attribute twill weaves differentiated by strands code. The first of these yields elements in the two directions that are only distinguishable by their colouring, not by location in the pattern. The other two patterns, while based on a similar weave, allow distinct elements to be identified from their location in the pattern. The repeating tileable unit in each pattern is outlined in black.

starting orientation. For a hexagon based tileable unit, it may be important to avoid 30° and 60° rotations (but note that the starting orientation of some tileable units, such as some hexagon and square colourings, may not require adjustment in this way).

### Scaling and Skewing

Tileable units can be stretched or shrunk in the east-west and north-south directions using the **Scale EW** and **Scale NS** settings. Any stretching or shrinking is applied to the tileable unit *after* rotation (see Figure 5).

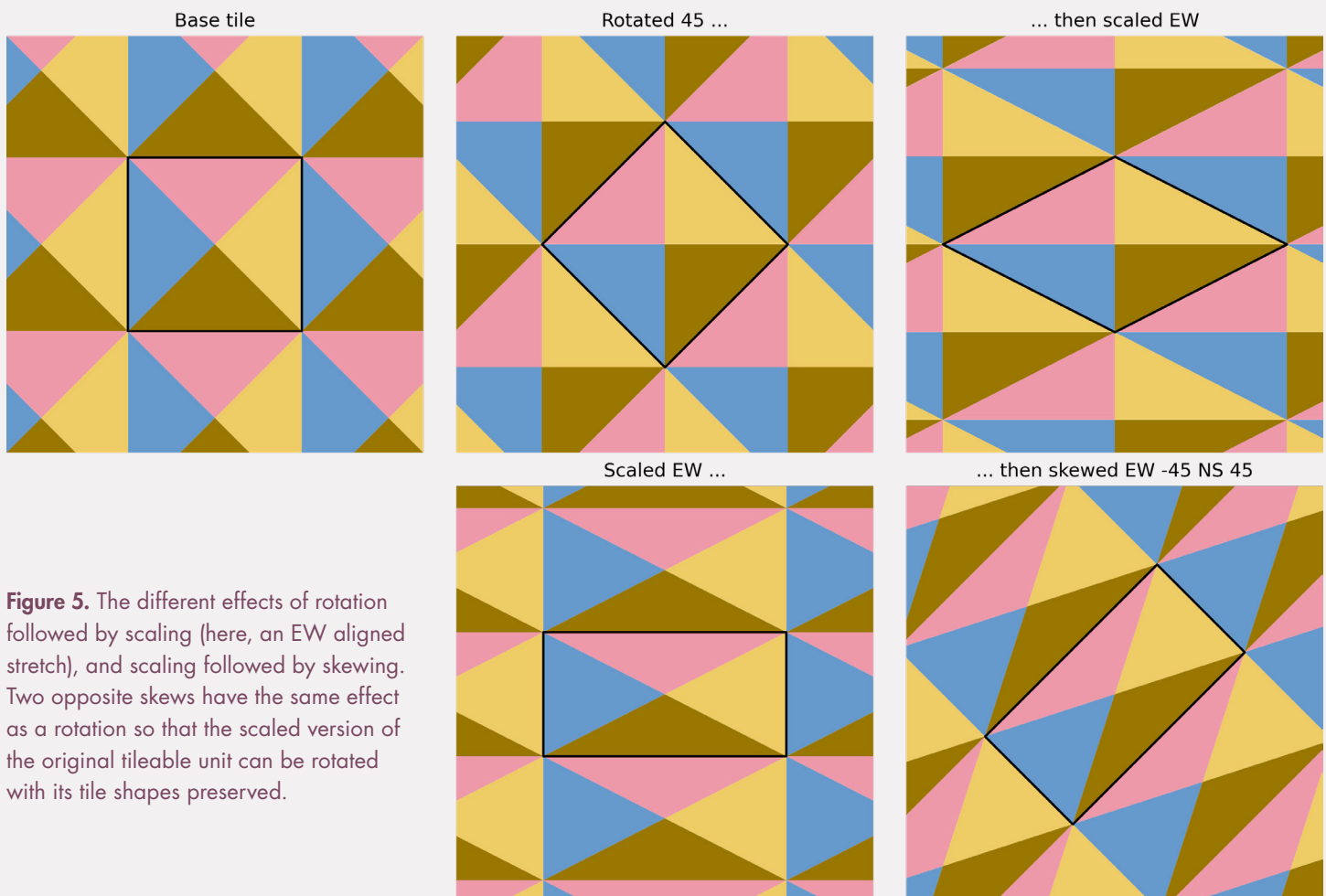
Tileable units may also have an affine skew transformation applied in the east-west and north-south directions using the **Skew EW** and **Skew NS** settings. Again, any skew is applied *after* rotation and scaling.

It is useful to know that a north-south skew combined with an equal *opposite* east-west skew produces a combined effect equivalent to rotation by the angle of the north-south skew. This means you can produce rotated patterns based

on scaled tileable units that preserve the shape you would get if that scaling were applied to the unrotated tiling. If you try to do this using rotation and scaling, you may get effects you do not expect, because the app applies the rotation first, then the scaling, and the resulting tileable unit is shown in the top row of Figure 5. If the desired outcome is the tileable unit in the bottom row of Figure 5, then use scaling followed by skewing to achieve the desired rotation. To apply arbitrary combinations of rotation, scaling, and skewing to tileable units in any order, you should use the Python `weavingspace` module.

### Insetting

You can *inset* tileable units in one of two ways, using either the **Group inset** and **Tiles inset** settings, or scaling combined with the **Scale as glyph** option (**H**). Insets are an important design feature of tiled maps both visually and practically, as they are one way to help readers to tell which element is which when a tiling is applied across a whole map.



**Figure 5.** The different effects of rotation followed by scaling (here, an EW aligned stretch), and scaling followed by skewing. Two opposite skews have the same effect as a rotation so that the scaled version of the original tileable unit can be rotated with its tile shapes preserved.

The most straightforward of these settings is the **Tiles inset**, which reduces the size of tiles in a tileable unit by the specified percentage of their spacing. The reduction in size is uniform regardless of the aspect ratio of a tile (it is implemented in software using a negative buffer operation). The effect of this setting is seen in Figure 6A. This can be especially useful when applied to weave pattern tileable units where it can enhance the woven appearance of the overall pattern.

While inseting individual tiles achieves a nice visual effect, it may not help with distinguishing which tile element is which in the overall pattern. Inseting the whole tileable unit using the **Group inset** setting can help with this, as seen in Figure 6B, where the position of each tile within the repeating tileable unit is clear. This setting can be combined with the **Tiles inset** setting as in Figure 6C. The **Group inset** setting is unavailable for weave patterns, as carrying out this operation on woven patterns would break strands and introduce discontinuities in the woven appearance.

A side effect of group inseting is that differences in the size and shape of elements may arise. The hexagonal tiles central to each tileable unit in Figures 6B and 6C are the

only tiles in these patterns that have retained their original shape, even if their size is slightly reduced in Figure 6C. Other tiles in each tileable unit are inset differently along edges external to the tileable unit than along interior edges, reducing their size relative to the central tile, and also introducing an asymmetry. In most cases these effects will be barely noticeable, but if a group inset without these side effects is desired, applying **Scale EW** and **Scale NS** settings less than 1, combined with turning on the **Scale as glyph** option, as in Figure 6D, is recommended. This approach works well on tileable units which are symmetrical about their centre and have a unit aspect ratio, but it can be tricky to select the right scale settings in many other cases, especially if rotation and skew are also in effect.

### PATTERN SPECIFIC OPTIONS

Many of the chosen tile and weave unit choices allow additional options explained below. These options appear at the bottom of the **General Settings** area when available.

#### Hexagon and Square Slice Offsets

These tileable units are generated by cutting a base hexagon or square into slices, starting from its centre and

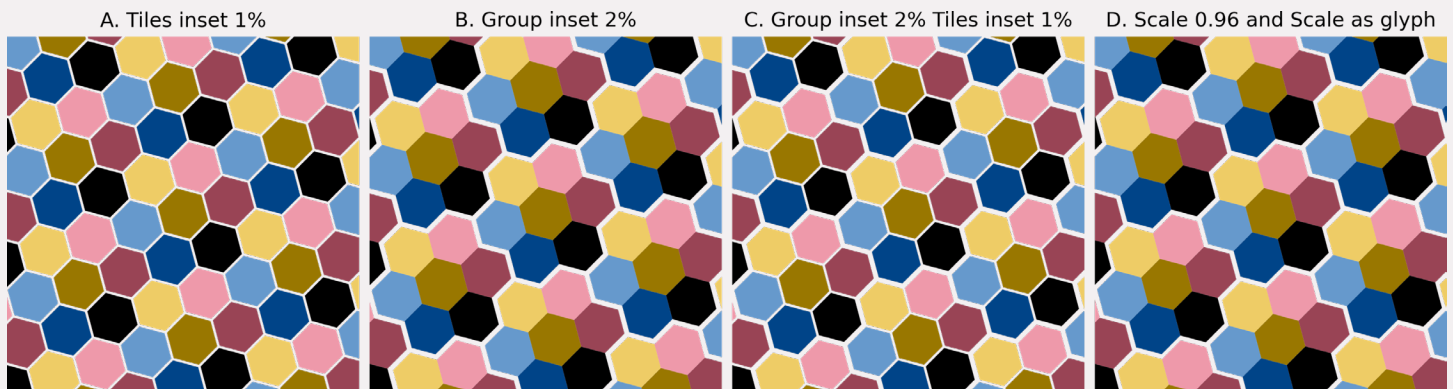


Figure 6. The effect of various inseting options.

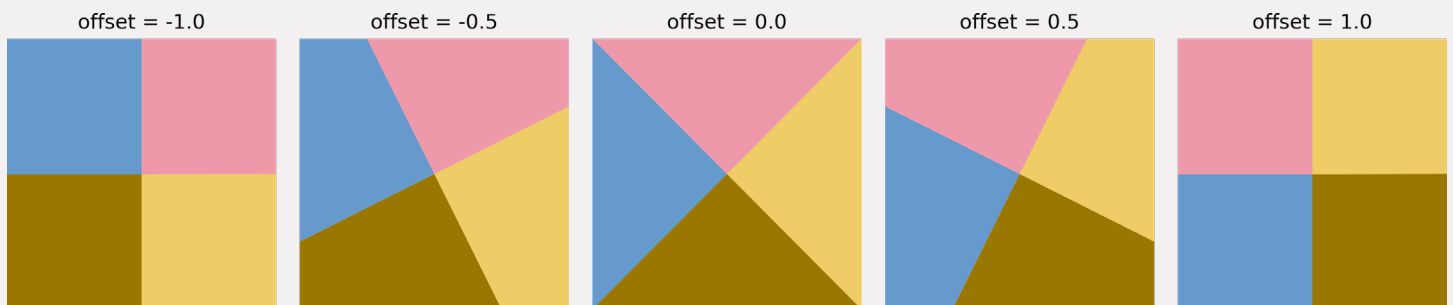
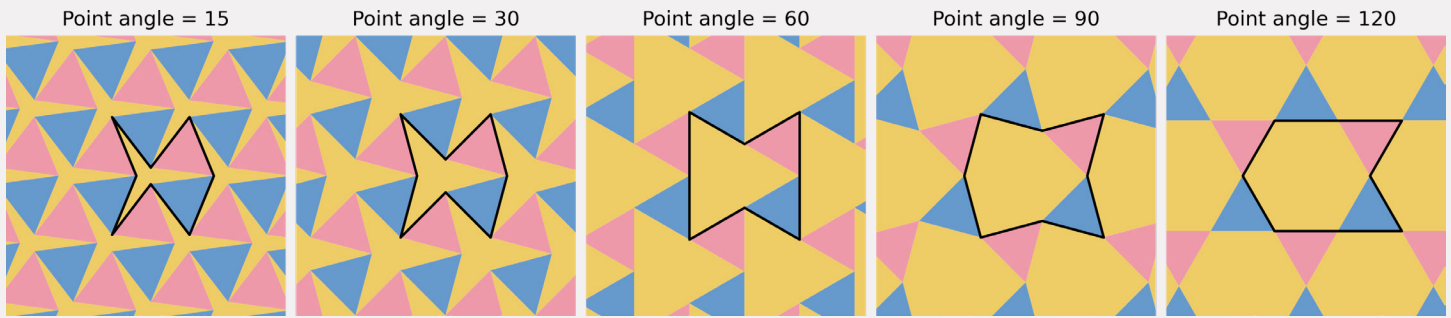


Figure 7. Tileable units produced by varying the Offset setting on a four-slice tiling of the square.



**Figure 8.** The effect of changing the Point angle of some star tilings can be unexpectedly dramatic. The repeating tileable unit composed of three tiles is outlined in black in each panel.

cutting to locations equidistant along its perimeter, to give equal-area tiles. In addition to the number of slices, an **Offset** between -1 and 1 is required. The effect of this setting is shown in Figure 7. Setting **Offset** to 0 means the first slice will start at a corner with successive cuts equidistant around the perimeter. The range of allowed values from -1 to +1 produces a range of different tileable units as shown.

### Star Tiling Point Angles

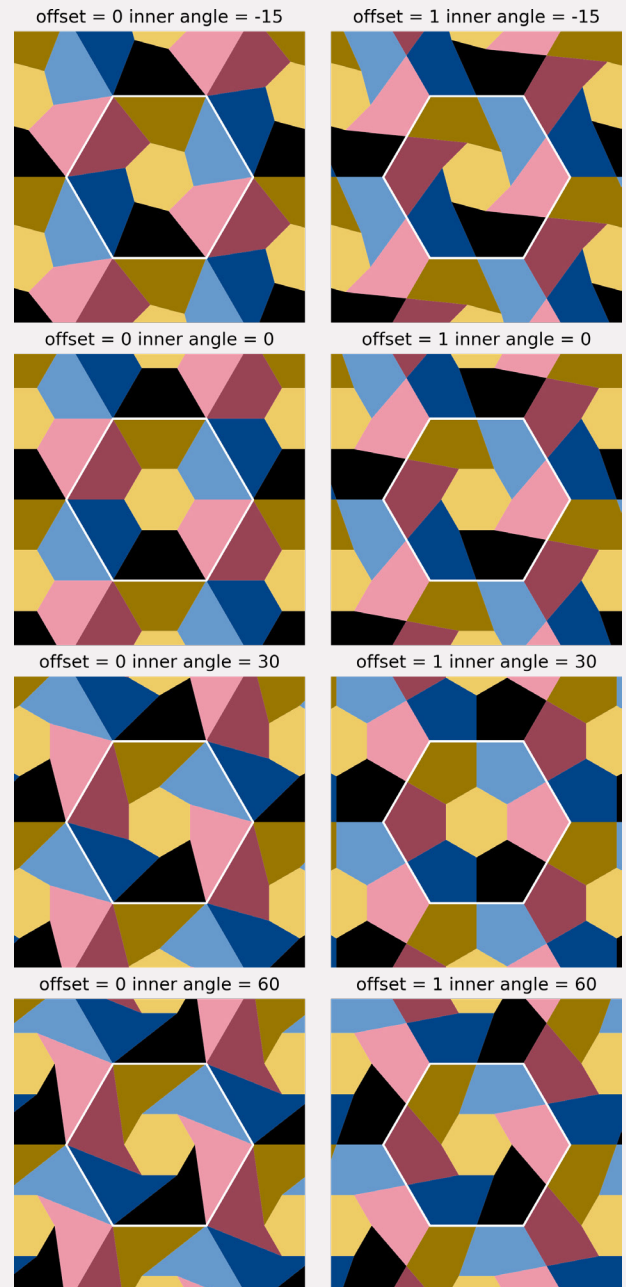
Some star-based tilings designated “star1” in the **Tiling type** drop-down have an associated **Point angle** setting (found under **Set tiling options**), which defines the interior angle of any tiling of this kind’s star polygon. Note that “star2” tilings do not allow this option. This setting is straightforward in its effect but can dramatically change the appearance of a tiling in ways that may not be obvious (see Figure 8). Increasing the point angle will change the size of the star tiles and, as a result, affect the overall scale of the tileable unit, regardless of its nominal spacing. The spacing is approximately correct when the point angle is at its default value of 30°.

### Hexagon and Square Dissection Offset and Inner Angle

MapWeaver’s dissection tilings are generated by adding an interior polygon to the base polygon at its centre and rotating it by the **Inner angle** relative to the outer polygon. Corners of the inner polygon are then connected to either the corners of the outer polygon (**Offset 0**), or the centres of the outer polygon edges (**Offset 1**). Examples of such tilings are shown in Figure 9.

### Weave Unit Over-Under Pattern and Strand Width

For weave type tileable units, two configurable settings are available, **Strand width** and **Over-under pattern**. The



**Figure 9.** Dissected hexagon tilings showing the effect of changing the Offset and Inner angle settings.

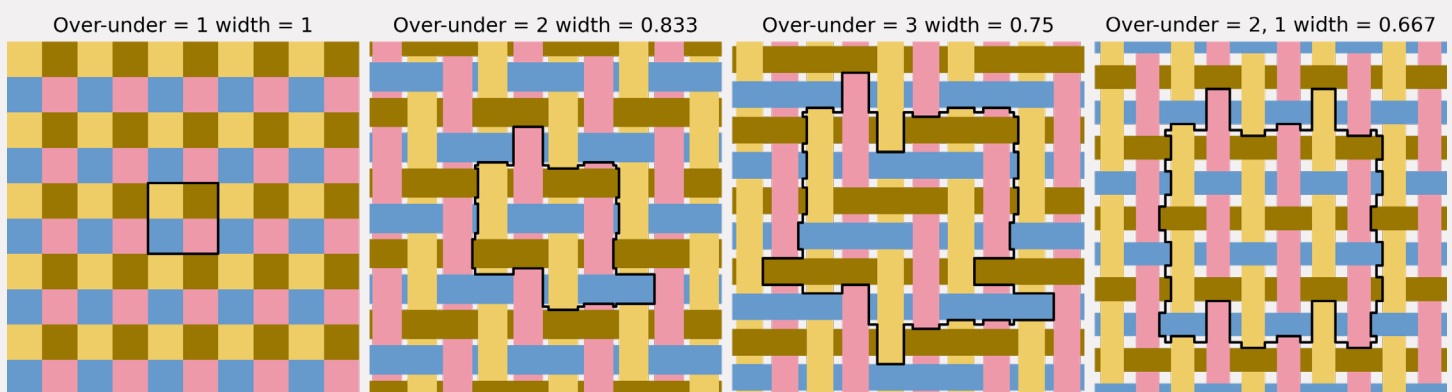
former is simply the width of strands relative to their spacing. As this setting is reduced from 1, which is space-filling, wider gaps open up between strands, giving the appearance of a more open weave. With very low settings the weave pattern will appear more like a cross hatching, although the “lines” are actually long, narrow polygons.

The **Over-under pattern** refers to the number of strands in the other direction that each strand in the pattern passes over, then under. In all cases shown in Figure 10, the base weave is a twill pattern with strands *a* and *b* in one direction, and *c* and *d* in the other. If only a single over-under value is supplied, then strands will pass over that number of opposite strands, then under the same number and repeat. If more than one number is supplied, it is interpreted as a sequence of over, then under steps that the weave pattern will follow. Careful examination of the last panel in Figure 10 will show that each strand running vertically passes over two strands, then under one strand running horizontally. An even number of comma-separated values must be supplied in the **Over-under pattern** box. If an odd number of values is provided, then the sequence will be repeated to yield an even number of values and that will define the weave pattern produced. While complex woven patterns can be produced in this way, long over-under sequences will yield large tileable units, which may be too large for effective mapping outcomes.<sup>7</sup>

## FURTHER OPTIONS

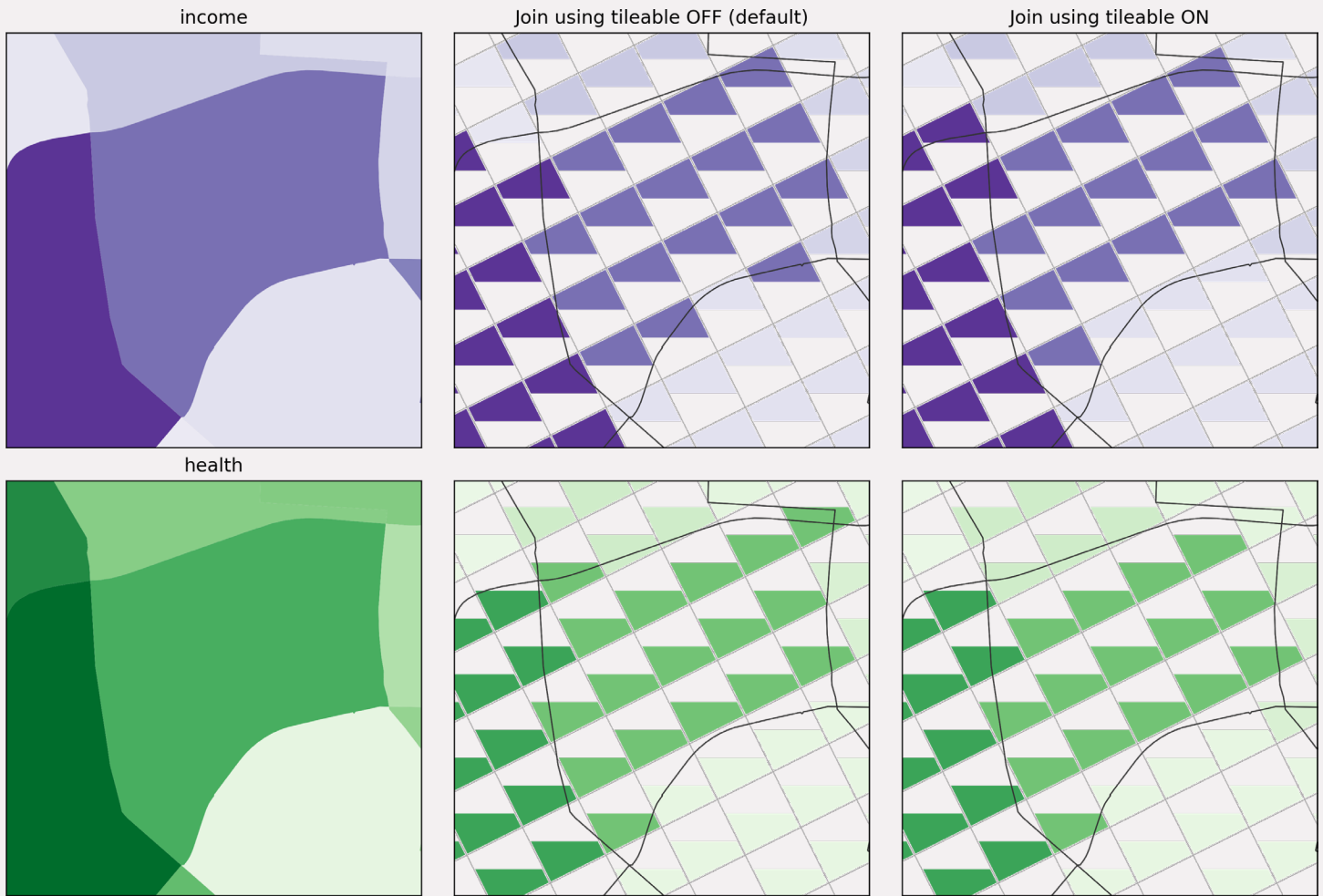
Panel (H) in the MapWeaver interface offers some additional options for control of how the final map is produced:

- When **Join using tileable** is selected, data from map areas are assigned to tiles based on overlap between the tileable unit of which each tile is a member, so that all the elements in any given tileable unit represent data from the same map area (see Figure 11). By default, this option is *not* selected and tiles are assigned data based on the map area that they overlap *individually*, so that tiles in a given tileable unit may represent data from different map areas.
- When **Retain tileables** is selected, all tileable units that overlap any part of the map area are retained in the final map. This may mean that tiles are included in the map that do not overlap any part of the map area, and that the final tiled map extends noticeably beyond the map area. This setting only makes sense when **Join using tileable** is activated. When **Retain tileables** is off, only tiles that overlap the map area are retained.
- Turning **Clip by map units** on clips the final map to the outer boundary of the mapped area. This may result in some tiles in the pattern being reduced to small fragments, but may also help map readers with orientation. Clipping slows down the map refresh, so it is helpful to keep this setting turned off while iterating on your design. The default *off* setting yields maps more consistent with the tiled aesthetic of the method, retaining complete tiles beyond the edges of the map area extent.
- The **Scale as glyphs** setting applies the **Scale EW** and **Scale NS** settings to tileable units independently

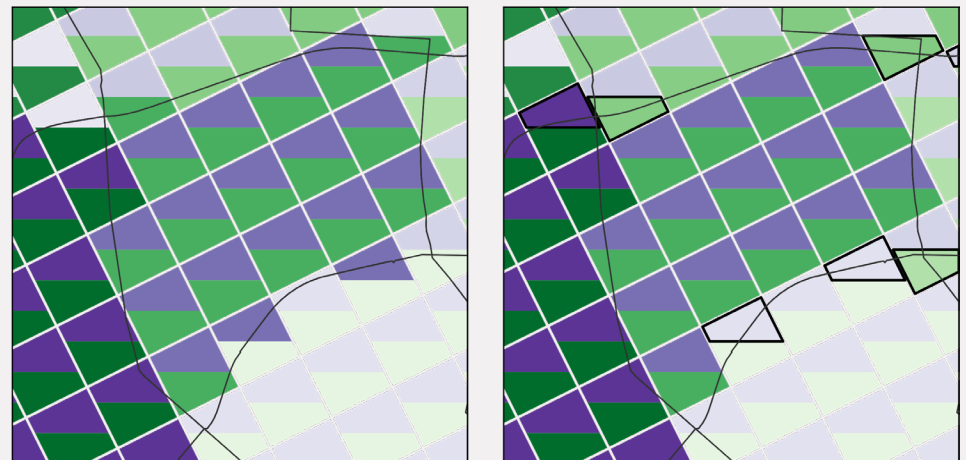


**Figure 10.** The effect of different “Over-under” and “Strand width” settings on a twill weave tileable unit with strands code “ab|cd.”

7. To really get to grips with the possibilities of biaxial weave patterns, we recommend using the `weavingspace` Python module, although the web app does offer a range of built-in options.



**Figure 11.** How **Join using tileable** affects overlay of tiles and source data. When this setting is off, tiles show data from the map area unit that they individually have the greatest overlap with. When set on, tiles show data from the area unit that their “parent” tileable unit has the greatest overlap with. In this example, tiles where this makes a difference are heavily outlined in the lower-right image. With the default setting, tiles in tileable units on the boundary of an area unit may pick up data from neighbouring areas, resulting in tileable units with combinations of attribute values not present in the source data, effectively “blurring” areas together.



from the spacing of the tileable units. This can be used to produce an inseting effect without altering the relative size of tiles in each tileable unit, but it is not a viable approach for non-convex tileable units.

- Turning on **Use tileable as icon** treats the tileable unit in your design as an icon and places one per map area rather than creating a tiled map. If you also turn

on the **Show map units** option, how this works will be more apparent.

#### 4. ATTRIBUTES AND COLOUR PALETTES

When a satisfactory tiled or woven (or even tileable unit icon) map has been achieved, the final stage of the design process is to associate tileable unit elements with

data attributes, and data attributes with colour ramps. The **Variables and Palettes selection (F)** section of the interface allows you to make these associations. As noted, it is advisable to keep the spacing of the design large while changing these settings, as changing them quickly can result in the interface and the design getting out of sync with one another, and a larger spacing will make this less likely to happen.

MapWeaver is not a complete mapping platform, so only unclassed visualization of variables is available in the interface, and only numeric attributes in the dataset will be available for selection. If you want to use other classification schemes, to design bespoke colour palettes, or to map categorical variables, you will need to do this in another platform, having first worked on the geometry of the tiles in MapWeaver and then exported the tiled map data for further work elsewhere.

### Colour Design

Our experience designing tiled maps with many variables has taught us that colour choice in such maps is a challenging design problem. We recommend thinking carefully about the relationships among the attributes in your data, and what aspects of those relationships, both statistical and spatial, you wish to emphasize.

## DIGGING DEEPER

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AS NOTED AT SEVERAL POINTS ABOVE, FINER CONTROL over options in making tiled maps is available using the Python `weavingspace` module. Of particular interest may be the option for creating an indicative legend for your map (as a geospatial data layer). Resources and download of the module are available in the repository at [github.com/DOSull/weavingspace](https://github.com/DOSull/weavingspace). Alternatively, the module may be installed from the Python Package

It may make sense, for example, to assign a number of related variables to the *same* colour palettes, and to assign them to tiles in the design that are close to one another. This has the visual effect of making that group of variables appear like a single combined attribute, but with departures from correlation in the group highlighted as contrasting textures. On the other hand, assigning contrasting colour palettes to all variables may make distinguishing which tiles represent which variables easier.

If your aim is to produce maps that provide an overall sense of the spatial distribution of multiple attributes in your mapped area, then the tools for colour design in MapWeaver may be sufficient. For more control over this aspect of the design, you can use the Python `weavingspace` module, or export your map to a geospatial data format for processing and mapping in other platforms.

### OPTIONS FOR EXPORTING YOUR MAP

You can export your map either as a geospatial data file (GPKG or GeoJSON), as a PNG image, or as an SVG vector file. The geospatial formats will give you the most control over what you can subsequently do with your map. If you just want a quick map to add to a presentation, one of the image export formats might suffice. Those who do much of their cartography in vector graphics software may find the direct export to SVG useful.

Index with the command `pip install weavingspace`. Other efforts to diversify the possibilities of `weavingspace` and MapWeaver are underway. That said, even we are often surprised by what is possible with creative uses of MapWeaver followed by further work within a GIS and/or vector graphics software. We welcome your examples, critiques, comments, and questions.

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## INTRODUCTION

THIS PAPER INTRODUCES AN APPROACH TO SPATIAL and information literacy instruction that we call “Maker Maps.” As a Map and Spatial Data Librarian (Theresa Quill) and a Creative Technologies Librarian (Leanne Nay) at Indiana University, we sought to combine our areas of expertise by using data physicalization and maker literacy to teach spatial literacy concepts. We began this collaboration in part because we enjoy working together, but also to bring some joy and creativity into our teaching. In an age of abundant tutorials for learning GIS software, we were looking for something we could offer students that they couldn’t get by asking GenAI to help them learn GIS. We also look for ways to keep our work interesting and engaging, and this approach satisfies both needs.

Maker literacy is the ability to learn, think, and communicate through the hands-on making of physical objects. Rather than focusing solely on technical proficiency, maker literacy focuses on curiosity, iteration, and collaboration. Maker-literate students are able to identify and define problems, select appropriate tools and materials, develop prototypes, and critically reflect on their work. Makerspaces are an ideal location for this type of learning; however, these concepts can also be incorporated into classroom environments. When applied to cartography, maker literacy helps students explore and represent data using physical materials such as paper, fabric, or LEDs.

## PAPER CIRCUIT MAPS

A paper circuit is a functioning electronic circuit built on a paper surface, rather than a circuit board. Paper circuits are often used in K–12 settings to teach basic concepts of electricity and computing. Using a battery, LED, and conductive tape, paired with a basic understanding of circuits,

Data physicalization, defined by Jansen et al. as “a physical artifact whose geometry or material properties encode data” (2015, 3228), is a concept that began in human-factors circles and has been expanded by practitioners of crafting and making (Huron et al. 2022). A common example of a data physicalization is a temperature quilt. These quilts are made of 365 squares, each of which is colored to visually represent a day’s high and low temperature. Cartographic data physicalizations continue in this tradition and combine elements of tactile mapping and hand-drawn maps. We have found that hands-on approaches help novice students approach new concepts without the burden of also learning a new software. Roth et al. found that to be true for advanced students as well, remarking that “the sketch mapping activities allowed students to tinker and play with lecture concepts in a low-risk environment using familiar, tangible materials such as pens, markers, graph paper, etc. Without the pressure of data wrangling or learning new software, they were able to be more intentional and reflexive during the design process” (2020, 50).

We have been iterating on data physicalization methods, and present four different projects that can be used in formal class instruction, workshops, or library settings: paper circuit maps, embroidered maps, a globe dress, and collaborative maps using stickers and yarn.

students can incorporate light into creative projects. Lee and Recker note that “paper circuitry materials are low cost, provide a low threshold to entry, and draw upon the familiarity that already exists with respect to paper as an interactive and manipulable medium,” as well as offering



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“multiple points of entry for students who are less familiar with computational thinking ideas” (2018, 198).

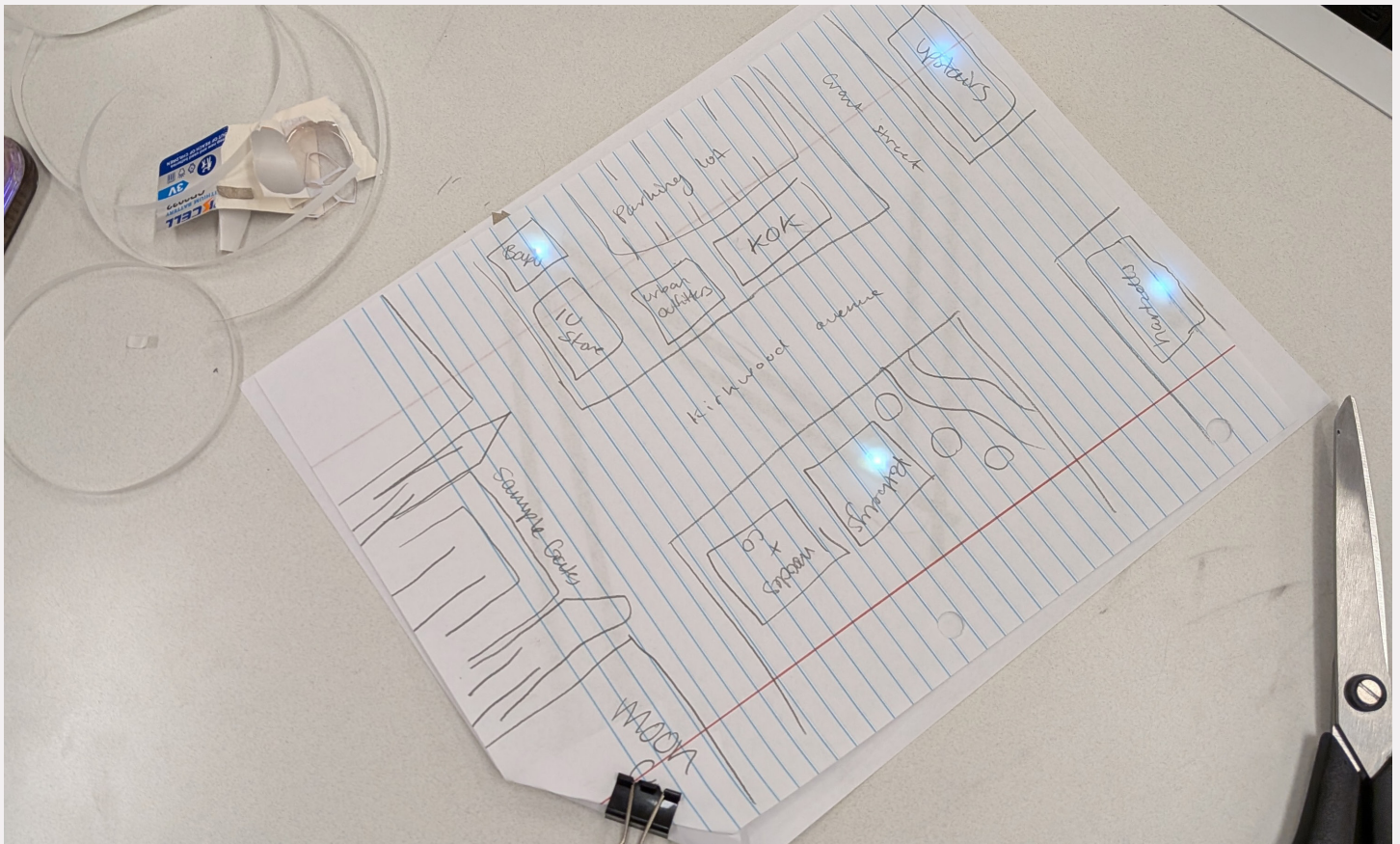
In the spring of 2025, and again in 2026, we partnered with instructor Olga Kalentzidou to lead a paper circuit mapping exercise for students in the undergraduate course *Human Geography in a Changing World*. This general education course hosts students across disciplines, primarily in the arts, humanities, and social sciences. We initially identified paper circuits as a means of comparing analog and digital approaches to mapmaking. Teaching paper circuit maps alongside GIS software such as Felt or ArcGIS encourages students to critically evaluate the strengths and limitations of each method.

Professor Kalentzidou began the activity by asking students to draw a map of Bloomington (where our university is located) on paper. We then guided the students in creating a paper circuit to illuminate specific points on their maps using LED stickers. Students first sketched a circuit template to plan component placement, then applied nylon conductive tape and added the LED stickers. Finally, they inserted a watch battery and secured it with a binder clip

to complete the circuit (Figure 1). We provided instructional handouts and circulated around the classroom to offer support as needed.

The primary strengths of this activity lie in its novelty and hands-on, collaborative approach. In a class of nearly forty students, instructors cannot provide individual instruction for everyone, making peer-to-peer learning a natural outcome. We observed that students who quickly and easily constructed their circuit helped their peers troubleshoot. Students from STEM disciplines have likely had exposure to paper circuits (or other electronics), but few students in humanities courses are familiar with the materials, which sparks more interest and curiosity. We also noticed that students put away their laptops and phones, removing a major barrier to instruction. Further, the joy and satisfaction that come from creating light cannot be overstated.

This activity can be expanded or adapted for a variety of classroom contexts. We used **Chibitronics LED stickers** because they are sturdier and easier for beginners to work with than traditional LEDs, which can be delicate and sometimes frustrating for new users. However, they



**Figure 1.** A student's hand-drawn map of the Indiana University campus with specific locations illuminated.

are also significantly more expensive. Companies such as [Adafruit](#), [SparkFun](#), and [Brown Dog Gadgets](#) offer paper circuit materials at a range of price points and provide tutorials designed for educators.

For a more advanced version, students could incorporate coding to add greater interactivity to their maps. The

[ChibiClip](#), which works with Chibitronics LED stickers, includes a browser-based coding platform designed for educational use. With this setup, students could create categories of lights to represent different data layers or use sensors to control when lights turn on and off.

## EMBROIDERED MAPS

OUR WORK WITH EMBROIDERED maps echoes the late eighteenth- to early nineteenth-century practice of map samplers in geographic education. In Britain and the United States, women and girls embroidered maps as a way to learn geography while also practicing with needle and thread (Tyner 2015, Eager 2024). Tyner (2015) asserts that this practice marked an opening up of the educational subjects deemed appropriate for women and the growth of geographic education, broadly speaking. Map samplers from this time tended to follow traditional cartographic conventions and included country borders, placenames, and north arrows (Smith 2021, Caughley 2015, Chandler 1835).

Many years ago, we offered a workshop wherein participants stitched over paper maps that had been removed from the library's collection, using embroidery to embellish the maps or trace a path. Participants used a variety of methods—some adding decorative elements, and others using embroidery to create spatial data. In Figure 2, the participant outlined the country border (polygon), added French knots for two villages that were not named on the basemap (points), and threaded a path in white between the two villages (line) to show the frequent journey traversed in a long-distance relationship.

While we had success with the activity as a crafting workshop, it was not until attending a [workshop presented by librarian Meg Miller](#) at the Western Association of Map



**Figure 2.** An example from our initial embroidery map workshop, showing the country of Bulgaria outlined, with a path connecting two villages.

Libraries (WAML) 2024 conference that we thought to use this technique as a way to teach about spatial data formats. We then brought it to Theresa's class, *Map and GIS Librarianship*. Students in this graduate-level course had various backgrounds: some were geography students with experience in GIS, while others were library science students with no previous instruction in spatial data. Rather than giving a standard lecture on vector data vs. raster data that would have been repetitive to geography students and dull to library students, we used embroidery to illustrate different data types. Students were given a hoop, fabric, buttons, thread, and needle and asked to create a map that was meaningful to them. Some students chose to map their physical route to the library while others took a more



**Figure 3.** Embroidered maps created in the *Map and GIS Librarianship* course.

philosophical approach and mapped their “path to librarianship” (Figure 3). We discussed how different elements in their map might be translated to GIS. Buttons or French knots were natural point data, threaded paths became line features, and general areas (sometimes also represented by buttons) became polygons. While we did not use the technique in class, we also discussed how cross stitch is a nice analog to raster data. The physicality of stitching a map helped illustrate these concepts even more than a hand-drawn map with paper and pencil. Students needed to be

intentional about their choice of material. Stitching on a button requires more time and thought than drawing a dot with a pencil. Changing colors requires re-threading and knotting a needle rather than picking up a different pencil. By the time traditional GIS software was introduced later in the semester, students had a solid understanding of spatial data formats and basic spatial analysis, and were not trying to learn concepts and software at the same time.

## GLOBE DRESS

THE “GLOBE DRESS” STARTED AS AN EXPERIMENTAL passion project, and ended up being a lesson in failure. I (Theresa) was initially inspired by the sewist [Sue-Ching Lascelles’s](#) circular caftans. Most “carto couture” is not spatially accurate. Could I create an “accurate” wearable globe? It turns out, as a novice sewist and decidedly *not* an

expert in map projections. . . no, not really. However, failure is a valuable part of the maker process and the globe dress is still a useful pedagogical tool.

It would have been relatively simple to create a [double hemisphere map](#) on two circular sheets of fabric, sewn

together into a dress. That, perhaps, might have been a better idea. Instead, I was thinking about the globe dress as a 3D, spherical object. Our bodies, of course, are not flat. Still, a caftan begins as two flat pieces of fabric. To create the dress, I cut two circular shapes with a 60-inch diameter out of thrifted bed sheets. Next, I pinned the fabric together to determine where the head and arm holes should fall before sewing them together. (Sewing on the curve is challenging! I recommend taking the time to press and pin the folds rather than my method of winging it.) I thought that if I sewed the dress before painting the map I would be able to pull and adjust the fabric into a globe-like shape easier. Next, I used QGIS and Natural Earth data to create a map template. I made a circular layout with a diameter of 58 inches to account for my seam allowance and used a series of custom orthographic projections<sup>1</sup> to simulate a globe. I taped my dress to the wall and used a projector to trace landforms, changing the projection as I moved and folded the dress on the wall. This method proved overly complicated and involved much more “eyeballing” than I had hoped. Perhaps makers with a better grasp on the mathematics of map projections or skill at creating globe gores would have more success. Nevertheless, I created a globe-like dress (Figure 4).

I wanted to make a wearable globe, which would naturally show areas accurately. But, this was unattainable for me, and the dress ended up being distorted such that it was larger towards the equator, which made me think about how the “equator” of our bodies is what we often attempt to minimize. How does the distortion of the dress mirror or question how I feel about my body? We envision this “globe dress” as a pedagogical tool that could be used in fashion design or gender studies classes. Some possible discussion questions include:

- How would you project your body onto a 2D surface?
- What would you choose to emphasize or minimize (where is the distortion)?
- What can be left off (are your feet on the map, etc.)?
- What cultural and political norms are influencing those choices in terms of where accuracy is most important?

I plan to conduct further research connecting cartography and fatphobia, and am developing an activity around projected bodies that draws on body liberation literature and feminist geography.

1. You can create a custom orthographic projection in QGIS by going to the **Settings** menu and choosing **Custom Projection**. Input your desired coordinates in place of the brackets in this formula: `+proj=ortho =lat_0=[lat] +lon_0=[lon]`. For example: `+proj=ortho +lat_0=0 +lon_0=-88.5`.



**Figure 4.** A “globe-like” circular caftan with hand-painted landforms.

## COLLABORATIVE MAPS

MOST RECENTLY, WE WERE INSPIRED BY A COLLABORATIVE mapmaking project from Tracy Tien, Johanna Okerlund, and Allegra Dufresne at Wellesley College (Tien et al. 2025). Their project included a map of Massachusetts made from origami-style pyramids, and a multi-layer map with paper pyramids and cross-stitched yarn to explore nighttime lights on the Korean peninsula. They invited their community to contribute to the map using materials and tools from their library makerspace. We used a similar approach and created the structure for two maps of Indiana—a sticker map to visualize the population of cities in Indiana, and a pre-settlement vegetation map made with yarn on a grid. Our materials reflect the nature of the data; yarn is natural and textured and well suited to representing land whereas vinyl is bold and artificial, reinforcing the feel of the built urban environment.

For our sticker population map, we started by creating a choropleth map that showed town boundaries, each color-coded by population into one of five categories, using data based on the Incorporated Areas of Indiana layer, provided by the Indiana Geographic Information Office and hosted on [IndianaMap.org](https://www.indianamap.org). We printed the map on our library's plotter printers and cut a sheet of mylar to place on top. Then we used a Silhouette Cameo cutting machine to cut out vinyl stickers, each of which was sized and colored to correspond to the population size. We invited participants to place stickers on the mylar to

represent the population across the state. We used mylar rather than placing stickers directly on the map so that viewers could compare the choropleth base map with the graduated symbol stickers, and so we could eventually use the city population sticker layer as an overlay on top of the vegetation map.

Our yarn vegetation map featured a base map made using [data from original nineteenth-century land survey records](#) and modern soil maps of counties in Indiana. After printing the map, we laid out a series of plastic grids commonly used for fiber art projects on top and traced the outlines in marker. Participants could then select a grid and use an embroidery needle and yarn to follow the outlines.

We kicked off our collaborative mapping project at the Creator Commons Makerspace in our main campus library. We set out the maps and materials on large tables with basic instructions, so that students visiting the makerspace could participate independently. Over the course of a few weeks, several student employees and students contributed to the maps, particularly the sticker map, but we hoped for more engagement. Few students participated without prompting from us or other library staff, so we sought another venue for the project. Fortunately, our local GIS Day was right around the corner. We set up our maps at a social networking event for students and GIS professionals hosted at a local cider company (Figure 5).



Figure 5. Collaborative maps at a GIS Day event.

This was notably a very different audience than the general student population and we also had the opportunity to explain the activities to attendees rather than rely on a hand-out. Unsurprisingly, we saw much more engagement and discussion at GIS Day. If we were to repeat this project, we would seek a partnership with an instructor to ground

the activities within a course and encourage more active participation and reflection while still reaching a general student audience. Now that the maps are nearly complete, we plan to display them near the map collections in our main library.

## CONCLUSION

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THESE FOUR PROJECTS ILLUSTRATE OUR APPROACH OF using physical materials and a maker mindset to teach core spatial literacy skills. We have anecdotal evidence that this approach interests students and allows them to engage with concepts without the complication of software, which can be particularly useful for introducing spatial literacy in

disciplines that do not traditionally employ formal spatial analysis. Future plans for this work include conducting a formal assessment study and continuing to refine and expand methods that integrate craft-based making with mapping.

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# The Map Making Game

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*One of the most familiar postmodern strategies for bringing a fresh perspective to a familiar situation is that of “making strange.” Making strange strips off the veneer of familiarity readers have come to expect, and presents those readers with something they have to discover anew outside of whatever context they would, hitherto, have relied upon to provide pat answers.*

*This paper proposes that other well-documented avenues for this type of strange making exist and deserve examination. Specifically, there exists a body of interpersonal psychobiology studies describing human society in game structure terms that remain largely unexplored in the cartographic literature. This paper introduces this psychedelic analysis, and proposes its application to contemporary explorations of the nature of maps and cartographic practice.*

*What is proposed is a strategy and toolbox of tactics that can, properly employed, take any or all existing conceptualizations of maps, map making, map use, or the informed practice of cartography and “make them strange” so they can be dispassionately examined and evaluated.*

## INTRODUCTION

IT SEEMS THAT HARDLY A DAY GOES BY WITHOUT someone or other raising an issue with the nature, activity, ethics, validity, or even the existence, of the informed practice of mapmaking we call cartography. Critiques have multiplied—ostensibly postmodernist, postuniversalist, postgenderedist, postcolonialist, postimperialist, post-normativist, post<insert negative term here>; and/or feminist, processualist, queer, indigenous, <insert positive term here>—but, while many of these critiques provide valid and pertinent analyses, they have ultimately proven every bit as narrow and problematic—in one way or another—as has any of the more traditional modern, default definitions of the nature of, and activity of making, maps. I have argued (Denil 2022, 2024) that this is because almost all these critiques (traditional and otherwise) have been grounded on comparative judgments of quality. That is to say, they are focused on matters of connoisseurship—“contingent knowledge about maps and their use”—rather than on abstract theory—“a juxtaposition between an artifact and what one thinks maps are” (Denil 2024, 47).

Postmodern critiques of cartography—grounded on the writings of figures such as Roland Barthes, Jacques Derrida, and Paul-Michel Foucault—were among the earliest of the current critical crop; notably the historian Brian Harley’s (2001) not-always-quite-accurate application of these French sources to maps (Belyea 1992).

One of the most familiar postmodern strategies for bringing a fresh perspective to a familiar situation is that of “making strange.” Making strange strips off the veneer of familiarity readers have come to expect, and instead presents readers with something they have to discover anew—outside of whatever context they would, hitherto, have relied upon to provide pat answers. Both Derrida’s tactic of “deconstructing” and Foucault’s of “problematizing” employed means that made no claims to fundamental or moral truth, and proposed no explicit ideals, but instead sought to expose ambiguities and contradictions in order to open up new, unspecified, social paths.



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While most applications of postmodern analysis have met with a somewhat uneven and contentious reception in cartographic circles, that history does not itself discredit the value of strange-making analytical tactics. This paper proposes that other well-documented avenues for this type of strange making exist and deserve examination. Specifically, there exists a body of interpersonal

psychobiology studies describing human society in game structure terms that remain largely unexplored in the cartographic literature. This paper introduces this psychedelic analysis—one that frames map communication as a game—and proposes its application to contemporary explorations of the nature of maps and cartographic practice.

## BACKGROUND

IN THE 1960S AND 1970S THE THEN-ASCENDANT cartographic positivists latched onto the so-called basic communication model of Claude Shannon and Warren Weaver (1949) (Figure 1) as central to their conception of cartography as the scientific exploration of a communication channel. Over the years various writers—Anton Koláčý (1969, 41) and Karl-Heinz Meine (1977, 75), among others—employed it as the key element in their sometimes astonishingly elaborate diagrams. Unfortunately, neither Shannon’s (1948) original “A Mathematical Theory of Communication,” nor Shannon and Weaver’s (1949) popularization, *The Mathematical Theory of Communication*—while significant for the then-new field of information theory—get beyond a purely technical/mechanical description of the transmission of orders. In adopting

Shannon and Weaver’s model, none of those positivist thinkers were able to—or, it seems clear, even suspected it would be desirable to—go beyond such a purely technical conception; even those that eventually decorated that core model with ornaments like “abilities and properties,” or “knowledge and experience” were simply adding epicycles to the basically mechanical core.

Interestingly, there is a part of the communication transaction that Shannon and Weaver wrote about but did *not* diagram—the so-called effectiveness problem: did the message recipient do as they were told? This action-result is, after all, as they both admit, the end goal of communication. Adding an action-result to the diagram changes everything (Figure 2).

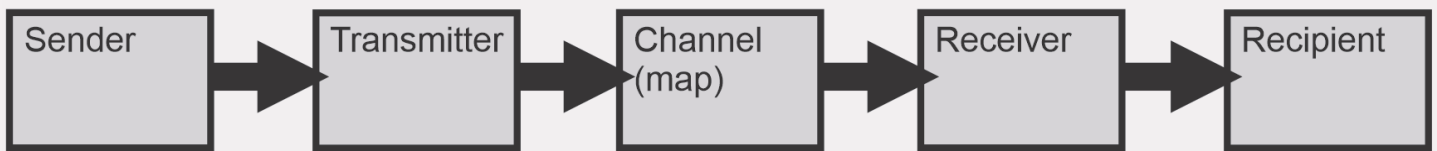


Figure 1. A version of Claude Shannon and Warren Weaver's 1949 communication diagram.

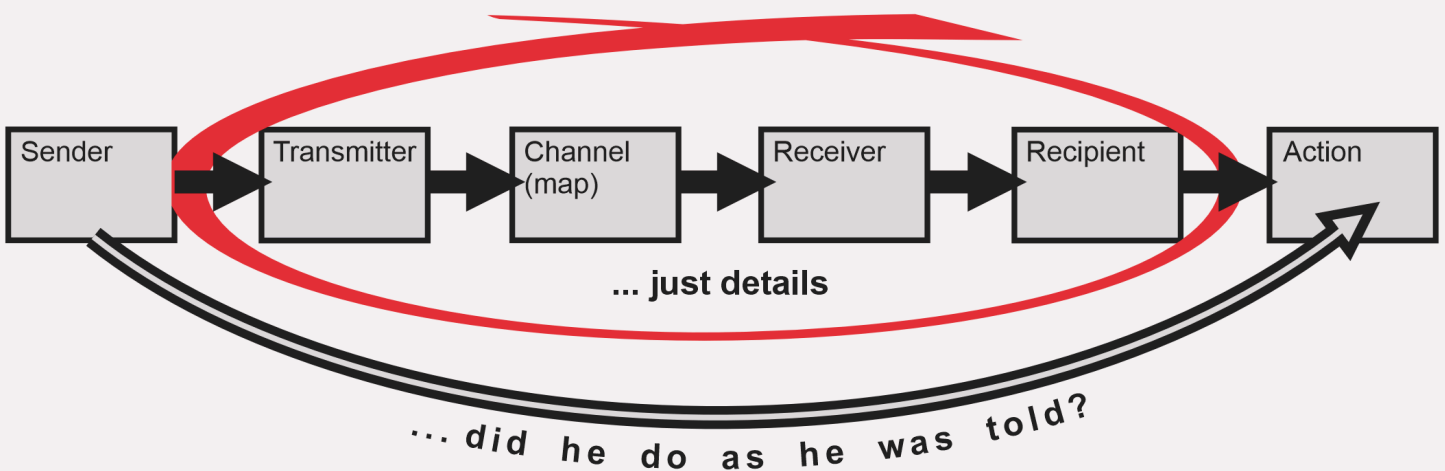


Figure 2. An expansion of Claude Shannon and Warren Weaver's 1949 diagram.

From this more complete diagram, it is clear that the transmitted message itself can be treated as largely irrelevant to the model and to the sender: as long as the performed

action is more or less what was desired, the meaning of the message the receiver actually heard and understood is (as far as the sender is concerned) basically immaterial.

## A DEMONSTRATION

LET US CONSIDER A REAL-WORLD INSTRUCTION/RESULT pair: an instruction that was relayed from Captain Ernest Medina to Lieutenant William Calley Jr. on 16 March 1968, and what subsequently transpired.

The recipient in this extended model, instead of being the end point of the process, is just another element. This element or actor is more or less predictable within certain parameters and limits—he has been trained—and can deliver desired results if properly played. It may be helpful to step through this using the Panofskian / three strata interpretation model (Panofsky 1955, 33–35; Denil 2016, 9–11).

At stratum one—the stratum that Panofsky terms a pre-iconographic description, restricted as it is to factual and expressional elements within the limits of whatever motifs are present—the recipient recognizes the signal as an instruction: *pacify the village of My Lai 4*.

At stratum two—consisting of conventional or iconographic meanings—the reader decodes the signal using what are, for them, standard conventions of language and professional practice: *you must pacify the village of My Lai 4*.

Then, at stratum three—the stage Panofsky called intrinsic meaning, reached through what he termed iconological interpretation—the recipient finds a way of applying the instruction to the world. At this third stratum, the recipient draws on information clearly external to the message and to the conventional understanding of the words that make it up to arrive at a fuller, implicit, meaning (Panofsky 1955, 30–32; Denil 2017, 10). That is how the recipient knows how to interpret the message: an example might be seeing a painting of a group of men around a dinner table and understanding that it depicts the Last Supper.

And when, going back to our expanded Shannon and Weaver model, we ask *did the recipient do as instructed?*, we learn that

at least 347 and up to 504 civilians, almost all women, children, and elderly men, were murdered by U.S. Army soldiers from C Company, 1st Battalion, 20th Infantry Regiment, 11th Brigade and B Company, 4th Battalion, 3rd Infantry Regiment, 11th Brigade of the 23rd (Americal) Division (organized as part of Task Force Barker). Some of the women were gang-raped and their bodies mutilated, and some soldiers mutilated and raped children as young as 12.<sup>1,2</sup> The incident was the largest confirmed massacre of civilians by U.S. forces in the 20th century.<sup>3</sup> (Wikipedia 2025a, *footnotes in original*.)

Thus, we can say: *Yes, the village of My Lai 4 was rendered pacific*.

Of course, this does not imply that all communication is meant to elicit an action, although eliciting directed action certainly was the goal foremost in Shannon and Weaver's minds—and presumably in the mind of the entire 1968 US Army chain of command in South Vietnam. We know that the end goal of all map communication is persuasion—to convince someone of something—and therefore “*doing as they were told*” becomes, when we are discussing maps, “*believing what they are told*.” The point of the My Lai example is to show how a recipient—who likely may have had some level of training, who likely may be operating under a variety of constraints, who likely comes preset with a range of predilections and presumptions—must be understood by the sender to at least the extent required to allow that sender to create a message that will, shall we say, *push the right buttons*. Communication, then, can be understood as a sort of a button-pushing game, a game played by the sender and the receiver.

1. Brownmiller, Susan. 1975. *Against Our Will: Men, Women and Rape*. New York: Simon & Schuster. 103–105. ISBN 978-0-671-22062-4.

2. “Murder in the name of war: My Lai.” *BBC News*. 20 July 1998.

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## MAKING A GAME OF IT

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IT MAY SEEM A BIT OF A STRETCH TO CALL COMMUNICATION a game, but I would propose that it is not: a game is, after all, simply “a learned cultural sequence characterized by Roles, Rules, Goals, Rituals, Language, and Values” (Leary 1982, 48). Essentially, *all* social activity is a game of one sort or another.

I am certainly not the first to point this out. Thomas Kuhn (1970) shows us that even something as dour and self-serious as “proper” science can usefully be conceived as a game with roles, rules, etcetera. Leary points out that “Kuhn describes how scientific activities are determined by paradigm—a distinctive world view, defining the problems and methods of any era. Science cannot go beyond the paradigm’s limits without risking being seen as eccentric and ‘unscientific’” (1982, 64). Bishop George Berkeley and Ludwig Wittgenstein have also pointed out the pervasiveness of game rule structures, as did the Marquis de Sade. The situation is described in Plato’s Cave and in the parable of the Blind Men and the Elephant. Culture itself is a game made up of other games.

Playing a game requires the participants to accept, internalize, and work within the roles, rules, goals, rituals, language, and values that define the game. For example, writing and submitting a paper to a professional journal is a game: if a submitted paper ignores the rules, rituals, and language considered pertinent and customary—and that define what qualifies as a legitimate professional journal paper—it will be turned down out of hand.

## ACHIEVING MASTERY

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NOW, THERE ARE TWO WAYS TO GO ABOUT MASTERING a game. One is to work within it, and the other is to stand outside. To work within the game it is necessary to immerse oneself in it, and to allow the game to define the sphere of understanding: the bounds of acceptability, the nature of the goals, and the value of the rewards. In effect the player drinks the Kool-Aid and accepts the game’s predicate universality.

These games, however, are *not* pointless: there is no way to achieve the game goal *without* playing the game. For example, it is *the mapping game itself* that makes map communication possible; it is *the game* that allows a map artifact to be recognized as bearing meaning, and it is *the game* that permits mapped meanings to be recognized and assimilated—and map readers persuaded. Both the map maker and map reader play the mapping game (each in their own roles). Mapicity—the adherence of a map’s outward attributes to paradigmatic norms, traditions, principles, etcetera, which in turn make a map believable, professional, and convincing, thus allowing a map to be recognized and leveraged (Denil 2012)—is, in this sense, the conceptualization of how the mapping game is played. The maker has to know what buttons to push on *that* reader, and that reader has to *agree* to having those buttons pushed—or at least to letting the maker try.

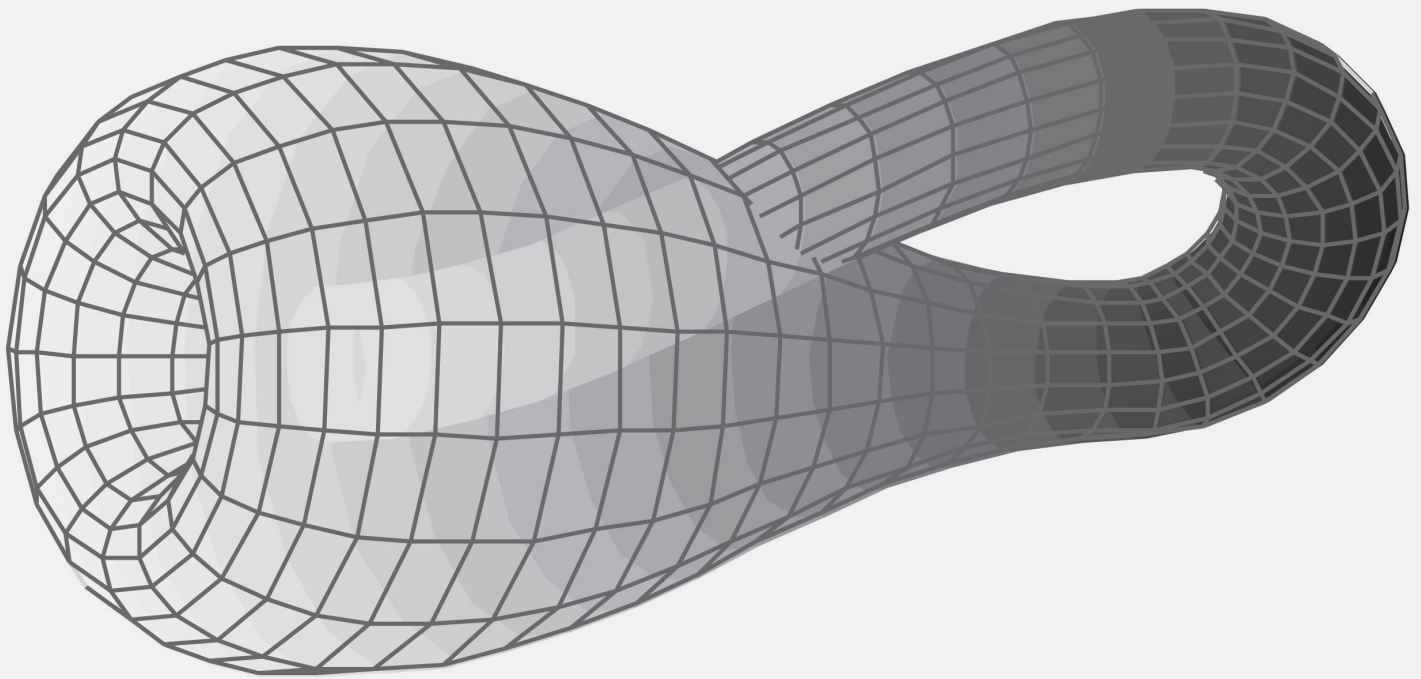
Learning to play a wide range of social games, the shape and characteristics of which may evolve over time through intersection with countless other games operating within various circles of autonomy, is clearly a critical imperative. Those unable to learn to play can be faced with consequences ranging from social or professional snubs, to ridicule, marginalization, ostracization, or even to incarceration in jails or in lunatic asylums.

So much for the stick: on the carrot side someone may actually want to obtain the potential goal—in this case to persuade the recipient to adopt a desired belief. Thus, to achieve the game’s goals, the game itself cannot be ignored. It behooves all the players to master it.

The game itself determines how this immersion plays out. There are games, like chess or go, that have not changed in centuries, but there are others—an extreme example is what we might call hipster-ism or dandy-ism—where ever changing currents must be ridden like a wave. In every case, the game roles, rules, goals, rituals, language, and values not only structure the game and allow the moves: they define the world from horizon to horizon. In fact, the entire universe of someone immersed in a game becomes something of a **Klein bottle** (Figure 3).<sup>4</sup>

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4. The Klein bottle is a mathematical figure in multi-dimensional space with only one side. Unlike the Möbius strip—which also has only one side—the Klein bottle is boundary-less, like a sphere or torus, but it cannot exist in three dimensional space without self-intersection. A game, like a Klein bottle, is self contained. There is no path away from the surface of a Klein bottle: you just travel around and around.



**Figure 4.** The Klein bottle: first described in 1882 by the mathematician Felix Klein. Source: Wikipedia user [Tttrung](#).

## TESTIMONY FOR AND AGAINST STANDING OUTSIDE

SOME PEOPLE MAINTAIN THAT THERE IS NO ALTERNATIVE to the games of society. For the historian Georg Hegel (d. 1831), for example, each individual's self is inherently social and cannot exist outside the games, because outside social culture is just a vacuum. In other words, to be a person at all one must be defined in the terms set by the games.

Other writers, however, maintain that such games must be evaluated on grounds that are not simply the ones provided, but must be framed and validated independently. In this regard, Ralph Waldo Emerson, John Stuart Mill, and Friedrich Nietzsche (d. 1882, 1873, and 1900, respectively) all agree with Bob Dylan, who, in 1966, wrote that "To live outside the law, you must be honest" (*Absolutely Sweet Marie*).

Outside the law, without positions and possessions to prop up the ego, persons are vulnerable, and relationships can be destructive as well as liberating. When outlaws deceive or exploit each other, there's no social structure, no comforting illusion (such as blame) in the background (perhaps this is why the song ends "in the ruins" of Marie's balcony). The gain from leaving the precincts of the

law is the possibility of achieving a certain independence of thought; the risk is vulnerability. . . . If one is a law unto oneself, no other law provides guidance, support, justification. (Brake 2006, 88)

Standing outside the game provides the advantage of placing game events in a richer context—a recognition that "there is an inside to experience as well as an outside," (Huxley 1954, 14)—and taking account of both permits each to inform the other in a sophisticated manner. Nonetheless, there are hazards in trying to stand outside a game. One is susceptible, for example, to fallacies of motivation: judging a chess game by the rules of lacrosse, or failing to see value in a game's rewards. On the other hand, the game, by its very nature, serves to restrict legitimate discourse and to constrict the field of action. For example, you are not allowed to stab your opponents on a soccer pitch: if you do, you are *no longer playing* soccer.

One recalls the failures of a Square, hero of Edwin Abbott's *Flatland: A Romance of Many Dimensions*, first published in 1884 (Abbott 1952), to convince the king of Lineland of the existence of two dimensions; or his Flatland neighbors of the existence of three; or even his friend a Sphere of the potential for four. None of the beings to whom a Square

spoke could conceive of a viewpoint outside the one their game vocabulary afforded. Yet, *we* recognize the superior position conferred by a Square's outside view, and share his frustration.

Does this still seem strange to you? Then put yourself in a similar position. Suppose a person of the Fourth Dimension, condescending to visit you, were to say, "Whenever you open your eyes, you see a Plane (which is of Two Dimensions) and you infer a Solid (which is of Three); but in reality you also see (though you do not recognize) a Fourth Dimension, which is not colour nor brightness nor anything of the kind, but a true Dimension, although I cannot point out to you its direction, nor can you possibly measure it." What would you say to such a visitor? Would not you have him locked up? Well, that is my fate: and it is as natural for us Flatlanders to lock up a Square for preaching the Third Dimension, as it is for you Spacelanders to lock up a Cube for preaching the Fourth. (Abbott 1952, *Preface to the Second and Revised Edition*)

## A USEFUL TACTIC

BEGINNING AROUND 1960, DR. TIMOTHY LEARY published several papers on interpersonal psychobiology studies that described human society in just these game structure terms. His central interest was how the mind adopted game structures to frame evaluation and understanding of the tsunami of input we each face every moment of every day.

Leary wrote that "...we are coming to realize that the brain is ... perfectly designed to *fabricate any reality we program it to construct*." (Leary 1982, 62, *emphasis in original*) He went on to remark that "It is useful to see all cultural institutions as expressions of the epoch's basic mythos; each discipline simply reorchestrating underlying themes of the age" (Leary 1982, 64). That is, colonizing the game for its own ends.

While other writers have seen the games structure as a paradox, or as a prison escapable only by faith (faith in religion or faith in philosophers), Leary had available useful psychedelic tools that, employed properly and with

Aldous Huxley has also noted how our language tends to keep us in the tracks of convention.

Every individual is at once the beneficiary and the victim of the linguistic tradition into which he has been born—the beneficiary inasmuch as language gives access to the accumulated records of other people's experience, the victim in so far as it confirms him in the belief that reduced awareness is the only awareness and as it bedevils his sense of reality, so that he is all too apt to take his concepts for data, his words for actual things (Huxley 1954, 23).

How can we usefully get around these barriers without surrendering all advantages afforded by the structure? How can we stand on a hilltop, like Alice in *Through the Looking Glass* (Carroll 1976, 163), and see the game board for what it is?

reasonable preparations of *Set* and *Setting*,<sup>5</sup> allowed anyone to actually see, recognize, and explore the consequences and ramifications inherent in the learned game sequences and to dispassionately examine the roles, rules, goals, rituals, language, and values that come with the games of society and culture.

He also pointed out, however, that:

From the standpoint of established values, the psychedelic process is dangerous and insane—a deliberate psychotization, a suicidal undoing of the equilibrium man should be striving for. *With its internal, invisible, indescribable phenomena, the psychedelic experience is incomprehensible to a rational, achievement-oriented, conformist philosophy*. But to one ready to experience the exponential view of the universe, psychedelic experience is exquisitely effective preparation for the inundation of data and problems to come. (Leary 1982, 65 *emphasis in original*)

5. "Set refers to what the subject brings to the situation, his earlier imprinting, learning, emotional and rational predilections, and, perhaps most important, his immediate expectations about the drug experience. Setting refers to the social, physical, emotional milieu of the session" (Leary 1982, 67 *emphasis in original*).

Richard Alpert (Ram Dass) tells us that Leary was reluctant to impose a model on the psychedelic experience. He tells us that Leary said:

We don't know what this is about yet and there are many models, but it would be best not to impose a model too soon, because a model that exists in the west for these states is pathological, and the model

that exists in [. . . the east] is mystical and religious and it's better we keep wide open. . . (1971, unpaginated: fourth page of "Turning On").

I, myself, take this as recognition of the danger of stepping back from one game only to observe it from another game: this trap has been uncovered by critical anthropology.

## CONSIDERATIONS

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THIS PAPER IS PROPOSING THE EMPLOYMENT OF PSYCHEDELIC DRUGS—specifically LSD (lysergic acid diethylamide), mescaline (3,4,5-trimethoxyphenethylamine), and psilocybin (4-phosphoryloxy-N,N-dimethyltryptamine)—to examine the game rules surrounding maps, map making, map use, and cartography. Despite decades of loose and ill-informed opinion to the contrary, none of these consciousness-expanding substances are addictive—they create no physiological attachment.

These drugs are physiologically safe. Over two thousand studies have been published, and as of 1968 despite the rumors there is no evidence of somatic or physical side effects. But they are dangerous; the sociopolitical dangers are there. We have incontrovertible evidence that these drugs cause panic, poor judgment, and irrational behavior on the part of some college deans, psychiatrists and government administrators *who have not taken them*. (Leary 1968, 250, *emphasis in original*)

Nonetheless, like any tool, these must be used carefully.

If [the user] is psychologically prepared and if the setting is voluntary and pleasant, then a whole new world of experience opens up. But if the initial experience occurs with inadequate preparation or fearful expectation and if the experience is involuntary and the setting impersonal, then a most distasteful reaction is inevitable. (Leary 1968, 78)

These substances will strip off veneers most people go through life believing are solid realities. This can be alarming, as it challenges an individual's consciousness of ego. Generally speaking, every individual's ego consciousness is anchored by a deep-seated commitment to their social and professional games, and ingesting these substances shows the user that the user's ego—and the games the ego is built upon—are rather less solid than they had been led to believe.

Sensory chaos, somatic inundation, cellular revelation. The plastic-doll nature of social reality and social ego is glaringly obvious. In a word, ego discovers that ego is a fraudulent actor in a fake show. Rubber stamp and tinsel. (Leary 1968, 37)

The impact of LSD is exactly this brutal answer to the question, who is ego? The LSD revelation is the clear perspective. The LSD panic is the terror that ego is lost forever. The LSD ecstasy is the joyful discovery that ego, with its pitiful shams and strivings, is only a fraction of my identity. (Leary 1968, 37)

This can be disturbing or liberating, primarily dependent upon "the set of the subject and the environmental context. If both are supportive of self-discovery and aesthetic-philosophic inquiry, a life-changing experience results. If both are negative, a hellish encounter can ensue" (Leary 1982, 50).

## A GRATUITOUS GRACE

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NOW, I AM NOT BY ANY STRETCH ADVOCATING THE *necessity* of the psychedelic experience, but rather identifying the value of its often neglected and denigrated

revelations in establishing an objective approach to understanding how to engage with the composition of meaning bearing cartographic artifacts. In this, I, myself, tend to

agree with Aldous Huxley, when he wrote that: “All I am suggesting is that the mescaline experience is what Catholic theologians call ‘a gratuitous grace,’ not necessary to salvation, but potentially helpful and to be accepted thankfully, if available” (Huxley 1954, 73).

Again, in speaking about the value of standing outside the game, I am not denigrating the value of the game, but only pointing out the power that comes from knowing it is a game. “Thinking outside the box” is a stock platitude normally mouthed without context, but, unlike a box, a game is a dynamic entity, existing in actions and interactions. If we step outside the game, we can step out of the roles, critique the rules and rituals, deconstruct the language, weigh the values, and judge the goals. Is a given rule a valuable convention, or simply an old habit? Is the game really worth the candle? Is it ever? Is the payoff in

coin of actual value, or is it paid out in shadows that melt in sunlight?

All this stuff is important, because while a game structures and legitimizes play, it can offer no justifications beyond itself. Ethics, for example, cannot be found in cartography because ethics are not found in, but are brought to, cartography—a “cartographic” ethics would be nothing but an adherence to the game rules, however defined. In the same way that you can choose to pack your ethical bags with discretion, or to just pick your ethics up from the side of the road, so too you can choose to play the cartographic game with a broad, sophisticated, well-informed skill, or, you can play it according to the rules printed inside the lid of the box. I would suggest that the rules in the lid are, at best, only a starting point.

## AN ANALOGOUS GAME

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IN HERMANN HESSE’S NOVEL, *The Glass Bead Game* (1943),

the rules of the game are only alluded to—they are so sophisticated that they are not easy to imagine. Playing the game well requires years of hard study of music, mathematics, and cultural history. The game is essentially an abstract synthesis of all

arts and sciences. It proceeds by players making deep connections between seemingly unrelated topics. (Wikipedia 2025b)

This strikes me a pretty good description of the cartographic game as well; both are grounded in their persuasive, rhetorical natures, and both serve as nexus for a tremendous range and variety of concerns.

## RECAPITULATION

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THE CONVENTIONS OF THE CARTOGRAPHIC GAME ARE varied and complex,

but once these [have] been recognized and assimilated, the [map maker has] complete freedom within the system, and when he [has] mastered the various processes he [can] use them to express his own feelings and ideas without any loss of sincerity. Far from hindering originality or talent, the restrictions [enable] very subtle, polished effects to be produced. (adapted by the author from Marrou [1964], as he was quoted in Vickers [1988, 49])

It is the forms and frameworks provided by the cartographic game itself that allow the map maker to produce what Cicero (2018) called “fluent arguments, brilliant

reflections, refined and colorful description” in order to effect the desired persuasion and elicit the desired actions.

There is, then, clear utility in viewing cartography as a game. But, to once again quote Doctor Leary:

the problem is always just how much structure the . . . game should have. If there are no overall goals or rules, we have ever-increasing specialization and dispersion, breakdown in communication, a Babel of cultures, multiple constrictions of the range in favor of deepening the specialized field. [. . . But,] if there is too much structure or overinvestment in the game goals, we have dogmatism, stifling conformity, ever-increasing triviality of concerns, adulation of sheer techniques, virtuosity

at the expense of understanding. Psychoanalysis.  
(Leary and Metzner 1963, 178)

Seeing cartography as a game allows us to observe it from outside its self-defined infrastructure of technique and virtuosity; to examine mapicity from a high ground not otherwise accessible. Although this strategy, by itself, guarantees nothing, it may afford us understandings allowing rewards ranging from implementation of true cartographic radicality (Denil 2011) to simply making better maps. As Leary wrote in 1962: “if the game contract is made explicit, behavior will change drastically in the direction that roles and goals demand. . . . people also automatically shift rituals, adjust new rules, and employ appropriate language once the commitment is made” (1982, 58). In the end, one can only game a system one understands as a game, and the game of playing is an integral part of mastering the game.

Social game based psychedelic studies from the early 1960s—before politically-motivated hysteria brought research to a halt—had a proven track record of significant success in bringing insightful understanding to demographic groups from right across the social spectrum: from the most to least affluent, and from the supposedly well-adjusted to the marginalized—“scholars, artists, medical doctors, professional intellectuals . . . nonprofessional normals [*sic*] . . . drug addicts (psychological or physical) . . . [to] inmates of a state prison” (Leary 1982, 50). In one very broad study, Leary reports that:

Many of the 167 subjects in our study were already involved in rewarding games to which they could return with renewed vision and energy. But many of our subjects came through the psilocybin experience with the knowledge that they were involved in nonrewarding games, caught in routines they disliked. Many of them moved quickly to change their life games. (Leary 1982, 51)

## CONCLUSION

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THIS NOTION OF A MAP MAKING GAME MESHES SEAMLESSLY with the conception of cartography I have discussed elsewhere; in particular, where I was “investigating how a map reader decides that a given artifact is a map, and what that decision means for the user’s relationship with the artifact” (Denil 2022, 42). There, and in the 2024 follow-up

Too, not *everyone* concluded that their life games needed to be changed. Leary notes that for some, “the ‘therapeutic’ effect of the experience did not last. They were left with pleasant memories of their visionary journey and nothing more” (Leary 1982, 51). This is because it is possible for the challenging experience to be affirming too. Huxley, for one, suggested that:

Under a more realistic, a less exclusively verbal system of education than ours, [. . . everyone] would be urged and even, if necessary, compelled to take an occasional trip through some chemical Door [of Perception] in the Wall into the world of transcendental experience. If it terrified him, it would be unfortunate but probably salutary. If it brought him a brief but timeless illumination, so much the better. (Huxley 1954, 78)

I, however, am *not* suggesting that these avenues of investigation are for everyone—or that *anyone* should be *compelled* to undertake them—but I *am* suggesting that it represents a valuable resource for investigation of ideas about maps, cartography, map making and map use: both those ideas considered contentious or controversial and those considered normative. That said, I *am* suggesting that anyone responsibly exploring these avenues of investigation will gain by it.

. . . the man who comes back through the Door in the Wall will never be quite the same as the man who went out. He will be wiser but less cocksure, happier but less self-satisfied, humbler in acknowledging his ignorance yet better equipped to understand the relationship of words to things, of systematic reasoning to the unfathomable Mystery which it tries, forever vainly, to comprehend. (Huxley 1954, 79)

article, “Is it a Map? The Map / Not Map Question,” I maintained that map artifacts only become maps when the artifact is transfigured in the mind of the map reader into a meaning-bearing, conceptual, map entity. This I maintain yet; the only difference here is that the map making game encompasses both the map maker and the map user,

and foregrounds the maker's intent. My larger, rigorously abstract, theory recognizes that the map artifact maker must have some sort of understanding of the map reader's concept of mapicity (Denil 2012, 77), but, due to the necessary abstractness of theory, the contingent details of any particular maker-user relationship are irrelevant. The map making game is thus proposed as a vehicle for exploring that relationship without predetermining the outcome with in-game assumptions.

No one *has* to play the map making game; but, however, if one or the other of the players—map maker or map reader—does *not* play, or insists on playing by rules that the other player does not recognize, then any number of things can transpire; but what is generally considered “map communication” becomes both problematic and unlikely. This situation is not unknown, and is commonly

called misreading. It is usually the maker that is most immediately invested in wanting to understand how to “press the reader's buttons”; but the reader, too, wants, and needs, to be reasonably certain they want to allow their buttons to be pushed.

Ultimately, this proposal to view cartography as a game, and to employ psychedelic tools and methods to explore the nature of that game, cannot, and does not pretend to, provide a whole and entire explanation of the nature and practice of map making. Rather, what is proposed here is a strategy and toolbox of tactics that can, properly employed, take any or all existing conceptualizations of maps, map making, map use, or the informed practice of cartography and “make them strange” so they can be dispassionately examined and evaluated.

## CODA

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One eyed jacks and the deuces are wild  
And the aces are crawling up and down your sleeve  
Come back here, baby Louise  
And tell me the name of the game that you play.

(Robert Hunter, 1969, *Doin' That Rag*)

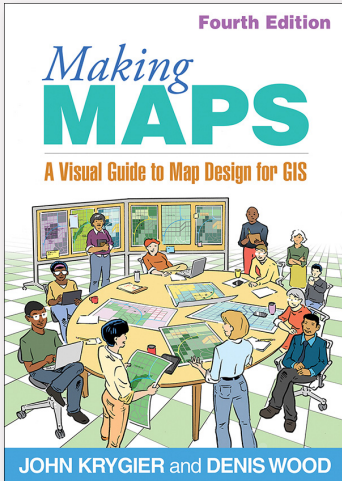
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## MAKING MAPS: A VISUAL GUIDE TO MAP DESIGN FOR GIS, FOURTH EDITION

By John Krygier and Denis Wood

The Guilford Press, 2025

306 pages

Softcover: \$62.00, ISBN 978-1-4625-5606-9

**Review by:** Lisa Gaetjens (she/her), Lisa Gaetjens Cartography

THE FOURTH EDITION OF JOHN KRYGIER AND DENIS Wood's *Making Maps* will be comfortingly familiar to readers of the previous edition. While some changes and updates have been made, and will be discussed in this review, the overall feel and quality remain unchanged. *Making Maps* gives a comprehensive overview of the major decisions that a mapmaker needs to make when creating a map, and presents them in step-by-step chapters, in the order in which they should be addressed. It begins with an assessment of the purpose of the map, and then moves on to dealing with data and the choice of mapping tools, before ultimately offering advice for handling things like color, words (text), symbols, and generalization. The authors profess to speak to three main types of readers: generally educated folks without mapping experience; students of geography, cartography, and/or GIS; and GIS professionals looking to improve their cartographic abilities.

The chapter structure of the new edition is largely unchanged from its predecessors, although there has been some rearrangement of the later topics. Twelve topical chapters,

1. "How to Make a Map,"
2. "What's Your Map For?,"
3. "Mappable Data,"
4. "Map Making Tools,"
5. "Geographic Framework,"
6. "The Big Picture of Map Design,"

7. "The Inner Workings of Map Design,"
8. "Color on Maps,"
9. "Words on Maps,"
10. "Map Generalization and Classification,"
11. "Map Symbolization," and
12. "Map Symbol Abstraction,"

are followed with "A Note to the Users of *Making Maps*," "Acknowledgments / About the Authors," and an "Index."

Each chapter contains succinct overviews of relevant topics, paired with thoughtfully selected map examples that highlight the points being made. Some of the example maps are historic or famous, but many are custom works created for the new edition. The penultimate page of each chapter features a few quotations about maps from authors, thinkers, and—occasionally—cartographers, and this touch gives a whimsical and philosophical bent to the text. Chapters close with a page of suggested further reading, and this bibliography is an incredibly valuable resource and helpful springboard for researching any cartographic topic.

The thesis of the book, if it can be said to have one, is that maps are a form of communication, and it is the goal, message, and expected audience of the map that should guide the maker in determining the "best" way to make the map. In this book there are no absolutes, only gradients of better and worse choices for the cartographer's message—given the tools and data available to them, and their intended



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audience. Each chapter is brimming with sample maps and other useful graphics that clearly demonstrate the effect of mapmakers' choices. For example, the illustrations in the section "Visualizing Visual Differences" (150–51) provide a handy, compact guide to type size, symbol differentiation, and the perceptibility of light symbols over dark backgrounds and vice versa. One map, *The Flight of Voyager*, appears in different forms in many different chapters—each exploring a different aspect of map design. In the Chapter 7 section on visual differences the map uses simple, black, and almost undifferentiable symbols to indicate a wide variety of feature types—creating what the authors call "a nasty, unintelligible mess" (152–53). Comparing this variant of the map to the clear and easy to parse versions the reader has seen in previous chapters is a particularly effective demonstration of the importance of establishing a visual symbol hierarchy. Showing the many variants of this one map drives home the importance of each of the mapmaker's design choices. Each map and graphic throughout the book has been thoughtfully designed to illustrate the impact of the cartographer's choices on the intelligibility of the map. Every decision has an impact on the map's effectiveness at conveying meaning, and, ultimately, on the meaning conveyed.

Another beautiful feature of this book is that it is software agnostic. The authors sum up techniques that have worked for mapmakers for centuries, without getting bogged down in specific tricks for certain software packages. The principles given in each chapter work equally well across both paid and open-source software, or even pen and paper, and the book's lessons can be applied to static maps destined either for print or for digital display. That said, this text does not offer any specific guidance for interactive web maps, although many of the same principles would certainly apply.

I would be remiss not to mention what is probably my favorite part of the book—the "Geographic Framework" chapter—which contains some of the clearest graphics and explanations I've come across about map projections, distortion, geoids, ellipsoids, and datums. The means used—primarily Tissot indicatrix circles and comparisons between projections—are not unusual, but are assembled and explained exceptionally neatly and succinctly. Following the style of the rest of the book, this chapter is succinct but thorough and introduces the reader to correct geographic terminology without being overly technical.

The book opens with a multi-page illustrated story (comic) about two neighbors who want to stop a city plan to widen the road in front of their homes. One of the women has just purchased *Making Maps* from the bookstore and they set off to make their own map to counter the city's proposed connector road. The comic story line reappears between some chapters and at the end of the book (spoiler alert: they stop the connector with the help of maps). I must admit that while I find this meta framing of the text a bit corny and would rather go straight into the "meat" of the book, it does, however, contribute to the authors' overall message that maps shape narratives, and that maps can be created by anyone with a little know-how. At the 2025 NACIS Annual Meeting, I attended a talk by Natalie Correa entitled "CartoGraphic; Sketch Mapping with Comics" in which she spoke about engaging general audiences in sketch mapping about their lived experiences side by side with creating comics to further draw out temporal narratives and emotional qualities from their memories. She pointed out the similarities in the way readers parse both comics and maps, and suggested that the interplay of sketch maps and comics could deepen the meaning of both. Perhaps reading a comic as an introductory framing to *Making Maps* is a logical entry point for readers who are new to mapmaking, and may help prepare them to understand and respond to the compelling narrative quality of well made maps.

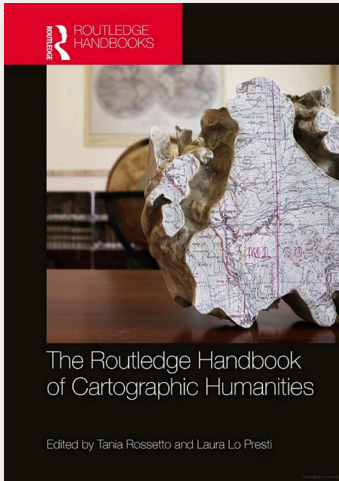
While the text and example maps from the previous edition remain largely unchanged, there are some significant additions and revisions. The authors have reorganized the book by moving the previous edition's closing chapters—"Words on Maps" and "Colors on Maps"—forward to the middle of the book, perhaps to better reflect their order in map creation. In Chapter 1, "How to Make a Map," there are added sections on "Principles of Feminist Data Visualization" and "Principles of Indigenous Data Sovereignty and Mapping" (26–27) that reflect current discussions on inclusivity and widening perspectives beyond historical power structures. New mobile device screen sizes have been added to their explanation of paper versus digital maps in the "What's Your Map For?" chapter (44–45), as have new pages on "Interacting on Screens" and "Visual Story Telling" (46–47). Chapter 3, "Mappable Data," has new text on "Aggregating" (71) and "Districting and Redistricting" (72), and Chapter 4, "Map Making Tools" has added sections on "Workflow" (91) and "Artificial Intelligence" (93) that include a list of the names of commonly used commercial and open-source

software programs. The final chapter—“Map Symbol Abstraction”—has had significant updates, including: more full color maps, an expanded section on cartograms, new writing about multivariate choropleth symbolization, and an explanation of isopleth (surface/heat) maps. Most of the updates to maps in this new edition serve to more closely align the examples with the explanatory text, to use more current data—such as those from the 2020 US Census—or both. Very little has been removed, apart from the page on visual variables within the “Color on Maps” chapter.

In composing *Making Maps*, Krygier and Wood have emphasized readability by focusing on relevant example maps and demonstrative graphics, each supported by short, succinct, text blocks. They also favor simple, plain-language explanations of relevant terms over fussy acronyms and technical jargon. This enhances accessibility for all readers regardless of prior experience with mapmaking or GIS, and lends a concision that allows the book to be read in a variety of ways: a thorough study, a casual skim, or a quick look-up.

Most aspiring and current mapmakers—whatever their level of GIS or cartography experience—can learn something from *Making Maps* and benefit from having a copy handy on their shelf. The additional and updated example maps keep the text relevant, and the additional types of maps discussed—cartogram, isopleth, multivariate choropleth—show an awareness of gaps in prior editions as well as the interests of readers. That said, the updates are not so extensive that owners of the Third Edition should feel compelled to switch to the Fourth Edition immediately. As was true with the prior version, the software agnostic nature of the text makes it a long-lived resource. Unlike books about specific programs or technologies that are out of date as soon as, or even before, they are published, any recent edition will resonate and be a useful reference text for many years. Krygier and Wood’s ability to distill huge amounts of information into such a concise, understandable book is truly remarkable. Clearly, they have read and thought extensively about all facets of mapmaking, and their massive knowledge base is used to the reader’s benefit. The Third Edition of *Making Maps* has, for some time, been the book I have most frequently referenced while making maps, and that will change only because I now own the new Fourth Edition.





## THE ROUTLEDGE HANDBOOK OF CARTOGRAPHIC HUMANITIES

Edited by Tania Rossetto and Laura Lo Presti

Routledge, 2024

444 pages, 71 black and white illustrations

Hardcover: \$300.00, ISBN 978-1-0323-5593-1

eBook: \$51.19, ISBN 978-1-0033-2757-8

**Review by:** John Pickles, University of North Carolina at Chapel Hill

*The Routledge Handbook of Cartographic Humanities* is an ambitious undertaking to explore emerging conversations in geography, the arts, and the humanities. The spatial turn has led maps and mapping practices to become central elements of new fields of interdisciplinary inquiry, variously labeled as the spatial digital humanities, geo-humanities, deep mapping, or map art, among others. The result is a series of productive conversations, explorations, and field crossings between the humanities and mapping studies. The editors see the cartographic humanities as an emerging arena where geography, literary studies, classics, archaeology, art and media studies, and digital humanities are engaging with each other around maps and mapping.

Both editors are geographers at the University of Padua, in Italy. The forty-two chapters of the *Handbook* are organized into seven Parts, each aimed to illustrate some of the interdisciplinary conversations that have arisen around maps, mapping, and cartography: theory and trends; textural connections; mediations and intermediations; cultural digitalities; troubles and disruptions; elicitations and co-creations; and public cartographic humanities. Chapters provide examples for conversations across a dispersed scholarly landscape with fascinating examples such as Renaissance chorographies, experimental art maps, Indigenous counter-mappings, GPS “selfies,” and museum exhibitions.

“Part 1: Preludes and trends” sets out some of the key intellectual moves. Veronica della Dora’s opening

chapter—“Mapping Inner Worlds: Cartography as a Humanity”—focuses on maps as forms of texts and practices. As Matthew Wilson notes in a dust-jacket blurb, maps move, and, as I (1995) have suggested, maps have their own social lives. In this vein, Matthew Edney’s “Processual Map History” insists that maps should be understood not as static objects but as elements of unfolding processes and controversies.

Part 2: “Textural connections,” extends this attention to practice and form by working across ancient, archaeological, historical, and literary materials. Chapters such as “Charting Movement through Historical Sources”—from Tiago Luís Gil—turn to itineraries, marginalia, and textual traces as quasi-cartographic details, while other essays on fictional and zoocentric cartographies probe how non-human perspectives and narrative devices complicate conventional map-territory relations. The effect is to pull mapping deep into the narrative and material textures of cultural production, showing how stories and archives are themselves shot through with spatial diagramming and imaginaries.

Part 3 shifts its focus to cartographic media: maps in and as film, advertising, design, and visual art. Essays on worlds for sale in print advertisements (Davide Papotti) and on maps as design tools (Roger Paez, Manuela Valtchanova, Ferran Larroya, and Josep Perelló) unpack how cartographic imagery frames commodities, landscapes, and experiences. There, authors explore some of



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the ways in which the political economy of cartographic reason is translated as it circulates through late modern visual cultures.

“Part 4: Cultural digitalities” reflects on mapping in human and more-than-human environments with examples drawn from GPS selfies, platform interfaces, location-based games, and automated mapping cultures. The essay “A Humanistic Rewire of GIScience” by Bo Zhao is especially interesting. It challenges technocratic celebrations of GIS by arguing for decolonial, reflexive, and situated approaches that foreground power, difference, and epistemic justice in digital mapping practices. Bo Zhao’s critique of efforts to geocode the world draws on critical GIS debates about how spatial data infrastructures act as devices of governance and surveillance. In contrast, the other essays in “Cultural digitalities” are more descriptive of emergent digital practices and affects, and in some cases the underlying political-economic logics of platforms and data extraction remain in the background. Still, the section usefully repositions the digital map as a dense socio-technical arrangement rather than a neutral interface.

The essays in “Part 5: Troubles and disruptions” engage more directly with colonialism, race, gender, and the Anthropocene. Andrea Pase’s analysis of “emptying and filling” in maps of inland Africa shows how colonial cartography produced blank interiors to be claimed and exploited, and how later mappings layered new projects and imaginaries onto those spaces. Clancy Wilmott’s “Cartography Contra Colonialism,” and the chapter “Indigenous Cartographies” by Davi Pereira Junior and Bjørn Sletto foreground Indigenous mapping as a site of resistance and ontological conflict, where alternative ways of mapping land, territory, and relationality unsettle imposed grids and property regimes. Stephen Hanna’s “Black Cartography as Memory Practice” and Christina Dando’s analysis of gendered mapping cultures probe the racialized and gendered inscriptions of power in cartographic practice, while David Chandler’s discussion of mapping in the Anthropocene examines how earth-observation and risk cartographies reconfigure governance and responsibility at planetary scales.

The “Part 6: Elicitation and co-creation” chapters shift the tone toward participatory and reflexive practices, some with the explicit sense that people’s cartographies offer emancipatory potential. They include chapters on cultural mapping projects, auto-cartography, and collaborative

mapping of community narratives and heritage. Nancy Duxbury and W. F. Garrett-Petts explore participatory cultural mapping as community-centered work rather than technocratic inventorying, while Giada Peterle uses auto-cartographic techniques to probe the researcher’s own positionality and affective geographies. Stephen Hanna, Amy Potter, and Derek Alderman’s work on mapping historical tours shows how routes, stories, and embodied movement co-produce landscapes of public memory.

The final part, “Public cartographic humanities,” follows maps into institutional settings such as exhibitions, collections, and public cultures. Martin Brückner’s “The Social Life of Maps” and Tom Harper’s reflections on public map exhibitions attend to curatorial choices, display formats, and institutional settings, tracing how some maps become canonical while others remain marginal. Here, again, the *Handbook* insists on the performative life of maps: they are staged, circulated, and contested as public objects whose meanings are continuously negotiated. For those working in museums, archives, and public history, this section underscores the importance of curatorial cartographies and offers concrete cases that link critical theory to institutional practice.

The book is blurbed by geographers Tim Cresswell and Gillian Rose, who praise the volume as a “state-of-the-art” and “must-read” intervention that demonstrates the richness and critical potential of contemporary map studies. A third blurb by Matthew Wilson focuses on how “maps move” and how, in the process, mapmaking practices become more curious and more open, vibrating among different conversations, and avoiding the potential limits of canonical interpretations—something that is one of the successes and pleasures of the *Handbook*.

Handbooks can often be unwieldy and diffuse, and my first impression on receiving this volume was that it was of such a mixture, offering and suffering from the form of a handbook. It is massive in scope and coverage, with an impressive range of content, and an exciting opening of conversations across often un-trammelled intellectual borders. As a result, at times it does feel a little dispersed. The scale and heterogeneity of the collection make unevenness inevitable, and the theoretical line throughout can feel more gestural than fully worked through, while the Euro-Atlantic skew in contributors, case studies, and the debates around “cartographic humanities” itself does mean that the *Handbook*, at times, sits uneasily alongside

the global aspirations of “cartographic humanities” and its wider cousin “environmental humanities.” But my colleagues and I, from Classics, Geography, Romance Languages, and Renaissance Studies, used the *Handbook* to guide a periodic interdisciplinary seminar, inviting occasional contributors from the volume to join us on Zoom. In this context, the *Handbook*’s coherence and value became clear. Topics are well chosen. Chapters are relatively short, but synoptic or suggestive. And reading 2–3 chapters at a time as a conversational focus for each meeting worked well. Indeed, the *Handbook* offers an extraordinary repertoire of cases, concepts, and methods that make it invaluable for teaching and for situating one’s own work within a larger set of mapping and cartographic conversations.

Geographers have, in recent decades, grappled with finding an appropriate balance between the roles of traditional concepts of cartography and the emerging roles and possibilities of new technologies, practices, and uses for maps and mapping. The central questions involved have already been raised on multiple occasions by multiple writers—the NSF-supported Friday Harbor conference on GIS and Society (Sheppard 1995); *Ground Truth* (Pickles 1995); Denis Wood’s challenge “Cartography is Dead (Thank God!)” (2003); *A History of Spaces* (Pickles 2004); and “Revisiting Critical GIS” (Thatcher et al. 2016), among others—enough, perhaps, that the condition and its progress have been sufficiently diagnosed. The necessary concern now is for what is to be done about it: how are these emerging imaging systems and mapping practices changing the social lives of maps and the specific forms of “worlding” our world? How are geography and the wider

field of mapping practices to respond to new technologies and the political economies that have been emerging? What, too, could be done to better understand the likely consequences of these spatial practices and imaginaries for society? The *Handbook of Cartographic Humanities* is an important contribution to furthering the hopes of Friday Harbor to expand conversations about mapping practice, democratize map knowledge, and create spaces for a renewed politics of spatial understanding.

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# 1,001 Novels

A Library of America

Author: Susan Straight


Medium: ArcGIS StoryMaps

**Story behind the story:** Susan Straight, a novelist based in Riverside, California, grew up with an unusual dual obsession: books and geography. She credits her mother, an immigrant from Switzerland, for her love of books. Her passion for geography came from her stepfather. "We'd go camping in a little trailer. We always had Auto Club maps and a road atlas. I was always obsessed with maps."

**Why it's special:** During the pandemic, Susan began to collect and compile novels by location, listing titles on scraps of paper. Christian Harder, an editor at Esri Press and a neighbor of Susan's, connected her with the ArcGIS StoryMaps team at Esri, and thus began a collaboration that resulted in an online compendium of 1,001 book covers and précis, organized by geography, that was ultimately published by the *Los Angeles Times*.

**The author:** Susan Straight has published 10 books, including *Mecca*, a finalist for the Kirkus Prize in 2022, and *In the Country of Women*, a memoir of migration, books, and family. She was born in Riverside, where she is Distinguished Professor of Creative Writing at UC Riverside.

**The Thousand Crimes of Ming Tsu by Tom Lin (2022)**  
Corinne, Utah  
A western like no other, with Ming exacting revenge on the men who kidnapped him to work on the railroad, saving him away from his wife, a tale of retribution and history that cannot be put down.

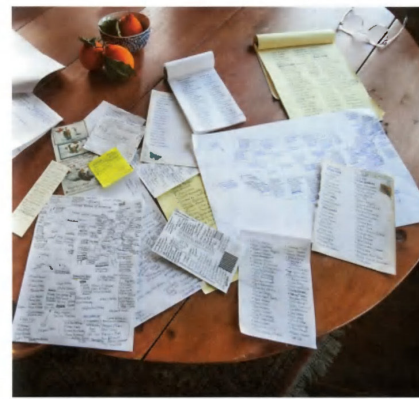


**Tomestone Courage by JA Jance (1994)**  
Blitch, Arizona  
Joanna Brady has just been elected sheriff of her hometown, and a deep mine holding two bodies leads her to uncover decades of secrets in this long-running series.

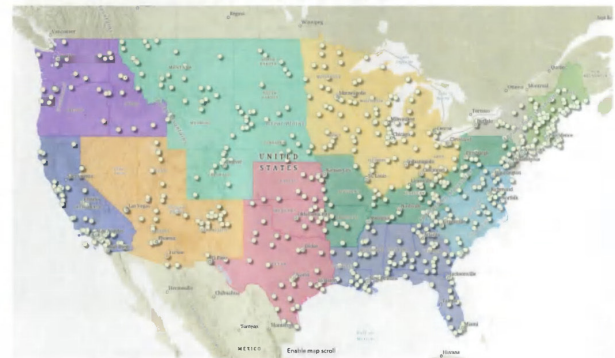


Above: Two books featured in the story's Enchanted Deserts & Coyote Canyons section.

Left: Susan Straight.



Susan's handwritten book lists, before her effort went digital.



Below: An interactive map featuring all 1,001 volumes (not shown: Alaska and Hawaii).

An example spread from the book. The link icon can be seen on the top of the lefthand page.

“Why Maps Matter” is a question that I hope we all, as cartographers, have asked ourselves to some extent or another, and it is the title of Chapter 2. To Carroll, maps add dimensions to stories that other communication media, such as text, photos, and videos, simply cannot provide, because maps are written in the visual language of location. In addition to identifying location, they also reveal patterns (past, present, and future) and show interrelationships—referring back to geographer Waldo Tobler’s First Law of Geography: “Everything is related to everything else, but near things are more related than distant things” (34; Tobler 1970). In this chapter, Carroll discusses the three primary elements—text, images, and maps—of a StoryMap, their purposes, similarities, differences, and strengths, and how they can be combined to inform the reader about the who, what, when, where, why, and how of the story. He then goes on to remark on how StoryMaps have the ability to incorporate another, fourth, element: that of sound.

Chapter 3, “Maps and Minds,” illustrates how closely memories are tied to a sense of place. Many of us, Carroll

included, utilize something known as a mental map—a map-like mental image composed of locational memories and other knowledge—when we think about past events. Much of this chapter is focused on reviewing some of the research literature related to spatial thinking and the brain, but there are also some interesting insights and conclusions that can help guide map-based storytelling; especially useful when that storytelling is geared towards a general audience.

The fourth chapter, “From Analog to Digital” starts with a historical overview of mapmaking at National Geographic. This ranges from the period of maps made using hand-scribed linework and glued labels, through the adoption of interactive computerized prepress systems from the Scitex corporation and the introduction of Esri’s Unix workstation-based GIS, ARC/INFO to, ultimately, desktop graphics software such as Adobe’s Illustrator and Photoshop. Having established this context, the author compares what he sees as the key similarities and differences in physical and web map storytelling. Physical maps have the advantage of simultaneously showing both

fine detail and a synoptic overview, while computer-based maps can accommodate changes in screen form factors, can afford various forms of navigation, and can support the potential for multi-zoom-level data. Printed maps exist as physical artifacts that can be collected in libraries—where they can be preserved and conserved, or hidden away to be lost or rediscovered. Digital maps can be delivered to a user (almost) anywhere almost instantly, but are subject to file-format obsolescence or data corruption. Digital maps can be animated, corrected, or updated, where paper maps generally cannot. While the light emitted from a display screen can shorten the user’s attention span, and the mapmaker’s usable color choices are at the mercy of both ambient light and the vagaries of the digital display’s capabilities and settings, a physical map is limited by factors like the durability of its substrate and the lightfastness of its ink.

The journey referred to in the next chapter, “The Journey to Storytelling,” is that of Carroll’s extensive career in maps; an arc that runs from his early days as an art director at the National Geographic Society and his introduction to cartography, through a decade as its Chief Cartographer—an achievement many cartographers would consider a pinnacle—through the early years of his alliance with Esri. Over the course of this journey, his concept of storytelling—combining interactive maps, text, and images—grew and evolved. His narrative highlights several of his early multimedia experiments, and the many different formats each new prototype took. His path culminated in an easy-to-use, web-based app that allowed users to author, publish, and disseminate easy-to-access web maps—maps that told stories the way Allen Carroll had, over the years, come to understand as the best way to reach people. Essentially, this is the story of the conception, refinement, and continuing evolution of what we now know as ArcGIS StoryMaps.

Chapter 6, “Maps in Dramatic Roles,” outlines how maps, even single static visuals, can play an important narrative role in multimedia storytelling. Panning, scrolling, and utilizing pop-ups can allow maps to provide additional information whether they hold a starring or a supporting role. Carroll details how maps can be used to locate, compare, interpret, provide context, and illustrate any narrative, regardless of the choice of style. This chapter ends with a brief “Mapmaker’s Mantra” that provides guidance to anyone making maps: “Be honest and accurate. Be

transparent and accountable. Minimize harm and seek to provide value. Be Humble and courageous” (139).

The “[Nine Steps to Great Storytelling](#)” that are laid out in Chapter 7 encompass the elements Carroll and his team recommend everyone should consider when building out an effective story. This chapter is an invaluable learning resource for anyone interested in storytelling; both new and veteran users of ArcGIS StoryMaps, and, for that matter, anyone else making maps.

Chapter 8, “Plan, Produce, Polish, Publish,” lays out the StoryMap creation process in detail. This step-by-step guide from story idea to publication is a companion to Esri’s [online tutorial](#), providing guidance, advice, and templates that allow the user to be creative and flexible.

In a sense, *Telling Stories with Maps* tells two stories: that of Carroll’s own introduction to, and evolution in, cartography, and that of the use and usability of ArcGIS StoryMaps. The two are bound together so tightly, however, that one cannot simply say that one part of the book deals with the “Lifetime” and the other with the “Lessons” (from the book’s subtitle: “Lessons from a Lifetime. . .”). The first five chapters of the book lean very heavily on Carroll’s career narrative, and while it is an interesting read that provides helpful context and insights into his thinking on what eventually became ArcGIS StoryMaps, some readers may find that story to be less relevant than the lessons.

From a visual standpoint, the *Telling Stories with Maps* companion [website](#) is a powerful extension to the book, providing, as it does, links to the online collection of featured StoryMaps. While the screen captures in the book provide some clues as to the content of each story example, they cannot come close to replacing the interactive storytelling experience. There are a lot of featured StoryMaps, their bolded titles peppering the text, each followed by a link symbol indicating that it is included in the companion website. In addition, each chapter concludes with an “Exemplary Stories” section, with even more StoryMap links. I, myself, feel that there are too many showcased stories, and that the sheer number of examples significantly detracts from the flow of the narrative. It is interesting to note that the author does highlight how printed maps are still powerful tools, even as his discussion concentrates on the opportunities afforded by interactive, computer-based solutions.

There are a great many takeaways a reader can gain from this book. It provides useful guidance for a first-time user of ArcGIS StoryMaps—outlining the importance of storytelling, demonstrating different ways to utilize maps in conjunction with images and text, and offering practical tips for using Esri’s storytelling platform—but its readership should not be limited to beginners. Although it contains a lot of step-by-step instruction, it does not claim to be an instruction manual, and anyone interested in any method of storytelling can benefit from, and be inspired by, its content. Carroll has an impressive history in cartography and his writing clearly demonstrates his strong desire to share his insights with the community.

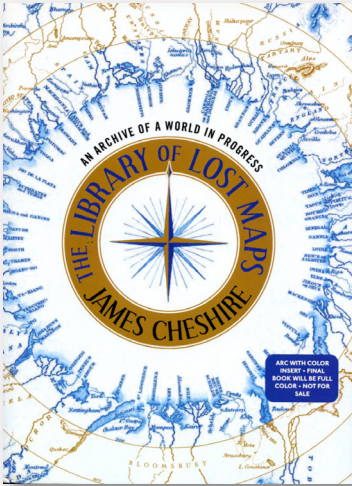
As with many Esri Press publications, the quality of the printing and layout does leave something to be desired. The design is less than cohesive: there is no clear structure, and the placement of illustrations and graphics seems

almost haphazard, curiously contrary to Carroll’s own storytelling advice. While the cover illustration certainly draws the eye, it is unclear how it relates to the focus of the book and, frankly, appears more suited to a kids’ book. These drawbacks aside, Allen Carroll’s *Telling Stories with Maps: Lessons from a Lifetime of Creating Place-Based Narratives* can be looked on as a useful addition to your library, and maybe even an opportunity to grow and expand your storytelling horizons.

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## THE LIBRARY OF LOST MAPS: AN ARCHIVE OF A WORLD IN PROGRESS

By James Cheshire

Bloomsbury Publishing, 2025

414 pages, including maps

Hardcover: \$40.00, ISBN 978-1-63973-428-3

eBook: \$28.00, ISBN 978-1-63973-429-0

**Review by:** Arden Benner, Trimble Maps

LIKE MANY OF YOU, I HAVE NEVER SET FOOT IN THE University College London (UCL) Map Library. I've never browsed its shelves, opened the drawers, or sorted through the piles of antiquated maps that are older by decades than most of us. After reading *The Library of Lost Maps*, however, I have a sense of nostalgia for this room I've never entered and whose (now retired) librarian I've never met. *The Library of Lost Maps* is not so much a book documenting a miscellaneous bunch of maps, as it is a novel about a library. It reads as if it were a memoir of the library itself, with the author James Cheshire taking on the role of dutiful biographer. Each chapter introduces a freshly rediscovered map pulled from the back of a drawer that was last opened who knows how long ago, and walks us through its background, reception, and acquisition by the archive. Through this framework we are introduced to a cast of characters (that is to say, actual cartographers) whose methodologies and motivations bring us outside the walls of UCL and into the mapmaker's own time and territories.

We are also introduced to their creations. Chapter by chapter, we're presented with map after map: maps created for war, maps documenting discovery, and plenty of maps that inspired change. Each is framed as the product of one or more cartographers' intent to persuade the reader of a particular worldview: "Cartographers have tremendous power to conjure lasting impressions of the world as they see it, but the consequences of their work often rest in the hands of decision makers using their creations" (244).

From Cuba to Antarctica, the maps Cheshire pulled for this project cover almost two hundred years and countless miles.

Chapter One, "Welcome to the Map Library," opens with Cheshire's personal introduction to the long-forgotten map collection—squirreled away in a dusty basement map room—that he only entered almost ten years into his time at UCL. His comprehensive description of this surprisingly cavernous library that has spent the last twenty years unstaffed ranges from its contents—"Bulging out of 440 bespoke wooden drawers and stacked on the shelves of tens of glass-fronted cabinets were thousands of maps and hundreds of atlases" (9)—right down to the pervasive scent of aging paper. He takes particular care in describing the condition of each map he examines; some in much better shape than others.

Institutional map collections around the world are seeing declining numbers of visitors. Similarly, it is also becoming more and more rare (especially in the age of virtual classes) for teachers to reference bulky and delicate physical materials that can be accessed more quickly and easily on-screen via a Google search. Many of the maps stored in the UCL Map Library seem not to have seen the light of day for decades, and we are left to wonder what will become of these primary resources if their repository is ultimately deemed to have outlived its purpose. "Part of the problem with the present is that our attitudes change and what we value now may not be what we value in the



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future, and the dull and ordinary of today may become highly valued curiosities tomorrow” (48).

Cheshire has pulled dozens of maps from the depths of the library—and tangentially mentions many others—integrating images of several into the margins and page spreads throughout the book. The marginal illustrations are a cool feature: some are maps on postage stamps or book covers; others are inset maps or other details from larger maps; and some are just library acquisition stamps. Sometimes the marginal maps are constrained to—occasionally shoehorned into—the page fly, and sometimes they shoulder the text body out of the way to take the room they need (Figure 1).

Each of the twelve chapters focuses on one or two maps that often share a common purpose, creator, or methodology. No map, as we well know, is created in a void—each and every map in the library came into being within the social, political, and cultural contexts of its making—and the author recounts those contexts, as well as the story of each map’s rediscovery in the library, to drive the narrative forward. He spins us a tale about the cartographers and their backgrounds, sponsors, and motivations.

BLOOMSBURY

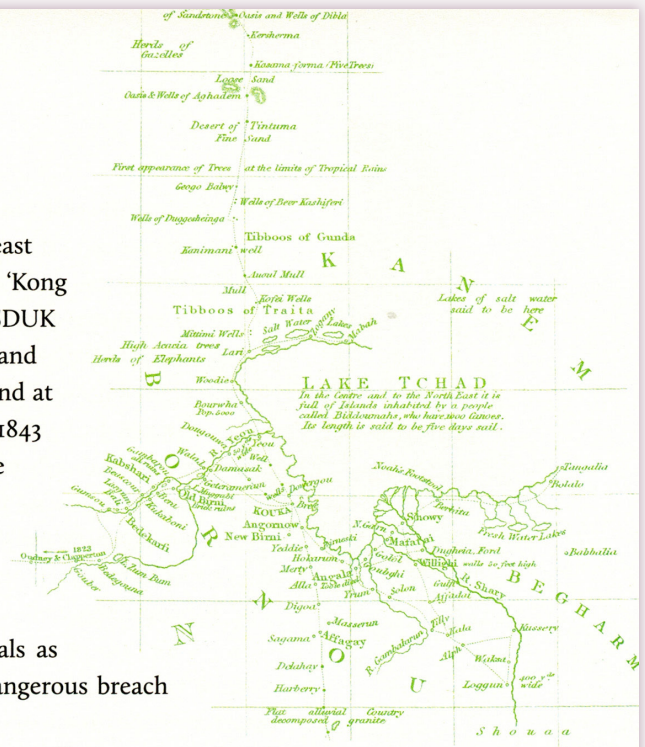
previously have been out of reach.<sup>27</sup>

They weren’t perfect, not least with the appearance of the mythical ‘Kong Mountains’ (see Chapter 1) on the SDUK maps of the African continent, and Beaufort did sail a bit close to the wind at times by copying from other maps. In 1843 the committee of the SDUK wrote to Beaufort seeking permission to credit him on the maps and to ask that he disclose his sources, to which he replied: ‘The early maps were ... mere copies of such materials as were accessible to us without any dangerous breach of copyright.’<sup>28</sup>

Elsewhere in Africa the SDUK maps offer some wonderfully vague but enticing labels including ‘High Acacia trees’ just to the north of ‘Herds of Elephants’ and the ‘Loose Sand’ marking a transition to ‘Herds of Gazelles.’<sup>29</sup>

Quibbles aside, there is no doubt that Beaufort wanted the maps to be the best they could possibly be for the era. He could have compromised and produced the maps as cheap copies at bargain basement prices, justifying his efforts as still giving the working classes something they would not ordinarily have, or perhaps that such a class could not appreciate the artistic or scientific qualities imbued in the maps.

Would a coal miner or textile worker really notice or complain that their map is lacking the latest border or a recently named peak or river? It was a sign of respect to these workers that they were not offered compromises. It was also an indication of how seriously the SDUK took geography and enabling everyone to see the world beyond their horizons.



Map 35 [Extract]  
West Africa II: Society for the Diffusion of Useful Knowledge (1839)  
37.5 x 29.5cm

**Figure 1.** A marginal map on page 127. The region around Lake Chad in central Africa as it was “known” by the Society for the Diffusion of Useful Knowledge in 1839. Notice the labels for “herds of elephants” and where salt water lakes are “said” to be.

One of my favorites appears in Chapter Four: “Bloomsbury.” Francis Beaufort was a cartographer appointed to the Society for the Diffusion of Useful Knowledge (SDUK)—an early nineteenth century group dedicated to public self-education in Britain. He served on its Map Committee, the mission of which was to make informative and topical maps available to the general public at moderate prices, an undertaking aided by the then-new and revolutionizing steam-powered printing press. Literacy rates were on the rise in the 1830s, and SDUK maps were a window into parts of the world to which many working, and even middle class, Britons had never before been exposed. In this regard, Cheshire quotes the 1840 president of the Royal Geographical Society: “Words following words in long succession, however ably selected those words may be, can never convey so distinct an idea of the visible forms of the earth as the first glance of a good Map” (128). Beaufort spearheaded the fifteen-year Map Committee project, publishing and disseminating over two hundred and twenty-four individual maps that, taken together, constituted a comprehensive atlas of the world. Cheshire speaks to Beaufort’s dedication to prioritizing cartographic accuracy and quality over profit; he notably refused to compromise on function or design, no matter how uneducated or poor his audience may have been. Reading about this, it struck me how even today we are still fighting for the right to public knowledge, open resources, and quality, affordable education—almost two hundred years later.

*The Library of Lost Maps*, both the novel and the actual place, are evidence that there is value still to be found in the aging paper maps of yore, but, as the author writes, we shouldn’t let our love for them halt our progress. In the modern day—where artificial intelligence is a looming force—these documents are essential to understanding where we have come from and how much we’ve grown. We too often take for granted the sophistication of our geographic education and how frequently we are exposed to news of events in the far-flung corners of the world. Just a few generations ago, the average person knew only hearsay about cultures thousands of miles abroad, and understood distant geographies only as vague shapes and labels on maps. Now that so many of us coexist with a smartphone in our pocket, maps may have changed forever, but even that would not diminish the value of the maps collected in the Library. They will continue to exist as they were when they were first created; acting as primary records of what once was instead of what currently is. As

interesting, evocative, or even quaint as these maps may be, moving forward we are equipped with technology at our fingertips about which our cartographic predecessors may only have dreamed. Likewise, we can reach further and faster; what we create can be available globally in an instant. In Cheshire’s words: “The technology will continue to evolve and, although big business has seen the value of maps, more and more people will appreciate that because such rich data is available, maps do not have to be the preserve of state actors or people with significant resources. Instead, they can be used to counter narratives and revolutionize how those in power are being held to account” (350). Today, maps are regularly made and shared to expose injustice, delineate food deserts, quantify climate change, demonstrate the extent of social inequity, and a myriad of other issues. Maps are integral to change: a fact *The Library of Lost Maps* emphasizes in chapter eleven, “Maps Go Digital.”

Cheshire intersperses *The Library of Lost Maps* with bursts of levity, and more than once I caught myself smiling while I read—whether it be at the petty antics of nineteenth-century cartographers or a mystifying “herd of elephants” label on an early map of Africa. I found the book to be an easy and entertaining read, one that I think will be equally attractive to map hobbyists and established geographers. The UCL Map Library clearly contains a multitude of unique and historically important maps, and this novel highlights a well-chosen selection of them. The visuals are vibrant and frequent, and the anecdotes are well-researched and recounted as if heard firsthand. Nonetheless, the limits of its scope are clearly defined. It is important to note that this book is specifically about the Map Library at University College London, and is not intended as a comprehensive guide to the history of mapmaking. Maps and cartographers from Europe—and particularly from the United Kingdom—predominate. Maps of London, for example, vastly outnumber maps of Asia within the book’s examples. It is unclear if this circumstance simply reflects the overall makeup of the collection, or only the authorial selection from it, but the absence of cartographers from elsewhere in the world is noticeable. All the same, I would recommend this book to anyone interested in maps, geography, or to those who have nostalgia for print media.

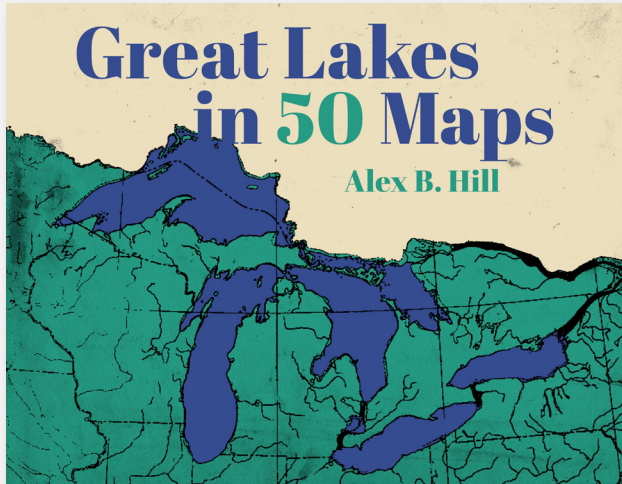
From beginning to end, *The Library of Lost Maps* is a journey through almost two centuries of cartography, with something in it for everyone—beautiful maps, historical intrigue, and even a fake mountain range. The novel

contemplates what it has meant, and still means, to be a cartographer: the importance of the integrity behind our work and the optimism that comes with knowing that maps, even ones far past their publishing date, can outlast us all. I finished it feeling pride in my work as a cartographer, respect for the cartographers like Francis Beaufort that came before me, and inspired to create visuals that someone may someday want to add to a library of their own. Readers should approach *The Library of Lost Maps* with the expectation and anticipation of great maps ahead. They should also note that visits to the University

College London Map Rooms are by appointment only, and—their [website](#) tells us—“are primarily for Geography Department and UCL staff/students.” You can email [geog.office@ucl.ac.uk](mailto:geog.office@ucl.ac.uk) for more information.

I will end this review with something James Cheshire wrote in his final chapter: a simple statement that I think will stick with me. “I now know that no two maps are the same because as soon as a map is held in someone’s hands it transforms” (357).





## GREAT LAKES IN 50 MAPS

By Alex B. Hill

Belt Publishing, 2025

127 Pages

Hardcover: \$30.00, ISBN: 978-1-5402-7000-9

**Review by:** Gareth Baldrice-Franklin (he/him)

*Great Lakes in 50 Maps* is the latest in the “50 Maps” series by Belt Publishing, a Midwest publishing house with a thematic focus on the Rust Belt of the United States. Previous atlases in the series have focused on cities—*Buffalo in 50 Maps* (CP review), *Detroit in 50 Maps*, and *Pittsburgh in 50 Maps*, among others—making *Great Lakes in 50 Maps* the first of these atlases to expand its focus to a region, and to include data from Canada as well as the US. All these atlases take the form of blog-like listicles—a series of more or less independent maps making up a sort of slide-show—albeit in print. This gives them a fun, pop-reading appeal. They are not the most thematically heavy-hitting of publications, but they do not pretend to be.

It is abundantly clear that the unique character of the Great Lakes region holds a very special place of significance for the author of this particular “50 Maps” atlas. Following a brief introduction to the region, the atlas is organized into four sections: “History and Culture,” “Ecology,” “Infrastructure,” and “Physical.” Each section contains a variety of maps pertinent to its topic—ranging from simple thematic or reference maps that emphasize general facets of geography—such as “Islands” (94)—to more unique characteristics, such as “Pumpkin Production” (102). For the most part, the maps follow the minimalist aesthetic of other Belt Publishing atlases, consisting of simple gray base maps overlaid with one or two thematic datasets. Color is generally reserved for the thematic data, and there are rarely more than one or two

colors on a page. Each map is accompanied by a short, two to four paragraph description, sometimes providing context—such as “Shipwrecks” (42)—while at other times—as in “Lake Depths” (57)—simply reiterating whatever information can be read from the map. On occasion, the text helpfully describes the origin and/or processing of the mapped data; “Lighthouses” (80), “Blue Space and Mental Health” (62), and some others, do this well. These brief descriptions connect the visualizations to broader data infrastructures, positioning this atlas as the product of a vast network of sources, not to mention a tremendous amount of work on the part of its author. The five reference maps in the back of the atlas show detailed bathymetry, borders, and populated places for each of the Great Lakes.

As with most atlases, some maps stand out more than others, both thematically and cartographically. The map of “Sugar Maples” (70), for example, shows the density of these trees throughout the region, while the text describes the significance of maple sugaring to local Indigenous peoples, as well as touching on climate change risks. I found the use of soft greens to be visually pleasing, and the map is clear in its symbolization, showing density by the color of raster pixels. “Lake Monsters” (44) is a charming addition to the “History and Culture” section, and the icons used for different categories of lake monster make for a fun and unique classification scheme. “Lighthouses” (80) makes excellent thematic use of the *firefly* symbol style, depicting each lighthouse as a glowing point atop one of the few dark basemaps in the atlas. Perhaps my favorite map,

however, is the two-page spread beginning on page 90, which proposes a driving route around the Great Lakes for a fully electric vehicle. This map, more than the others, provides a truly unique perspective on the Great Lakes in a way I'd never encountered.

While I am glad the atlas begins with a map of "Indigenous Names" (22), it is one that is unfortunately difficult to read. It contains many tiny place labels attached to barely visible circles atop what appears to be a population density layer. Even more confusingly, there are also larger labels that seem to indicate areas associated with various Indigenous groups, although the map fails to make the relation between these two label categories clear. It does not help that the Indigenous lake names are for the most part covered by other labels. The overall result is disappointing, considering how intertwined Indigenous names are with an understanding of place. More egregious, however, is the "Treaty Lands" (24) map on the following page. The map shows a jumble of overlapping polygons indicating native land ceded and reserved through treaties with the US government. While the map itself is fine—though does lack a legend—the map's description bafflingly presents the settler colonization of America as a nuanced, both-sides issue, and, strangely, emphasizes the differences between the rhetoric and actions of the fifth and seventh American presidents: James Monroe (1817–1825) and Andrew Jackson (1829–1837). I wished there had been some mention, by name, of Indigenous participants in treaty negotiations, instead of the presidents who oversaw some of the notoriously violent resettlement and removal policies. Frankly, I was disappointed by these maps, particularly because their themes are so important to how we understand the Great Lakes today.

On a cartographic design level, I was also disappointed by a lack of consistency. Many atlases establish a consistent visual vocabulary and grammar across the entire map collection. This language can be subverted where appropriate—at times to dramatic effect—but *Great Lakes in 50 Maps* seems to modify its symbolization standard almost at random. Most of the maps in the atlas contain the same three base layers: a dashed line representing the boundary of the Great Lakes watershed, polygons of "Rust Belt States" in light gray, and a darker gray polygon representing the "Rust Belt / Megalopolis" layered atop them. On most of the maps, the border of the watershed is black, but it is red on some—for example on "Start-Ups" (48) or "Lake Monsters" (44)—for no obvious reason. As a

cartographer who looks for, and teaches students about, the intentional use of visual language to communicate meaning, I find the result frustrating. If the symbol schema for the three features that appear on almost every map in the atlas had been kept consistent, then those base-map features would not need to appear in the legend on every map. This would, in turn, leave space in the legend for each map's thematic data; something that is missing from too many of them. The lack of thematic legends on so many maps is very frustrating. It is true that sometimes descriptions of thematic features can be found in the accompanying text, but not always—and when it is not, it requires the reader to consult the data sources index in the back of the book, or, as a last resort, to just guess.

There are also issues with occlusion from overlapping data, in addition to the already mentioned problem with obscured lake names on the "Indigenous Names" (22) map. The "Islands" (94) map uses graduated circles to show islands, based on their size, throughout the lakes. However, stretches of the coastline with a lot of small islands essentially become solid patches of black ink, completely occluding larger islands. Other graduated symbol maps struggle with the same problem, such as "Invasive Species Risk" (64), which has so much overlap among the partially transparent circles that it is very difficult to distinguish individual points. A white stroke around the edges of the circles might have been helpful, or some aggregation of close-set points. The handling of transparency, in general, is another source of consistent visual difficulties. In "Population Density" on page 37, a partially transparent county-level choropleth map is overlaid atop two shades of basemap gray (the Great Lakes states layer and the Rust Belt / Megalopolis layer), making it difficult to distinguish between the various shades of the choropleth, depending on whether or not they are atop the states, the megalopolis, or Canada (represented in white). For this map, the use of a single background layer, with one color, would have been preferable. The lake reference maps at the back of the atlas use bathymetric contours but they are not labeled, nor is there a note about their interval. In Lakes Huron, Michigan, and especially Ontario, the lines are so tightly packed that it is difficult to discern lake depths at all. Hypsometric tinting, and the addition of a legend, would have drastically improved the readability of these maps.

The role of Canada in this atlas is also confusing. After all, a large portion of the Great Lakes watershed is located there. While some maps, such as "Wetlands" (52), contain

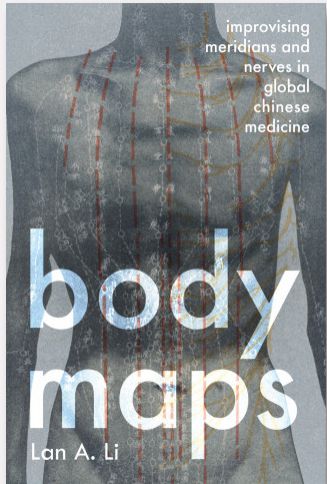
data from both countries, others curiously omit Canada altogether. I am struck in particular by the “Football Proximity” (46) map, which shows every National Football League (NFL) team in the Rust Belt states, yet covers only *one* of the four Canadian Football League (CFL) teams located within the Great Lakes watershed—and that one was only mentioned in the description! Except for the CFL team locations (which is public knowledge) I suspect that data availability issues are likely to have contributed to the paucity of atlas information about the Canadian side of the border. Still, it is hard not to assume that the publisher’s focus on the Rust Belt played a significant role. Whatever the reason, this silence is unfortunate, as it weakens an atlas ostensibly about the Great Lakes watershed as a whole.

Overall, I was disappointed by the lack of visual coherence between maps, and by other general inconsistencies throughout the atlas. These were particularly frustrating because most of the maps are visually quite simple, and a few small edits would have made a big difference. Moreover, the simple style also undercuts the significance and majesty of the lakes themselves, which are often depicted in white, falling to the bottom of the visual hierarchy. Some maps, such as “Football Proximity,” as

previously mentioned, do little to articulate or complicate the unique character of the region. I understand the “50 Maps” atlases are often produced on short timelines, and I want to acknowledge how challenging it would have had to have been for a single person to produce all the writing and maps contained within. That said, I have enjoyed other atlases in this series more, including *Detroit in 50 Maps*—also by Alex B. Hill—which is a far more visually cohesive and striking atlas, and Vicky Johnson-Dahl’s *Buffalo in 50 Maps*. It is disappointing that this Great Lakes atlas seems so rushed.

I was both excited and honored by the opportunity to review *Great Lakes in 50 Maps*, and keenly felt the disappointment I have expressed upon reading it. I came to this review as a cartographer, instructor, researcher, and—most relevantly—as an atlas lover. When I read atlases, I focus on both individual maps and the ways in which they do or do not coalesce into a larger visual story. I am also currently a resident of the Great Lakes region, and, although I do not live within the Great Lakes watershed, I have spent a good deal of time on the shores of Lakes Michigan and Superior. I believe the lakes to be special, worth celebrating and protecting.





## BODY MAPS: IMPROVISING MERIDIANS AND NERVES IN GLOBAL CHINESE MEDICINE

By Lan A. Li

Johns Hopkins University Press, 2025

386 pages, 74 figures

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**Review by:** Zhaoxu Sui (he/him), The Pennsylvania State University

IN TRADITIONAL EAST ASIAN MEDICINE, ACUPUNCTURE and moxibustion are practices, respectively, of placing needles in, or burning dried mugwort upon, nodes and channels of the patient's body. To put it simply, the major channels (*jing-luo*) transport *qi-xue*—the necessary vital energy and blood—to interconnect the body's internal organs. In Lan A. Li's *Body Maps: Improvising Meridians and Nerves in Global Chinese Medicine*, she connects these channels with their graphic representations as meridians mapped onto the human body (Figure 1). Framing these meridian maps within wider social, political, and historical contexts, she offers a diverse, interdisciplinary genealogy of this concept of an invisible bodily network that underpins East Asian traditional medicine. This author suggests that the development of these representations of the human body is entangled with the changing socio-political environments in East Asia, the scientificity of East Asian medicine, and the seemingly inevitable conflicts that arise when culturally-based medical concepts are blended into those of other cultures. Eventually, these integrated attitudes become a naturalized part of everyday discussions surrounding our health and wellness practices.

This evolution in accepted medical practices can be seen in the attitudes of my own family. My grandparents always say that “Western medicine” is only for relieving pain, but that Chinese medicine cures diseases by regulating balance within the human body. My mother, too, always goes to the Chinese medicine hospital to take acupuncture from a renowned doctor to cure her sore shoulder. The



**Figure 1.** A *tu* of a human figure (described as “meridian man” by Li). This *tu* illustrates a particular *yin* meridian (足太陰脾經) connected to an internal organ, the spleen. This *tu* was retrieved from [Historical Anatomies on the Web](http://historicalanatomies.com/).

doctor she sees there is experienced, state certified, and knowledgeable—and she finds that the treatment usually works very well. In contrast to this, my father insists that the treatment only works because the needles directly engage with the nerves—that is, with physically visible parts of the body—and not through a mystical interaction with *qi-xue* flowing through *jing-luo* meridian channels. He, himself, believes in capsules and antibiotics, especially those exported from Western countries.

Lan A. Li is a historian, filmmaker, and assistant professor of the history of medicine at Johns Hopkins University, undertaking extensive research into the ontological and epistemological aspects of technologies of body and health in East Asia. According to her, the success of this project is due in large part to the support that she has received throughout her research career from institutions such as Johns Hopkins and Rice Universities, as well as from friends from all over the world. This book benefits from her diverse cultural and disciplinary background, her deep familiarity with the topic's body of knowledge, and her meticulous translation of important East Asian medicinal terms. Careful translation is especially important here because it regulates the way readers associate key East Asian terms with, or differentiate them from, their English counterparts. Li often uses transliterated terms such as *jing-luo* and *qi-xue*—definitions for which I have placed in the glossary at the end of this review—but she sometimes annotates her illustrations in Chinese characters. She uses the term “East Asia” to explicitly encompass the multiplicity of cultural influences intersecting in this type of medicine: believing that despite the somewhat nationalistic sinocentrism coming from China itself, it is a mistake to view *jing-luo* and meridians as exclusively Chinese. For example, as I discuss below, the early modern Japanese translators studying Dutch documents at Dejima, in Nagasaki, employed some very nimble terminological gymnastics in order to bridge the fundamental gaps between Dutch and Japanese medical concepts.

One of the most important terms throughout this book is *tu*, referring to a technical image or diagram that offers a template for action, a type of philosophical category of knowledge production (Bray et al. 2007). In modern Chinese, a map is referred to as a *di-tu*, or terrestrial diagram (Wang 2023)—a term with a very specific

definition—but *tu* is a broader category, referring to all sorts of technical illustrations. The *tu* examined in this volume serve as a vital device for making material *jing-luo*—the otherwise invisible channels of *qi-xue* transport. Li refers to the graphic representations of *jing-luo* as “meridians,” and throughout the book provides many examples of *tu* depicting human bodies with meridians drawn on the skin. In the “Introduction,” Li constantly parallels *tu* with maps in order to emphasize their similarities as instruments of power “bound by their material construction, their political circumstances, and the demands of graphic conventions” (17). However, she points out that, unlike maps that often imply precision and accuracy, *tu* are understood to leave room for imagination.<sup>1</sup> It is this crucial difference between the two modes of representation that drives meridians into confrontation with nerves in later chapters.

The chapters in *Body Maps* follow a chronological order from ancient times to the modern era, with discussions featuring certain individuals, varying graphic representations of meridians and nerves, and the human body as the stage upon which this all plays out. By placing these actors into the contexts of greater political and social environments, Lan A. Li highlights the dynamic evolution of this understanding of human body across cultures and across time.

In Chapter 1, Li illustrates some of the early graphical representations of *jing-luo*—again, referring to the channels in the human body related to the transport of *qi-xue*. The positioning of these channels and nodes is reflected in *tu* even in this early period, empirically instructing practitioners and scholars and allowing them to pass down this knowledge. This chapter features many ancient anatomical concepts that place the human body within the framework of traditional Chinese/East Asian cosmology. In East Asian contexts, the outer environment—such as the flow of *qi* in nature or the balance between *yin* and *yang*—relates to the body. This contrasts with the ancient European notion of a “rational human soul”—something that is particularly attached with the human body (Lagerlund 2007, Yrjönsuuri 2007)—by instead placing *jing-luo* and a body's internal organs in an understandable relationship and manipulable pattern of outer nature.

1. This argument also applies to *di-tu*. Wang (2023) suggests that *di-tu* are artistic representations that blur the boundary between personal experiences and objective nature of the world. Wang's book has previously been reviewed in *Cartographic Perspectives* (Shah 2025).

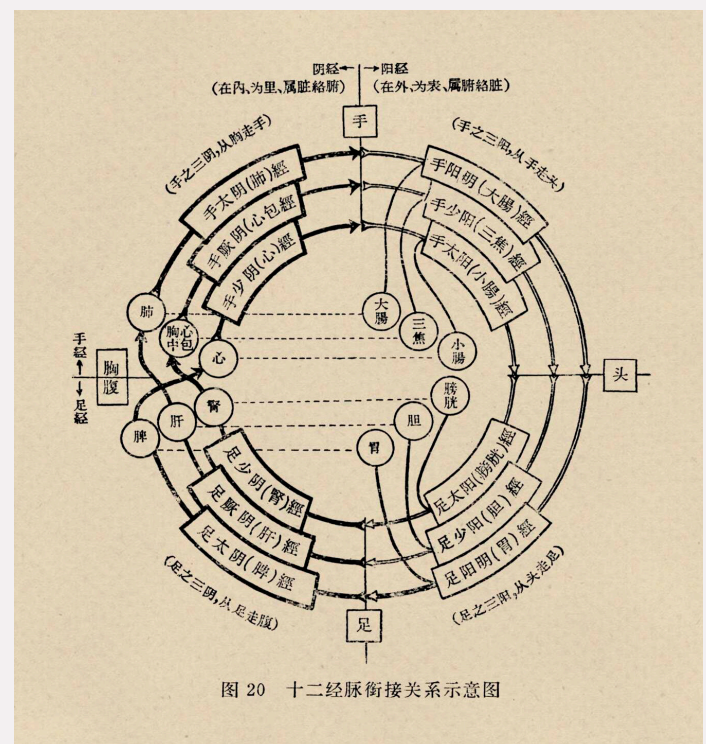
East Asian *jing-luo* and meridians, and European concepts of nerves and blood, are all cultural objects with different ontological ranges applied to a human body. In Chapter 2, Li illustrates early trans-cultural efforts to bring reciprocal understandings of meridians to Europe and of blood and nerves to East Asia. Li explains, for example, how European scholars employed the power of metaphor by very broadly translating—or mis-translating—meridians as *miak*—a neologism that represented a sort of combination of blood, nerves, vessels, and humors—in an effort to fit them into the then-standard European humoral model the translators themselves recognized. This effort, however, was not fruitful, because the concepts of blood, nerves, vessels, and humors were already sufficiently established amongst European readers to make the new concept of *miak* seem superfluous. At about the same time, Japanese scholars engaged in translating Dutch medical materials tried to fit the concepts surrounding blood and nerves into an East Asian context, mis-translating them in their attempt to use them to describe the human body as they understood it. Nerves, for example, are translated as *shin-kei* in Japanese, granting them material existence through meridian-like channels (*kei*) and attributing to them connections to extra-human spirits (*shin*) that would likely have astonished Europeans. As a result, these metaphors—developed solely in East Asia, and only understandable within an East Asian context—become an inextricable part of the East Asian understanding of the European concept of bodily nerves.

This confluence and intermingling of East Asian and European medical thought gave many people hope that it could explain both the phenomena of sensation and give meridians an anatomical manifestation. Chapter 3 positions late nineteenth- and early twentieth-century investigations into the relationship of the nervous system to the network of meridians, in the context of the desire of many scholars to establish nerves as anatomical structures—equivalent to meridians—that work to stabilize *jing-luo*. Meridians, however, are not nerves—unlike nerves, they are neither visible in photographs nor on anatomical charts—and eventually scholars, such as Cheng Dan’an in the early twentieth century, abandoned the use of photographs and nerves to explain meridians after trying these methods for decades, prompting a search for other ways to describe them.

In Chapter 4, Li concentrates on the era after the establishment of communist China in 1949. Dialectical

materialism, as a distinct component of Marxist-Leninist ideology, drove scientists in China to combine meridians with scientific pursuits in different ways. The author narrates the stories of two important figures in China: Zhu Lian and Wang Xuetai. Zhu Lian believed that acupuncture functions through the body’s nerves, and borrowed procedures from Pavlov’s behavior experiments to test the limits of meridian-based therapeutics. In contrast, Wang Xuetai pursued deep studies into historical texts, in alignment with prevalent Maoist dialectical materialist discourses, to develop new types of *tu* illustrating how *jing-luo* systems cycle reciprocally within the body following legible patterns, which parallels dialectical materialist discourses concerning “the unity and conflict of opposites” (Figure 2).

Meanwhile, in the late twentieth century, researchers outside of China pushed *jing-luo* and meridians into the cutting edge of behavioral and physiological studies, specifically for a type of therapeutics using needles to numb specific parts of the body (acupuncture analgesia). The main characters in Chapter 5—Lu Gwei-djen and Joseph



**Figure 2.** A *tu* described as a *meridian wheel* by Lan A. Li (Figure 4.11). This *tu* illustrates all internal organs framed in circles, and meridians framed in rectangles. Yin meridians are featured on the left, and yang meridians are featured on the right. This *tu* was originally Figure 20 in Wang Xuetai’s 1966 work, *Zhenjiu xue shouce*.

Needham—looked to gate control theory (which describes how non-painful sensations can override and reduce painful ones) to explicate acupuncture analgesia. They believed that needles and numbness function in the corresponding body area and organs to cure the pain, although their experiments could not prove a direct correspondence to the functionalities of all the meridians and nodes described in ancient texts. These analgesia experiments are not the only way to push the study of *jing-luo* and meridians further, yet, as Li points out, the crucial question comes down to what kind of ontological certainty a “scientific experiment” can give, and what kind of certainty it cannot.

In a **recorded book talk** available as a YouTube video, Li describes her volume as a perfect example of “using East Asian sources to theorize East Asian techniques.” In both Chapter 2 and Chapter 4, she introduces a contrasting example of the use of Western sources to theorize East Asian techniques, such as how scholars from different eras tried to align meridians with Western medical concepts, including the humoral body and Pavlovian theories. On the one hand, their attempts to introduce Western sources often oversimplified the East Asian understanding of meridians, and on the other hand, in the absence of theorization, the whole idea of meridians was ineffective and unpopular in the West. Nonetheless, meridians still exist in classic East Asian *tu*, and are still employed in traditional East Asian medicine. This has led researchers such as Wang Xuetai and Lu Gwei-djen to develop new types of *tu* to improvise and diversify the discipline, and to use these *tu* to interpret both meridians and *jing-luo*.

For cartographers, Lan A. Li’s *Body Maps* introduces a useful analytical category of *tu* as an encompassing term for all technical graphics that do not necessarily embrace the precision and accuracy sometimes thought of as implicit in the term *map*. The *tu* concept offers a template of action, grasping at a specific type of technique (see Bray et al. 2007). In the context of meridians, a *tu* is a vessel, making *jing-luo* visible for people to recognize and practice their acupuncture and moxibustion techniques on the body. The length of meridians cannot be accurately measured with a fixed graphic scale, nor can they be generalized—in fact, doctors and practitioners regularly use the length between their patients’ knuckles to measure the precise locations of their nodes and meridians—and the imprecision of *tu* fits right in with that, leaving the necessary room for the imagination. The existence of *tu* provides a viable alternative to the modernist vision of cartography

and maps, echoing other research directions in alternative mapping. It is worthwhile to build on the analysis of *tu*, joining them with other mapping activities—particularly decolonial, feminist, and indigenous—across the world, such as Hawaiian hula performances and navigations, Amazonian and Andean body mapping, and situational mappings. Beyond the variations in the textuality of these practices, these all offer templates of action, emphasize the experiences of the human body, and give room for imagination. This book shows how *tu* are developing so as to facilitate the ancient cross-cultural techniques of acupuncture and moxibustion that are still widely used, while simultaneously advancing both traditional medical and mapping practices into the twenty-first century. This identifies *tu* as a distinct cultural practice that offers an interesting and successful model for other types of mapping looking to visualize a whole range of invisible objects.

In general, *Body Maps: Improvising Meridians and Nerves in Global Chinese Medicine* is a challenging but fruitful read for cartographers. It requires readers to have specific knowledge of, and interests in, East Asian cultures and medical technologies, but Li has made the reading easier to digest with her carefully curated translation strategies, engaging storytelling, well-placed body maps (*tu*), and other figures. The book spans many disciplines—including anatomy, medicine, history, linguistics, geography, politics, cultural studies, anthropology, and cartography—to give a highly discursive discussion of body maps in East Asia. Even though the engagement with cartography is mainly concentrated in the introduction—with smaller bits scattered among chapters—it is an enlightened book of art that constantly inspires me to think of maps and their genealogy.

## GLOSSARY

**Di-tu** (地图 / 地圖): a modern Chinese term for map.

**Jing-luo** (经络 / 經絡 / 經絡): major anatomical channels in the human body that Li argues are “both material and invisible, felt in the body . . . and seen in hand-drawn images” (x).

**Miak**: Latin transliteration of *jing-luo*, particularly used by Willem ten Rhijne—a seventeenth-century Dutch doctor and botanist who studied Japanese medicine, especially acupuncture and moxibustion (100).

**Qi / Chi** (气 / 氣 / 氣): the vital energy and a type of internal fluid that is essential to human life (xiii).

**Shin-kei** (神經): the seventeenth-century Japanese translation of the Dutch term for nerves. *Shin* refers to extra-human existence, deities, or spirits, whereas *kei* points to *jing* in Chinese.

**Tu** (图 / 圖 / 圖): a type of technical image in East Asia that facilitates a practice (xii).

**Xue** (血 / 血): blood in modern Chinese contexts, but used for all fluids “nourishing the body” (101).

**Yin** (阴 / 陰) and **yang** (阳 / 陽): Taoist concept of complementary forces in East Asian cosmology, but also applicable to the body. *Yin* and *yang* are used to classify *jing-luo* and internal organs, connecting the human body to the environment through these patterns (278).

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Robinson, Arthur H., Joel L. Morrison, Phillip C. Muehrcke, A. Jon Kimerling, and Stephen C. Guphill. 1995. *Elements of Cartography, 6th Edition*. John Wiley & Sons.

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