Cartographic Perspectives

The Journal of nacis

Number 93, 2019

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IN THIS ISSUE

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IN THIS ISSUE (CONTINUED)

REVIEWS

Cartographic Perspectives

The Journal of **nacis**

ISSN 1048-9053 | www.cartographicperspectives.org | @nacis

All material published in the journal is independently reviewed and/or edited. Submissions are accepted from members of the journal staff and editorial board, but the authors play no role in the assessment or editing of their contribution.

ABOUT THE COVER: *Detail from* Iturup, *by Heather Smith. To see more of Heather's work, visit heathergabrielsmith.ca. The entire map is also featured in this issue's Visual Fields section.*

LETTER FROM THE EDITOR

A topic of much discussion at the recent NACIS Annual Meeting was diversity and inclusion. I think most NACIS members would agree that improving diversity in our profession is a worthy goal, even though amongst us we might have a range of different ideas about the practical steps needed to achieve that goal. Both the academic literature, as well as online news articles and blog posts, discuss how an increased focus on inclusivity has benefits for the profession, our organization, and the world we map. Some scholars have developed cartographic techniques to bring indigenous voices into maps (Pearce 2008), while others have developed or advocated for participatory mapping approaches that enable indigenous people to shape what is mapped and how it is mapped (de Almeida 2014; Wilmott 2019). In the popular press in 2018, Sarah Holder **has examined** how, when more women are involved in mapping, what is noticed and deemed worth mapping changes.

In some ways our organization has already made, and is continuing to make, progress on becoming more diverse and inclusive. I have now been a NACIS member and regular attendee of the conference for twenty years, and I am never the only female in the room anymore. This is also definitely *not* true at other conferences I regularly attend. Despite our progress, as a Society we can continue to improve and be more inclusive in other ways. Since the Annual Meeting, while wearing my editor hat, I have been thinking about how the journal can assist in improving diversity and supporting inclusion in our Society and the profession more broadly.

One way we can raise the profile of these issues is to solicit and review books about or authored by underrepresented groups. In this issue of *CP*, I can point you to the review of *W.E.B. DuBois's Data Portraits: Visualizing Black America*. In his review, Brandyn Friedly wonders why John Snow's cholera pump is ubiquitous while W.E.B. DuBois's work is almost completely unknown among cartographers. Book reviews like these offer an opportunity raise the profile of underrepresented groups within the broader community. To that end, if you know of publications that NACIS members should know about, please get in touch with either myself or Mark Denil, our book reviews editor, to suggest that we solicit a review copy of the book.

A second way that the journal can contribute to diversity and inclusion is to solicit and publish opinion pieces that discuss diversity issues in the profession. We do have an *OPINION* section, but we do not often receive contributions for consideration. If you would like to

initiate a broader conversation about some aspect of diversity and inclusion, I encourage you to consider submitting a piece.

A third way is to support the development and publication of research on cartographic methods to bring additional voices into our maps. I encourage all of you to have a close look at Meghan Kelly's peer-reviewed article in this issue, which brings feminist perspectives to symbols designed to tell the stories behind refugee border crossings.

I am sure there are more things we can also do within the journal to support diversity and inclusion. I encourage you to write to me at **editor@nacis.org**, to share your good ideas with me about how the journal can do something differently and/or additionally in support of these goals.

Because the first 2019 issue was special issue whose editorial was written by the guest editors, this issue is my first opportunity to thank those individuals who served as peer reviewers for submissions to *CP* with final decisions in 2018. Without these reviewers, we would not have a quality journal.

James Ash
Sarah Battersby
Susanne Bleisch
David Bodenhammer
Sébastien Caquard
William Cartwright
Federico Cugurollo
Jacqueline Curtis
Sara Fabrikant
David Fairbairn
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Francis Harvey
Eva Hauthal
Timothy Hawthorne
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Jonathan Huck
Toru Ishikawa
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Chris Perkins
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Erik Steiner
Catherine Schroeder Turk
Ming Tsou
Laurene Vaughan
Travis White
Peter Zeile

I would also like to acknowledge the support I receive from CP's Assistant Editor, Daniel P. Huffman, my section editors (Jake Coolidge, Terri Robar, Sarah Bell, Fritz Kessler, and Mark Denil), and CP's Editorial Board (Sarah Battersby, Cynthia Brewer, Matt Dooley, Matthew Edney, Sara Fabrikant, Bernhard Jenny, Patrick Kennelly, Mark Monmonier, Ian Muehlenhaus, Michael Peterson, Anthony Robinson, Amy Rock, and Robert Roth). CP relies heavily on the contributions that all of these volunteers make to producing our Society's journal.

CP 93 kicks off with an edited version of the address given by the most recent winners of the **Corlis Benefideo Award for Imaginative Cartography**, James Cheshire and Oliver Uberti, entitled "Imagination and Collaboration." Winners of the award are invited to address the Society at the Annual Meeting. NACIS will be seeking nominations for the next conferral of this award in early 2020. I hope that this piece inspires you to think about someone whose work you could nominate. Watch out for details on how to nominate someone for this award in NACIS News.

In *CP 93*, you will find two *PEER-REVIEWED ARTICLES*. In the first, Peter Cobb and colleagues describe a research-led pedagogical approach to teaching about spatial analysis of the past, through asking students to produce web maps of a landscape in western Anatolia from historical literary accounts describing that place. In their article they reflect on the tools they used, insights about the place being mapped that were derived from the mapping process, and the ability of the approach to support students in learning to think critically about digital tools.

In the second article, Meghan Kelly also visits the Near East in her account of developing a new approach to mapping border crossings based on her interviews with Syrian refugees. She demonstrates how feminist perspectives and concepts such as the body, intersectionality, reflexivity, and transformation can be used to enrich conventional cartographic representations of borders to capture border experiences more richly. To illustrate her techniques, she applies them to maps of the border crossings described in her interviews. She presents methods suited for mapping single crossings experienced by a single interviewee as well as methods for aggregating and comparing border experiences.

In *CARTOGRAPHIC COLLECTIONS*, Theresa Quill and Michelle Dalmau describe Indiana University Libraries' program of digitizing their Russian Military Topographic Map collection to make it more widely available. An interesting component of their collection management method is that it documents not only the standard map metadata but also the provenance of each map, providing insight into how the map made it out of the Soviet sphere of influence and into American hands.

In *VISUAL FIELDS*, Jake Coolidge profiles the finalists of MonoCarto 2019, a monochrome mapping competition organized by CP's Assistant Editor, Daniel P. Huffman. If you weren't able to see these works in print at the Annual Meeting, you can see them, along with commentary from the judges, in this volume's *VISUAL FIELDS*.

Six book *reviews* complete *CP 93*. Jasmin Khangura reviews *Mapping Asia: Cartographic Encounters Between West and East*, a title that presents a collection of papers based on a meeting of the International Cartographic Association's Commission on the History of Cartography. Brandyn Friedly introduces us to *W.E.B. DuBois's Data Portraits: Visualizing Black America*, a fascinating discussion of an exhibition W.E.B DuBois developed for the *Exposition Universalle* in Paris in 1900 to tell the story of African Americans since Emancipation. Brandyn wonders why this work is not better known within our community. His review inspired me to buy the book; perhaps it will do so for you too. Next, Betsy Mason and Greg Miller's recent book, *All Over the Map: A Cartographic Odyssey* is reviewed by daan Strebe. He notes that the volume contains many examples of less-known maps with interesting stories behind them, and endorses it as an interesting and pleasurable read. Harrison Cole reviews *Where the Animals Go: Tracking Wildlife with Technology in 50 Maps and Graphics*, the most recent book authored by the 2018 Corlis Benefideo Award winners James Cheshire and Oliver Uberti. While their address, which opens this issue, provides some details about the construction of individual maps, Harrison's review provides you with an overview of the volume's contents. John T. Bauer assesses the contribution of a recent addition to books on using GIS in teaching, *Introduction to Human Geography Using ArcGIS Online*. He finds that it could be used to support a GIS-led approach to teaching a general introductory human geography course using easy-to-use GIS tools. Finally, Nat

Case reviews *The Writer's Map: An Atlas of Imaginary Lands*, a book of 25 essays devoted to examining the intersection between maps and literature.

I hope you enjoy the contents of this issue.

Amy L. Griffin
Editor, *Cartographic Perspectives*

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DOI: 10.14714/CP93.1565

Imagination and Collaboration

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Receiving the Corlis Benefideo Award for Imaginative Cartography was a tremendous honor not least because it came with an opportunity to address the NACIS community. As two independent mapmakers, we are grateful to have been spotted amidst this great sea of talent. What follows is an adaptation of our acceptance speech from the 2018 NACIS Annual Meeting in Norfolk, Virginia. Our original talk can be viewed here: **youtu.be/3hrcziwEyPo**.

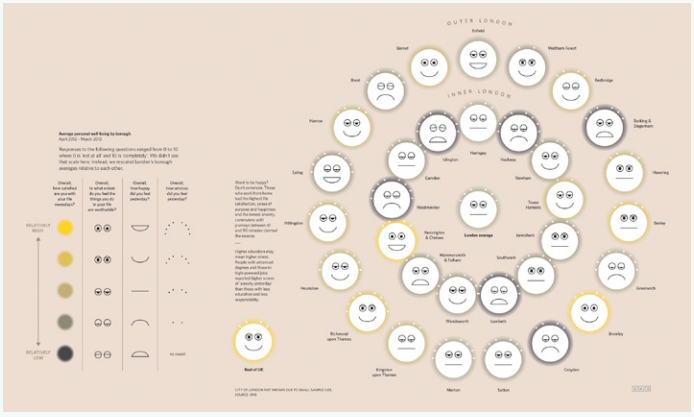
IMAGINATION

Oliver: Good evening. In preparing our remarks, James and I sought to learn more about Corlis Benefideo. For those of you who don't know him, he's the mysterious cartographer at the heart of Barry Lopez's short story, "The Mappist," who heroically clings to his cartographic principles to the chagrin of his employers. Perhaps you can relate. Fictional as Benefideo may be, the values his character embodies are real: curiosity, dedication, imagination. So I must say how delighted we are that NACIS created an award to celebrate imagination. *Serious* imagination. In the serious world of adults, imagination is often relegated to the realm of children, as if we've outgrown its utility. We couldn't disagree more.

Imagination can be a way in. For the cartographer, an imaginative approach can clear a path into a particularly thorny dataset. For readers, it can open a door to understanding—suggesting what the map is about before they read a single word.

But what does it mean to be imaginative? If you agree with the Oxford English Dictionary that it means "having or showing creativity," then we must also define "creativity." For us, creativity is an exercise in surprise. It's about making unexpected connections. Unexpected conversions. *This* is like *that*. This *becomes* that.

For example, what if we took some data on life satisfaction, sense of purpose, happiness, and anxiety and converted each metric into a different facial attribute? Now what if we combined them and applied this conversion to all thirty-three of London's boroughs? Numbers becomes faces become a map.



To be imaginative then, to make unexpected connections, you need to maintain a deep visual inventory of things to connect. We call this "keeping the well full." We go to art museums, travel, read, window shop, browse historical atlases and interior design catalogs, you name it. You never know when a visual reference will come in handy. So we're always looking, looking, looking. The idea for our map showing how to visit all 270 of London's Tube stations in a single day came while looking at a piece of art in Russell Square station not far from James's office.

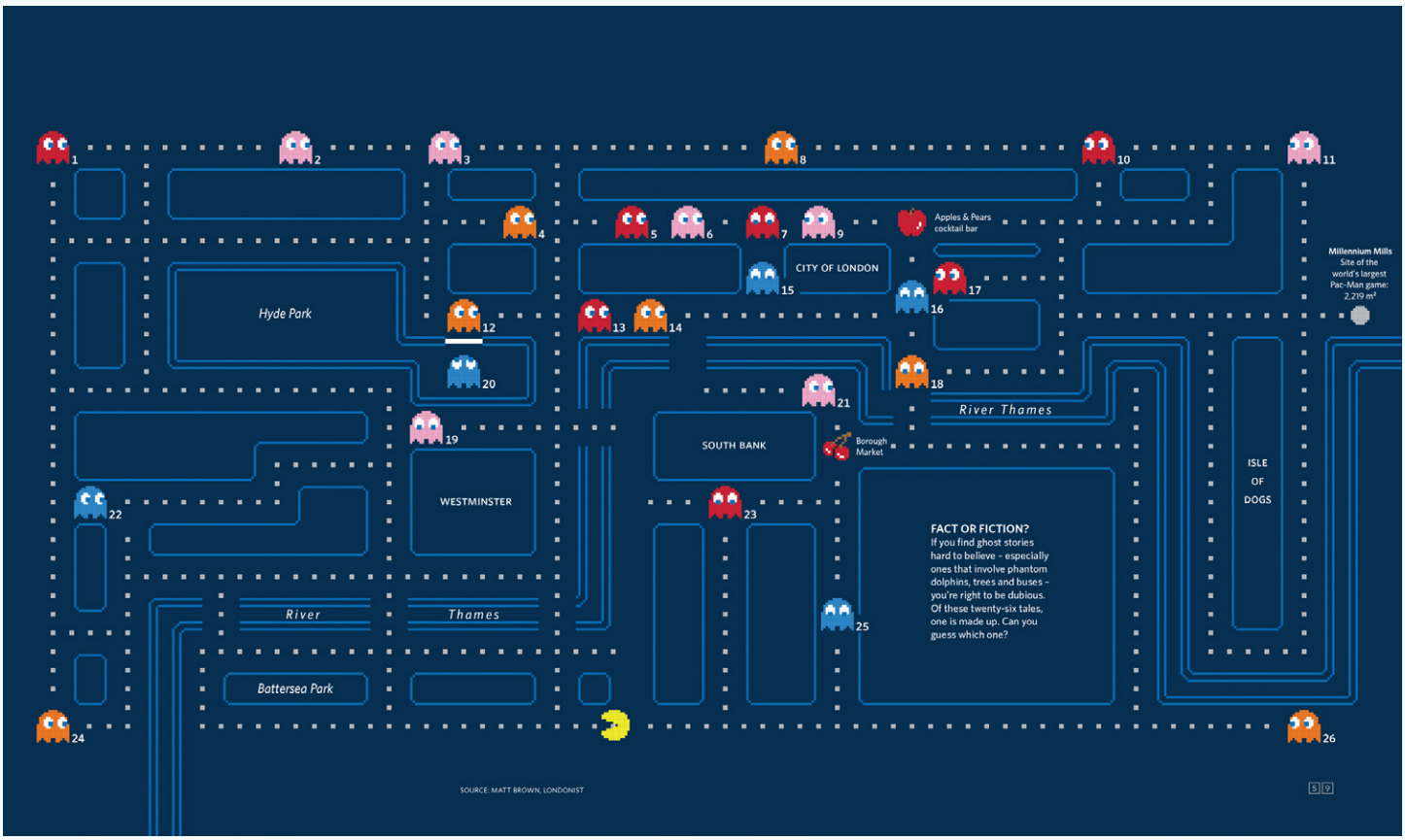
For another graphic, we had a list of haunted locations around London that we wanted to map. So I said, "OK brain, what's something visual and modular that involves ghosts?" This soon escalated to correspondence with the Pac-Man permissions teams at Namco in Japan. Upon submitting a draft, Namco informed us that "pretzel and pear cannot be used. Please [replace with] apple and strawberry." We replied with an amended design, to which we received the following: "Stems of apple and cherry have to be brown (please refer to the design guide for the exact color)." I took this as a good reminder that even when you're being imaginative, details matter. They're what make the metaphor convincing.

I did not always have the courage to make such imaginative leaps, at least not with cartography. I recall one of the first "map meetings" I attended as an entry-level designer at *National Geographic*. Senior designers, photo editors, text editors, researchers, and some of the top cartographers in the world were huddled around a map of Phoenicia. I noticed an opportunity to use color to link some labels and arrows, but I was just 23 years old, fresh out of school. Who was I to speak up?

I studied fine arts, not geography. For most of my life, maps were prompts for my imagination, not products of it. The earliest was a wooden puzzle of the fifty United States. Assembling those colored pieces over and over as a child induced a lasting synesthesia. To this day, when I imagine a state I see it as the color it was in that puzzle. California is lime; Michigan a sky blue; my home state of Pennsylvania, a chocolaty brown.

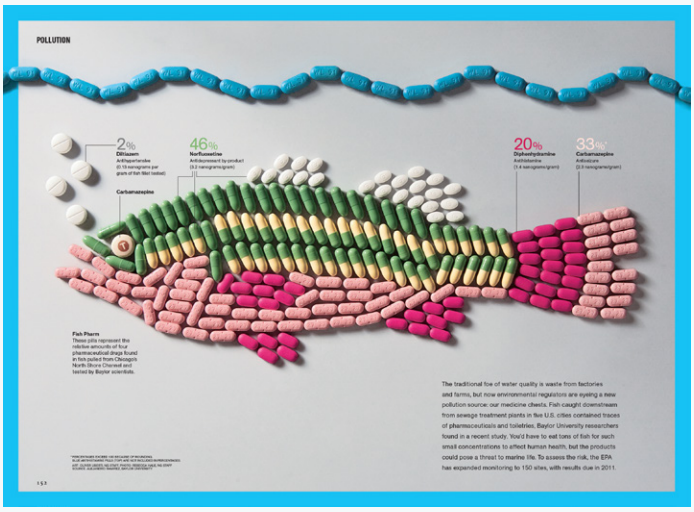
The memory of those shapes proved useful many years later during a pitch meeting at the magazine. The story team was marveling at a video in which Senator Al Franken drew a map of the US from memory. To me, this was not such a big deal. "I can do that," I said. I was not believed. A pen and a napkin were fetched, and I proceeded to replicate the wooden puzzle forever engraved in my mind. My colleagues found this demonstration remarkable enough to put it in the magazine. What was remarkable from my perspective was that they could not see what I saw.

Differences in how we see the world are what make the world interesting. They're also what make *our work* interesting. These differences arise from our range of life



experiences—where we're from, where we've gone, what we've read, what we like, who we love, even those unfortunate events that happen *to* us. But in our professional lives—in companies, universities, and newsrooms—differences can be discouraged in favor of "the way we've always done things around here." We submit that it is precisely our imaginative differences that we must get into our work.

A few months after the napkin map, the magazine was preparing a special issue on the world's water crisis. A story was proposed on an EPA study that had found trace amounts of pharmaceuticals in fish in watersheds around the country. I was asked if I had an idea of how we might visualize it. "Easy," I said. "We'll make a fish out of pills."



I had begun to trust my imaginative instincts. And when those instincts told me to leave the magazine, to rent a small house in Michigan, and to begin collaborating on a book of maps with a geographer named James, I listened.

CURIOSITY

James: My route to mapping came from collecting what I now know to be spatial data. As a teenager, I obsessed over mapping technology, specifically the Casio Pathfinder wristwatch. It had a compass in it. And a barometer. And an altimeter. It had enough memory to store *twelve* hours of temperature and altitude data. On family hiking holidays, I would provide near-continuous updates on the drop in temperature due to the environmental lapse rate as we walked uphill.

From moving weather fronts to human migration, I've always been curious to know how the world worked and how we could navigate through it. Geography offered answers. However, it wasn't until years later that I discovered my passion for mapping them. Even as an undergraduate I didn't set out to make maps. I was driven by collecting and analyzing spatial data. My first real passion for this came from glaciology, and mapping shrinking glaciers in Iceland and Alaska. I then hit a stumbling block. Glaciology quickly became physics—and I'm no good at physics. Still, the methods I had used in my fieldwork, such as geostatistics, gave me a framework for conceptualizing the world in data points. They'd also shown me how maps can bring mountains alive. So with an itch for mapmaking and still no real clue about physics, I was drawn towards GIS and population mapping. That choice ultimately led Oliver and I to cross paths.

His world of design and my world of mapping first united in 2010 when Oliver was still at *National Geographic*. I was studying for a PhD that focused on the geographic patterns of millions of surnames in Europe and beyond. Oliver sought help to produce a map of the most popular surnames in the US. When the map was nominated for an award in London in September 2012, Oliver flew over and stopped by my office to say hello. The success of the surnames map had got me thinking, what if we took all the data we could find—on happiness, house prices, art, violent crime, and life expectancy—and created a new visual guide to my home city for the twenty-first century?

London: The Information Capital captured a moment in the city's history. It was still on a high from the Olympics; the UK had just conducted the most detailed Census to date; more and more of its datasets were being released; and maps were more popular than ever thanks to the internet and a number of hugely successful exhibitions. We now realize that we were just starting to see the power of maps when combined with the promise of big and open data. Since the book was published in 2014, we have seen tremendous progress in this space to the point where cartography can sometimes seem like an arms race to map the world quicker and in more detail than ever before.

COLLABORATION

To keep up, it helps to have a collaborator. In many researcher-designer relationships, the designer comes in at the end. For us, the mapmaking process is an equal partnership from conception to the final map. When we find a promising topic or dataset, typically we'll start by discussing the editorial angle we want to take and possible projections or visual metaphors that could help us frame the story. I will produce initial exports. Oliver will then test crops and color palettes, and I will re-export the data accordingly. It's a constant back and forth.

For example, this graphic shows the origin-destination flows of commuters in Southern England. In R, I drew slightly transparent lines between where people live and where they work. I thought my export looked pretty good. Then in Illustrator, Oliver swapped my black background for blue and applied effects to make the lines glow.

A graphic that scales rectangles by the number of works each artist has in the Tate galleries started life as a basic treemap. Oliver then painstakingly broke the export into its constituent parts, transformed the rectangles into picture frames and sculptures, and arranged them salon-style in "the gallery." Turner is the artist with by far the most works in the Tate so we licensed one of his paintings to fill the biggest box. What could have been an uninspiring collection of boxes is instantly brought alive for the reader.

For our second book, *Where the Animals Go*, our collaboration expanded to include scientists all over the globe who were using new technology to track the movements of animals in unprecedented detail. This experience taught us that it's not fair to expect everyone who creates or analyzes spatial data to be cartographers. Many scientists create maps with an academic publication in mind and then move on without giving them a second glance. Others are nervous of sharing data with those outside their field for fear of their work being misrepresented or used without credit. We may disagree with these perspectives, but they persist. Oliver and I see one element of our work as being able to work with people with such concerns to bring their research to a broader audience.

Working together, geographer and designer, we help scientists find and show narratives in their data. Perhaps counterintuitively, this is mostly an exercise in data *reduction*. We are both fond of saying that a large part of our job is cleaning hairballs. Take "The Seals Who Map the Southern Ocean." This map started out as a mass of lines showing the routes traveled by hundreds of seals around Antarctica. The initial impact came from the sheer volume of tracks collected. Beyond that, we realized the tangle did not communicate much else. Our solution was to extract the journey of a single seal named Rudolf and add annotations and contextual detail such as bathymetry and ocean

temperature to help readers grasp what a seal can teach us about warming seas.

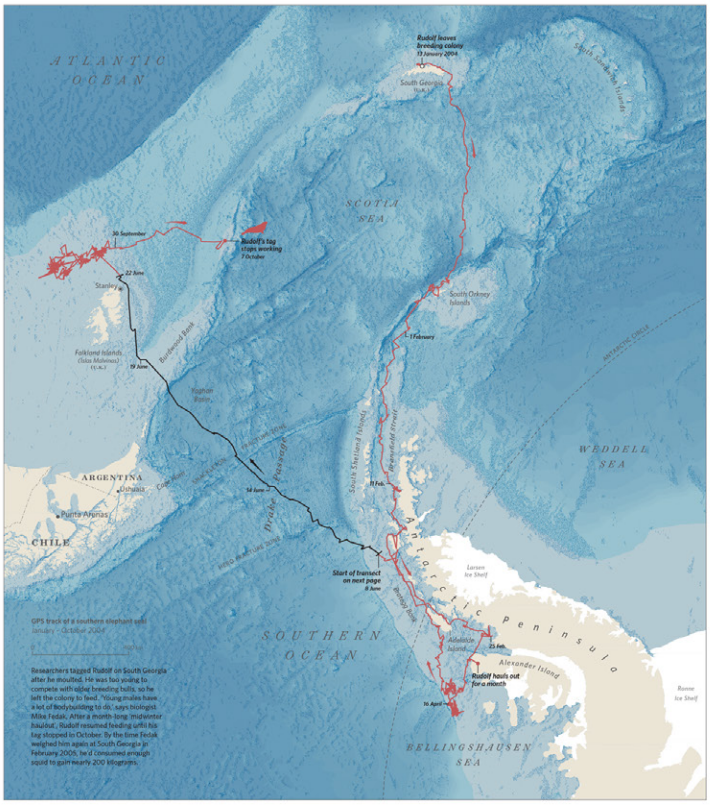
This is the storytelling power of Small Data. Think of a nature documentary. You never hear about every gannet in the colony. The power comes from focusing on a breeding pair that represents the broader story. Barry Lopez's story would've been insufferable if instead of hearing about the life of Corlis Benefideo we had to read the biographies of every person in Fargo. We find story in specificity. But specificity takes more work. More reporting, more analysis, more time.

In "The Mappist," that sort of time-intensive mapping is what Benefideo longed for, what his employers loathed, and what drove him to strike out on his own to make 1,651 hand-colored maps of North Dakota. Oliver and I share a reverence for such historical methods. In fact, many "historical" maps can hold their own with the most data-driven of outputs of today.

Working together, geographer and designer, we're able to combine cartographic details and typographic hallmarks of the past with the computer power of today. Charles Booth's door-to-door "poverty map" of London remains among the most detailed social surveys ever undertaken. In *The Information Capital,* we used transparencies (as Benefideo might have done) to overlay Booth's 1889 map with current levels of deprivation.

Working together, geographer and designer, we're also able to imagine new roles for basemaps. Thanks to the range of Earth observation data now available, basemaps no longer have to be just backgrounds; they can become part of the story. For example, we can obtain meteorological data that reveals the winds encountered by albatrosses encircling Antarctica or satellite imagery that captures the ice floes used by snowy owls while hunting waterfowl. In fact, most of the data acquired for the *Animals* book was for the basemaps—over 200 gigabytes of terrain and vector layers, much of which did not make it to print. As we've learned, that's just part of the process.

With each map, with each book, you'd think the process would get easier. In some ways it has. What once took us a week, we can now complete in under an hour. Part of this is thanks to new software, part of this is thanks to experience, but most is due to the fluency we have developed working together.



The Seals Who Map the Southern Ocean

TO GET YOUR BEARINGS in a new city, you might wander the streets, consult a guidebook or seek recommendations from locals. Often the best approach is to try all three. When it comes to understanding our world's polar seas, oceanographers find themselves in a similar boat; they have deployed sensing buoys to drift in the currents and used nautical charts to study specific areas. However, the one thing they have always lacked is local knowledge.

Step forward Mike Fedak of the Sea Mammal Research Unit (SMRU) at the University of St Andrews in Scotland. He and his colleagues have been conversing with seals about their neighbourhoods for years. They may not do much talking, but the sensors glued to their fur – which fall off when they moult every six months or so – give us information about climate change and seal behaviour that we would never have discovered on our own. For instance, an elephant seal named Rudolf (left) was able to collect sea temperature data under the ice along the Antarctic Peninsula, areas oceanographers would find it hard to reach.

Lars Boehme, an oceanographer at SMRU, recalls unease from other researchers in the early days of 'animal-directed sampling'. They said seals aren't as 'impartial' as scientists. They'll only visit parts of the oceans that are important to them.

For those at SMRU, however, that's exactly the point. 'We're trying very hard to learn about the animals,' says Fedak, 'and, as a by-product, deliver information to oceanography in general.'

It's unlikely that one seal will transform our understanding of the Southern Ocean, but

Weddell seals stay close to ice shelves and provide researchers with many readings from a few areas; southern elephant seals like Rudolf (opposite) produce long transects as they roam the oceans.

Rudolf's long track and deep dives mean he's 'the first seal I introduce students to,' says Clint Blight, the technical brains behind much of SMRU's seal-tracking visualization software.

Southern elephant seal tracks by tagging location
Breeding colony
South Georgia
Marion
Kerguelen
Macquarie
South Shetland
Weddell seal tracks

SOURCES: MIKE FEDAK AND CLINT BLIGHT, UNIVERSITY OF ST ANDREWS; GEBCO; GSHHG; NE

[101]

Oliver: Aspiring authors are often told to "write the book you want to read." For cartographers, the advice could be, "make the map you want to frame." As James and I were working on *London: The Information Capital*, we began to imagine a new type of book, one that we had always wanted but had never seen. Cartography books tended to fall into a few categories. There were instructional books that advised how to pick the appropriate projection or visualization technique. There were anthologies that gathered examples from the past or best practices from the present. There were gift books full of maps as jokes or one-off concepts. And there were, of course, atlases.

What we hadn't seen were collections of original maps designed to comment on the world we live in now. "What if," we wondered. What if we took a step back and used maps to reflect upon larger patterns? To us, the distinction was like the difference between a news article and an essay. We need both. And in writing and photography, we get both. A previous recipient of this award, Rebecca Solnit, builds each of her essay collections as an ensemble. Top photojournalists build a point of view through photo essays not single shots. Where, we wondered, was an equivalent for cartography?

With *London: The Information Capital* and *Where the Animals Go,* we aimed to build a case through a series of "data essays." In *London*, it was a case for what data can reveal about life in a twenty-first century city. In *Animals*, what data can now tell us about the natural world. In both, we tried to take the long view. To put the present in the context of history while also looking to the future.

James and I are now at work on a new book. We've gathered data, designed spreads, written stories. But we're still going back and forth on the book's title because one of the nagging questions that we continue to revisit throughout our process is: what are we trying to say? What's our point of view? What is the sum of 100 maps?

Originally, our publisher commissioned our London book under the working title: *London Infographics*. In a way, that's a perfect example of how many editorial desks think of maps and graphics—as singular things about a subject: a map of London; a chart of population over time; or, as the narrator of "The Mappist" modestly described his own achievements, "some illustrations, however well done."

After James and I had produced a few dozen such "illustrations," we realized that the whole was communicating something more than its parts. We realized that this collection of data, pulled from public data stores and open data policies at the national and city level, would not be possible *in any other city at that time.* So the sum of 100 maps became not *London Infographics* but *London: The Information Capital.* The maps themselves were making an argument for open data, for London as an example for the rest of the world, for the power of maps—and mapmakers—to help inform policy and to improve our lives.

Flip through a magazine or scroll through a site and you'll often see the map as the accompaniment, a complementary figure that helps elucidate "the main story." It is our firm belief that maps can *be* the main story. We believe that you, the cartographer, can be the lead. You have a voice on par with writers and photographers. You have the power to make patterns visible. You have the power to *show* the change we see in this world. You have the power to warn, to reveal, to defend, to delight, to connect, to direct, to focus, to fascinate. You have the power to fire the imagination of a new generation, just like *The City of Ascensions* did for Phillip Trevino in "The Mappist," just like those wooden puzzles and Casio Pathfinders did for us decades ago.

At the end of "The Mappist," Corlis Benefideo says, "the real question, now, is what will *you* do?"

It's a good one. A few suggestions:

To power your imagination, trust your instincts and keep the well full. At conferences, go to sessions on subjects you know nothing about.

To take your maps to the next level, find a collaborator.

And to find your voice, take a cue from Mr. Benefideo himself. You don't have to retreat to North Dakota (or Michigan), but allow yourself time to push an idea as far as it'll go. If there's a subject you're passionate about, don't stop with a single map. Make a lot of maps. Maybe not 1,651, but enough to hear what they're starting to say.

Because you, the mappists, have a voice. And we want to hear it.

DOI: 10.14714/CP93.1488

PEER-REVIEWED ARTICLE

Mapping Historical Texts in the Classroom: The Anatolian Travelers Project

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The process of mapping provides an active approach for students to engage with landscapes of the past. As part of a graduate-level class called Spatial Analysis of the Past, *students were given an assignment to create online maps of nineteenth-century travelers' accounts about western Anatolia (Turkey). Travelers often record their experiences of journeying through foreign landscapes. Although usually written from the perspective of an outsider, these first-hand accounts can serve as valuable primary source documents for geographical information about these regions. The participation of students in mapping these accounts can prompt deep reflection in the classroom regarding the subjectivity of spatial representations and understandings. This class assignment served as the initial step in a larger research undertaking called the Anatolian Travelers Project, an ongoing, open access initiative. This project attempts to collect, organize, and visualize regional travelers' accounts through online mapping, to improve our understanding of how people interacted with this landscape and its inhabitants. The project records and compares, among other things, the travelers' modes of transportation, the routes they chose, their observations about the land and people, and what they felt was worth recording and publishing. Here, we reflect on the use of web mapping as a pedagogical method in teaching the past by reporting on the results of our classroom experimentations. Specifically, we focus on four learning goals: the integration of historical and archaeological methods, an increase in digital literacy among humanities students, experimentation with visualization decisions, and an investigation of landscape and spatial perspectives. Our experiences in the classroom will help inform our future implementations of online mapping as a teaching tool. In terms of technology, we utilized the Neatline plugin to Omeka for mapping, though we consider infrastructure ultimately interchangeable.*

PROJECT BACKGROUND

The Anatolian Travelers Project developed from our archaeological research on diachronic human movement through the landscapes of western Anatolia (Cobb 2016). This region has always been an important area of transit from the Aegean coast to the central Anatolian plateau, and is traversed by east-west river valleys separated by stark mountain ranges (Figure 1). Due to the region's long history of habitation and migration, it is necessary to utilize multiple approaches to understand the relationship between people and place. Archaeologists already commonly leverage a variety of methods to study movement, from the digital analysis of paths over surface models, to the phenomenological experience of the landscapes today (David and Thomas 2008). Yet travelers' accounts can provide a different perspective on these areas and how people traveled through them, reflecting the authors' varied circumstances, motivations, and decision-making factors. These texts can provide a qualitative dataset for travel prior to modern forms of transportation, potentially serving as analogues for the prehistoric movement patterns and landscape interactions that are of interest to archaeologists.

Western Anatolia is fortunate to have a long tradition of attracting visitors who documented their experiences in

Figure 1. *Map of western Anatolia, from the Ancient World Mapping Center's* Antiquity À-la-carte.

the region. Thousands of years ago, it was the subject or setting of a wide-ranging set of works, including Hittite military annals and Xenophon's *Anabasis* (Landry and MacLean 2012). In both cases, interest lay less in the landscape itself than in the actions that took place there. For the Hittite kings, western Anatolia was a liminal zone, marked by struggles with peoples referred to in Hittite texts as "Arzawa" and "Ahhiyawa," the latter possibly referring to Mycenaean ("Achaean") Greeks (Beckman 2016). Xenophon's account of travel through the region shares this military emphasis: it focuses primarily on the arduous journey of his army, recording place names and distances but little other information about the landscape (Purves 2002; Stoneman 2015). Yet during the Ottoman period, especially throughout the sixteenth to nineteenth centuries CE, the area attracted a significant number of European author-travelers who were drawn to the region for a wider variety of reasons, prominent among which was the region's classical past and its Biblical connections—for instance, as the location of the book of Revelation's Seven Churches of Asia (Mellink 1966; Robert 1980).

Our project set out to gather these and other accounts for detailed analysis of western Anatolia. By mapping each account, we both visualize the individual narratives and enable the spatial comparison of multiple voyages by different travelers, including those from different chronological periods. Over time, we hope to build a comprehensive dataset of travelers and their written responses to this region. The Anatolian Travelers Project serves as an online, open access platform for creating and sharing digital maps of these historical accounts. The Penn Libraries have provided the software infrastructure to support and sustain our project over the long term. We hope that these maps can serve as the foundation for future class-based projects interested in addressing some of these same pedagogical and theoretical issues, for research endeavors focusing on human interaction with the landscape of western Anatolia in any period, and perhaps as a model for scholars documenting travelers' movements in other regions.

Although our project has multiple ultimate research goals, our first practical step was a classroom assignment for the *Spatial Analysis of the Past* graduate-level class taught at the University of Pennsylvania in the spring of 2017. This assignment provided the opportunity for us to reflect on experimenting with mapping texts in the classroom, the subject of this paper. We hope our observations

will contribute to ongoing conversations in the literature about teaching through mapmaking (Sack 2018; Huffman 2018). The first section below provides a more detailed overview of the project's goals, and especially our initial pedagogical objectives. Next, we discuss a range of similar research on mapping texts and the past. Then we provide an overview of our online tool selection process, to highlight the tradeoffs during implementation. A subsequent section outlines the text mapping assignment the students undertook in the classroom. Finally, we end with a reflection on our experience with this teaching and learning experiment, by considering how online mapmaking with historical texts impacts students in the classroom.

PROJECT GOALS

As with any digital humanities undertaking, the Anatolian Travelers Project was designed to serve a variety of functions. We intend for this to be a long-term project, and thus we plan to achieve these multiple goals iteratively as we proceed. For this classroom experiment, our first concern was to deal specifically with different tools and methods that could encourage and enable learning in a classroom environment. In this section, we outline the specific pedagogical goals of implementing the initial part of this project as a class assignment. First, however, we provide further details about our ultimate goals of landscape research, data collection, and information sharing. Although not mutually exclusive outcomes, current digital methods do place some limitations on our ability to achieve a proper balance among these objectives. For the moment, however, these motivations contextualized our classroom decisions, from the immediate learning objectives to tool and text selection.

The original genesis of the project was a desire to better understand the archaeological landscapes of western Anatolia. The maps, as the final product of our project, will help us address several research questions regarding human movement through western Anatolia, including during prehistoric time periods. First, we aim to interrogate our sources to understand why historic travelers came to this region and described it, and how they conceived of what they saw and experienced on a phenomenological level. Second, we will study the logistics of transportation, including the means of travel, the choices made about the routes of movement, and possible motivations for travel. This region could be crossed by horse, cart, or foot, and the choice understandably affected the routes each traveler chose. Yet route choices may also have involved practical and environmental concerns, such as the avoidance of flooded rivers, lack or dilapidation of infrastructure and other safety concerns, or interactions with local inhabitants that may have impacted access to certain locations. Third, we want to record what these travelers noticed along the way: what drew their interest and with whom did they interact? The lived experience of moving through a landscape reflects a variety of factors that we hope to capture through the compilation of as many narratives (datasets) as possible. Some of these factors may be consistent through time in the same landscape, so understanding movement in historic periods can inform us about movement in previous periods. In these ways, the maps will help address our goals of supporting both the prehistoric archaeological research of the region and the historical research about travelers.

To form the foundation for our research, another major goal of the project is to collect and share data about this region's past. Comparing travelers' accounts can be challenging, given the diversity of spellings and toponyms used by different authors. However, by mapping the texts, we began to standardize the way space was presented. Thus, it became easier to determine that multiple authors visited the same place, even if they named it differently. Pedagogically, this act of standardization foregrounded the students' roles in curating and interpreting data as a necessary byproduct of the mapping process.

Ultimately, we hope that by sharing these data online, we will enable further research on travel in this region that engages explicitly with the choices of the individual student mapmakers. Another researcher looking at this region could use the maps made by the students, and hopefully gain insights from those maps. At the same time, since each student made different choices about how to visualize the data, these choices will impact the subsequent research. Since these travel accounts are all in the public domain, we are able to publish all the maps with open access, helping to advance wider initiatives in open archaeological and historical research. Although this project began in the classroom, a few students took on larger roles beyond the class. One managed Penn Museum volunteers' further addition of maps and data to the project,

and another graduate student supervised an undergraduate work-study student during a subsequent semester to finalize the maps. We intend to continue to develop the maps and add data over time.

Although we were ultimately motivated to undertake this project due to these larger research aims, we began implementation of the project as a class assignment. In this context, our initial main goal was pedagogical, so here we introduce the specific class context for our work on the Anatolian Travelers Project. *Spatial Analysis of the Past* is a graduate-level course offered as part of an archaeological science curriculum, intended to build students' skills in analyzing archaeological evidence. In the spring 2017 semester, the course had an enrollment of 13 students, including two advanced undergraduates. The class covered both the practicalities of using digital tools to study space, as well as the theoretical considerations of spatial analysis in historical and archaeological contexts. Among the main tools and methods covered were 3D modeling, GIS, space syntax, and geophysical investigation. Weekly assignments, partially completed during an in-class lab session, helped build skills and encouraged students to think through theoretical issues. Each student also helped lead class discussions once during the semester and developed an online tutorial to guide other students in using a specific tool. The instructor and many of the students had primary research interests in archaeology; however, we also had a handful of students whose background was in text-based historical research. The variety of academic backgrounds strengthened our discussions of the different methods and theoretical approaches. Western Anatolia's archaeological sites and landscapes served as the setting for most assignments, chosen based on the instructor's research agenda. As with most of the topics covered in the class, this online text mapping project was originally the focus of a single week of discussion and instruction in the first half of the semester, with a subsequent assignment. Prior to reaching this point, students had engaged with GIS analysis of various types, providing a solid foundation for thinking through spatial problems. For example, the previous week saw the application of GIS route analysis to the study of travel through the landscape. This earlier work offered students a suitable segue into reading the accounts of people who had recorded their own movements through the landscape.

Our mapping of these texts had multiple learning objectives within the classroom setting. Here we outline the four main ones before revisiting them below during a discussion of the results of this pedagogical experiment. First, we aimed to construct an assignment with relevance to both the historians and archaeologists enrolled in the course, one that had the added benefit of acquainting the archaeology students with the use of historical sources, with which they have less experience in their own research. Second, the students had an opportunity to consider working with and sharing data publicly via the Internet, thereby gaining exposure to selecting and using tools for creating and publishing web maps. These assignments thus also encouraged an increase in digital literacy among the humanities students in the classroom. Third, we wanted the students to confront decisions about visualizing textual descriptions of space on a 2D map. A significant yet exciting challenge was—and continues to be—how to display the wide variety of ways in which different authors discuss their surroundings. Students experimented with several methods of representation, and our project continues to wrestle with the difficulty of cartographically conveying the uncertainty inherent in the texts. After all, we are dealing with the travelers' conceptual "maps" of the region, which will differ from the geospatial map upon which we are plotting their journeys. Nonetheless, the pedagogical value of grappling with the different levels of interpretation required to spatially render textual accounts proved to be one of the most rewarding parts of the classroom experiment. This leads to our final classroom objective: to incorporate the students' close reading of the texts, foregrounded in theoretical aspects of the perception of space, within the specific context of Europeans traveling in the Ottoman Empire. Because the text mapping assignment examined the same landscape as the archaeological assignments, the creation of textual maps also provided a new way for the students to think about travel through western Anatolia.

RELATED WORK

Fortunately for our project, over the last decade online mapping has become a normal aspect of our everyday lives, with tools like Google Maps ubiquitously utilized by contemporary travelers. Naturally, this interest in online mapping has progressed into scholarship, intersecting with multiple decades of the application of standalone two-dimensional spatial analysis tools, like GIS, for studying the past (Connolly and Lake 2006). Online

mapping projects complement this work through an emphasis on visualization and presentation, collaborative data creation and management, and the ability to create and share ever-larger datasets that can underpin more robust research. The continued improvement of these tools increases their usability and enhances their role in digital humanities research. In order to better situate our own efforts, we review some of the current trends in mapping's application to texts and research about the past.

DIGITAL INVESTIGATIONS OF ARCHIVES

Several recent projects build on the strong tradition of text analysis in the digital humanities by pushing in the dual directions of growing datasets to study larger phenomena and focusing, at least partially, on the spatial component of the historical information. The Mapping Texts Project of Stanford University and the University of North Texas seeks to combine text-mining and geospatial visualization methods to search for meaning in large, historic newspaper datasets (Torget et al. 2011; **mappingtexts.org**). Efforts thus far have focused on mapping the quantity and digitization quality of the newspapers, as well as locating variations in language patterns across Texas. The online visualizations combine timelines with mapped circles that vary in size or color to represent newspaper data.

A narrative-centric spatial analysis is provided by Vincent Brown's *Slave Revolt in Jamaica, 1760–1761: A Cartographic Narrative* (**revolt.axismaps.com**), demonstrating an effective platform for visualizing history within the limitations of the available evidence. Among other innovative symbology choices, the map makes use of fading tracer lines to reflect the uncertainty of movements by the rebel slave army. Brown's work has helped to expose the strategic intelligence of the rebels, while simultaneously using colonial basemaps that reflect the spatial view of the oppressive power (Brown 2015). While Brown's project focuses on the visualization of an already existing database, other efforts have been made to create comprehensive datasets for the Atlantic slave trade as a whole. Perhaps no large-scale digital history project has recently caught the attention of the general public as fully as the Trans-Atlantic Slave Trade Database, which has digitized the records of tens of thousands of slave trade sea voyages (Eltis 2007; **slavevoyages.org**). A popular *Slate* article transformed these data into an animated map of the forced transport of people from Africa to the Americas over multiple centuries (Kahn and Bouie 2015). While the interactive *Slate* map effectively communicates the scale and orientation of the slave trade, particularly in reference to the destination of enslaved peoples, other visualization choices raise questions concerning the transformation of meaning through the digitization of documents, such as the absence of agency from the map (Rusert 2017). Even the simple act of mapping digital slavery archives therefore brings with it both the opportunity to include narrative and experience within quantitative representations of data and the possible pitfall of producing what popular audiences may interpret as a definitive model.

In these cases, however, the emphasis of the mapping projects tends towards data visualization and publication, with the authors employing methods that support analytical interpretation of the data. Where public presentation is of greater concern, such as the *Slate* article, a concentration on effective storytelling through data is the primary concern. Missing from these projects is a consideration of the pedagogical value of creating these maps in the first place, especially when students participate. The Mapping Texts Project, for example, cites the participation of students in the project, but does not consider what value arises from their inclusion in the process of mapping.

LITERARY GEOGRAPHY AND MAPPING NARRATIVES

While the creation and visualization of digital archives can serve to connect large datasets with narratives, there remains a gap between the qualitative experience of individual movement and its cartographic representation. In light of this problem, a slightly different perspective on mapping texts has emerged from literary studies that investigate fictional spaces. Literary geography explores how texts describe and represent space, as well as how they produce conceptual landscapes in response to those spaces, especially through the interrelations and networks among people and places in the narratives (Alexander 2015). This field also deals with how texts are received in different parts of the world, and the related reader-author interaction via the texts (Saunders 2010). As Sheila Hones has observed, "the idea that the literary text itself can be understood as a spatial or geographical event happening in the interaction of multiple agents" has guided recent research projects that seek to understand how editors, publishers, and ultimately readers shape the metaphorical landscape of a text (Hones 2017). In the case of non-fictional travelers' accounts, these multiple vectors of representation and creation make

their way into the narrative descriptions of travel and are influenced by the author's literary environment.

In her study on George Macdonald's novel *Lilith*, Dryer (2012) explores the spatial implications of the protagonist's transportation into a magical world where his choices are inscribed upon the landscape. Dryer is particularly interested in examining the lack of choice in the literary space of the labyrinth, where all choices inevitably lead to the same conclusion. This approach to mapping space creates a conceptual map, something like a "mental map," that does not attempt to accurately reflect space but rather to represent relationships between literary locations and the movements among them. Along these same lines, Caquard (2011; 2013) surveys the interface between mapping and narrative in literature, film, fiction, and personal narratives such as blogs or oral traditions in indigenous societies. Although he finds that geospatial storytelling allows for powerful visualizations of narratives, Caquard argues that currently we are bound by our reliance on what he calls "grid maps"—commercial services such as Google Maps. These deploy satellite imagery and modern cartographic standards to produce scientifically accurate representations of space, on top of which "narratives" are mapped. This misses out, however, on the diverse narratives of spatial interaction, such as those found among indigenous societies, that do not conform to modern conceptions of mapping (c.f. Caquard et al. 2009). Our project and in-class assignment have highlighted a similar tension between representation and reality, showing that the mental landscapes of our Anatolian travelers are often difficult to pair with top-down satellite imagery.

SPATIAL ANALYSIS AND VISUALIZATION

Digital spatial analysis tools, such as GIS, have for years impacted every aspect of the historical research process (Knowles 2002). Recently, attempts have even been made to extract quantitative data from experiential narratives of travel through landscapes. For example, Murrieta-Flores, Donaldson, and Gregory (2017) have applied GIS to the study of historical works of travel writing about the English Lake District. They found that the locations mentioned by travelers, moving by cart on major thoroughfares, corresponded directly to the least-cost paths through the Lake District, indicating the importance of the natural corridors of the region to wheeled transport. Similarly, Rahman, Zaman, and Hafiz (2016) used aggregated point analysis to create boundaries for the city of Dhaka, Bangladesh based on mentions of specific and locatable places in historic texts. By comparing this map with the local geomorphology, they concluded that the texts can provide a relatively accurate idea about the boundaries of the pre-Mughal city. In both cases, the impetus towards recording data points from narrative texts serves as a model for how scholars can create and share spatial datasets from historical accounts.

There have also been previous attempts to use Neatline software in the mapping of texts. Neatline, explored in detail later, is a plugin to the open source web exhibit-building software Omeka. Evans and Jasnow (2014) used Neatline to investigate Homer's catalogue of ships in Book 2 of the *Iliad* (**ships.lib.virginia.edu**). By using novel methods of syntactic analysis to pay close attention to the relationships between place names in the text, the authors found that Homer describes accurate travel routes in the catalogue. More interestingly, the use of Neatline allowed the authors to also locate an exception to this rule that would have otherwise remained uncovered. The representational power of Neatline, the authors suggest, combined with their methodological approach, should allow previously unlocated sites mentioned in the text to be geographically determined in the future.

Other scholars have also touched on the relationship between the mapping process and the study of history in multiple contexts, with particular focus on the mode of visualization. For example, Muri (2016) highlighted the importance of spatial visualization as part of the historical research process in her work on London's Grub Street. Earley-Spadoni (2017) advocated for applying digital humanities approaches, including digital storytelling and data visualization, to archaeological studies. A prime example of the latter is the recent proliferation of network analysis studies in archaeology, where the connections among sites are foregrounded (Brughmans 2013). Thus, there are many possibilities for the visualization of data, but we also need to consider the impact of data uncertainty on visualization. MacEachren (1995) discusses several issues with attempting to deal with uncertainty during the mapping process. Color saturation of symbols, blurred or transparent symbology, and the resolution of objects can all play a part in signaling the uncertainty of a mapped feature. Yet such sophisticated graphical representations also run the risk of overwhelming both new users of the mapmaking tools, such as students, and an audience unfamiliar with unclear information. We must always take into consideration the fact that most users of the maps, who are generally untrained in critical perspectives, may view

the results as certain because of the polished visualization, even though the underlying data are actually uncertain.

TRAVELING IN ANATOLIA

Past efforts to map Anatolia more precisely include the products of nineteenth-century German cartographers, whose works would become popular resources in the era of many of the travelers' accounts investigated by our project (Débarre 2016). While these maps were extremely useful to us for locating the toponyms mentioned in some of our texts, it is clear that the aims of these travel narratives and the cartographic representations of space in the nineteenth century were often at odds. Turning to recent work, we can find other online projects, including *Travelogues: Travellers' Views*, produced by the Aikaterini Laskaridis Foundation, which has been cataloging accounts from travelers to the Eastern Mediterranean from the fifteenth to the twentieth century as part of a larger interest in Greek heritage in the region (**eng.travelogues.gr**). The Anatolian section of this website provides a valuable guide for finding accounts to map. Similarly, Külzer (2016) relies on travelers' accounts to help understand routes through this region in the Byzantine period, as part of a larger effort to map the changing territory of the Byzantine Empire and movement through it. Another project called Mapping Ancient Texts is using online tools, similar to our own, to map travel narratives and correspondences, highlighting movement among sites, rather than just the sites themselves (**mappingancienttexts.net**). The Mapping Ancient Texts project team covers ancient authors, will likely expand their dataset to Anatolia eventually, and happily appear to intend to create a publicly accessible resource.

If we step back and consider the specific context of foreign travelers in the Ottoman Empire, we also intersect with scholarship on nineteenth-century orientalism (Said 1978). These travelers came to Anatolia with preconceived notions about what to expect in terms of the landscape, peoples, and government. Europeans considered the East a land of decadence, fallen from the height of a classical past. This is often reflected in their writings as condescension regarding the local inhabitants. Many of the author-travelers had an amateur interest in archaeology, so especially palpable can be their characterization of the treatment of local archaeological remains, including destruction (Cobb 2018). In our project, we hope to consider the impact of this orientalist milieu on foreign travelers' perceptions of space, thus contributing to larger post-colonial dialogues.

THE ANATOLIAN TRAVELERS PROJECT

Like many of these digital projects, our approach foregrounds the importance of collecting the data together in one place and visualizing the texts spatially to inform our understanding of past movements through western Anatolia. Yet we also hope to focus on *all* travelers who recorded this area, rather than just the most famous ones, in order to mine the "long tail" of the dataset for additional insights. For the time being, our approach is qualitative, focusing on visualization and interaction with the texts, rather than on spatial analytical approaches such as least-cost path analysis, though those are important to our wider interest in the region and to further archaeological research. By combining qualitative and quantitative approaches, we hope in particular to prevent the devaluation of individual factors impacting decision-making, especially the cultural or ideological purposes of the travel. Our project attempts to grapple with these factors while reflecting the narrative created by the author, including dealing with their own original decision to publish their journeys as texts. Like other projects, we also emphasize the open and online nature of our work both to support other researchers and to engage with the public in a more fundamental and educational way. Most immediately, however, our project hopes to foreground the pedagogical value of map creation. Many mapping projects employ student workers or utilize student resources in the classroom to collect, parse, or visualize data. Rather than treating this simply as a necessary part of any mapping project, we hope to encourage scholars and researchers to use the mapping process as a teaching opportunity with its own benefits.

EVALUATION OF TOOLS

In preparation for the Anatolian Travelers Project, the Penn Libraries evaluated several different online mapping tools for their suitability for this project's requirements. We reviewed tools that matched our use criteria with the understanding that each tool would bring with it some limitations. Since this project was starting out as an experiment with multiple goals, we realized that no one tool would be a perfect match for our project. The class

instructor determined the most important criteria in collaboration with the digital humanities specialists at the Penn Libraries. In this way, our tool decision was driven by the necessities of the classroom setting, but guided by our vision for the project's future.

Before looking for the right tool, a researcher should ask a number of different questions: they should consider the data they are starting with, the desired final product, the team that will collaborate on the project, how to acquire the correct tool, and how to learn to use that tool effectively. Our requirements for a tool prioritized ease of use and the ability for multiple contributors to work simultaneously. Given that our intended users had limited web design and mapping experience, we sought a simple, easy-to-learn interface. Yet we wanted a powerful tool with multiple means of data input and output, without the need to invest substantial effort in customizing any part of the process. Most importantly, we sought the ability to display textual narrative alongside a map and timeline, "out of the box." Increasingly in university environments, libraries and digital humanities centers contain the expertise to assist with these types of digital collaborative projects, as was the case with the Penn Libraries.

Mapping for the humanities often falls into three separate, but related, use cases: geospatial analysis, visualization of tabular data, and storytelling. Geospatial analysis usually involves the statistical processing of vector and raster spatial datasets, often within GIS software. An example would be working with multiple types of geometry collected during an archaeological surface survey to determine the target area for a future season's fieldwork. Several types of information may also be recorded in tabular form, such as ancient trade routes or the locations of sunken ships, based both on coordinates of the findspots and associated data collected from large text corpora. Esri's ArcGIS, a powerful software suite with extensive analytical capabilities, is the most well known tool in this category. It runs only on the Windows operating system, is complex to learn, and requires a license fee. QGIS (**qgis.org**) is a very similar tool in terms of complexity and functionality, but is free, open source, and runs on additional operating systems. As a result, it has seen increasing popularity in the humanities over the last few years. The web application CARTO (**carto.com**) provides a limited subset of the analytic functionality of the main GIS platforms, but as an online tool it better supports collaboration while being free for small-scale use.

Apart from being processed and analyzed, the data must also be mapped. Often, this takes the form of static presentations of an existing dataset with little to no accompanying narrative, leaving large amounts of interpretation to the viewer. CARTO is currently the most popular platform for this type of map, enabling users to import various base maps and upload tabular data. It requires minimal understanding of web design to create professional-grade visualizations. For users interested in more complex customization, MapBox (**mapbox.com**) allows the creation of custom basemaps, and provides free accounts with limited functionality. Tim Waters has created the free online Map Warper (**mapwarper.net**) tool to crowdsource the georeferencing of historic maps, and it can be used for a variety of purposes. Researchers with minimal training in web design can also take advantage of Leaflet (**leafletjs.com**) for customizing user interaction with spatial data.

Storytelling, through the mapping of narratives, is a specific type of visualization that best fits the goals of the Anatolian Travelers Project. The tools we investigated included StoryMap JS (**storymap.knightlab.com**), an easy-to-use website for highlighting the locations of a series of events. This free tool also enables maps to be embedded in other websites. Esri, too, supports an online product called Story Maps that enables the creation of exhibits using existing basemaps in their archive. This tool can exchange some data with ArcGIS and is therefore ideal for projects where the pre-existing work is already Esri-compatible, and it offers some limited free functionality. In both cases, the focus of the application is on quick and simple production of a visual narrative, with very little room for customization without significant programming experience.

The Neatline plugin to the open source Omeka content management system is also designed for storytelling and mapping narratives. We decided to utilize this software for a number of reasons. First, Omeka enables large collaborative projects and has a significant community of support. The Penn Libraries offered workshops on Omeka and Neatline, allowing the students to begin building their maps after a brief training session. In addition, without any customization, this system afforded good integration between an interactive timeline, based on an additional plugin called Simile, and the main map. Second, we could place links in the narrative text to any element created on the map, thus allowing for a close relationship between the text and the map. We could also add extra information about each map element in a customizable

popup box. The georeferencing of historic maps is directly supported in the interface, as is adding a wide variety of geometries. Although the interaction of the various pieces does add complexity, we benefited from the flexibility of the software. The Penn Libraries has been extending this tool, adding functionality for creating a map legend, importing a variety of spatial formats, and for exporting data for reuse in other systems.[1] This is possible due to the open nature of the Omeka source code base, which allows for expanding functionality through easy modification. These contributions to the community should benefit other Neatline users, further highlighting the benefits of open source software.

MAPPING ASSIGNMENT

The instructor for the *Spatial Analysis* class independently developed all course assignments, including the Neatline text mapping task. In addition to the pedagogical motivations discussed above, the purpose of the assignment was to both produce a map that could be shared publicly on the Internet and to support archaeological field research in this region of Anatolia. Because the specific tool we selected had significant influence on the shape of the assignment, the practical details of the assignment were articulated in collaboration with the digital humanities specialists at the library.

The week began with a discussion during class time about the purpose of the exercise and the theoretical considerations of mapping historical texts. The discussion was facilitated by two graduate students, who proposed readings for the class, as well as the instructor. We read two articles: Murrieta-Flores, Donaldson, and Gregory (2017) and Rahman, Zaman, and Hafiz (2016). The former was an example of how literary texts could be studied with the analytical tools provided by GIS while the latter used a variety of documents, such as texts, itineraries, and urban descriptions, to map the spatial extent of a historical urban area. Both readings allowed students to contextualize the process of transforming textual narratives into two-dimensional maps. In particular, the students interrogated the analytical validity of utilizing certain GIS tools, such as k-means clustering and least-cost-path analysis, for interpreting the past. Our subsequent class meeting provided lab time for the students to choose and begin mapping their texts. Library specialists conducted these lab sessions in order to answer technical questions specific to Neatline and Omeka. The assignments were further facilitated by the online tutorials written by two students to guide use of the tool for our specific workflow, as well as by the public documentation made available by the Neatline development team (**docs.neatline.org**).

We provided each student with a login to Omeka that allowed them access to all parts of the system through the dashboard screen. The next step for the students was for each participant to select their own individual text and conduct primary-source data entry in an unsupervised environment. The only guideline was that the traveler's account should describe the central portion of western Anatolia, with a preference for publications documenting travel prior to the introduction of railroads to the region in the mid-nineteenth century. Students were guided towards Google Books and **Archive.org** as possible repositories of traveler accounts, and a few illustrative examples were provided for reference. Ultimately, however, we intended for the students to take an active role in the selection, curation, and visualization of their data so as to better replicate future, personal projects. This control also encouraged students to be more discerning throughout the mapping process, as "best practices" had to be formed through individual reflection and use of the Neatline tool. Although students had the option of mapping texts from non-English languages, only one student chose a text in French. This decentralized model of data entry enabled great flexibility for varied experimentation with texts and visualization. Instead of mapping entire texts, however, students mapped only those sections of the texts that covered the region under investigation, usually amounting to just a few pages. The students independently designated which parts of the texts were appropriate and noteworthy for visualization on the map and decided how to visualize them. At the end of the assignment, each student also wrote a paragraph reflecting on the process.

Each map constitutes an "exhibit" in Omeka, which currently prevents participants in the project and the public from viewing multiple accounts as layers on the same map, a desideratum for the future. The public view of a Neatline exhibit is composed of three separate elements: the text

1. For source code, please see the Neatline-related subprojects of this Github group: **github.com/upenndigitalscholarship**.

itself, which is shown on the right-hand side of the screen; the map with geometry and popup windows, shown on the left-hand side; and the timeline, which is displayed at the bottom of the screen (Figure 2). Contributors can add new "records" to the map through the Neatline map interface, where they control the popup window information for each record, as well as its geometry and display style on the map and its chronological characteristics for the timeline. Records for our purposes might represent sites, villages, routes, mountain ranges, areas, or bodies of water, among other things. Style options for geometry include type (point, line, polygon), size, color, opacity, default zoom, and additional settings. For this assignment, each student was required to map 30 records, an artificial number meant to ensure a uniform workload.

Neatline records can interlink with a variety of different elements within the website. Omeka itself contains an element type called "item" for managing HTML content, and these items can serve as the content for the popup window associated with a record. Records are identified, and can be navigated to, by unique alphanumeric names called "slugs." Within the exhibit's narrative text, we can add links as HTML tags that use the slug as an attribute to connect to each record. These links are highlighted in grey for display and emphasis within the narrative text (Figure 3). The timeline also links to the records, based on their chronological properties. In this way, the narrative text, timeline, and popups are all interlinked with the records displayed on the map, providing multiple levels of information for the viewer.

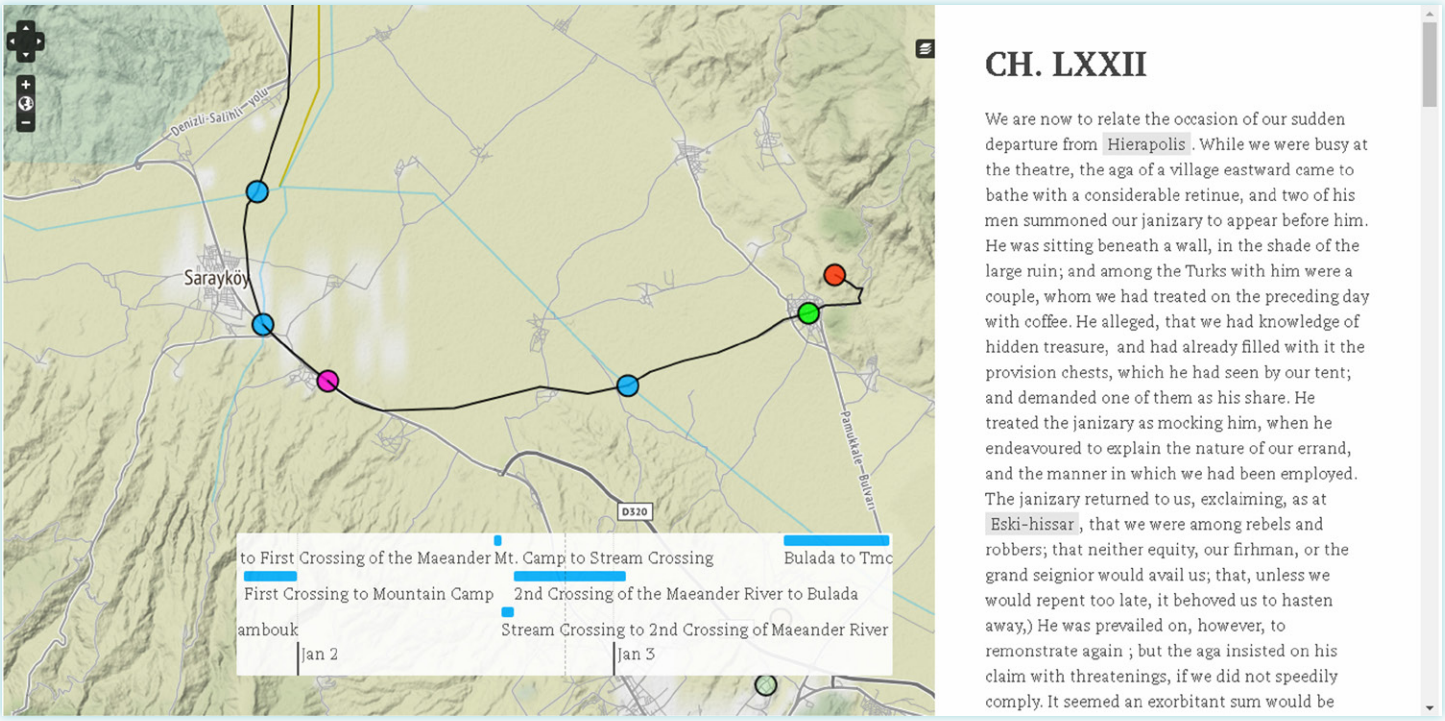

Figure 2. *Visualization of Richard Chandler's (1825)* Travels in Asia Minor and Greece. *Various color hues were used to designate feature classes: red represents ancient sites, green contemporary or modern sites, blue the crossings over rivers or streams, and purple the location of a campsite. Map by Jordan R. Rogers.*

RESULTS

Implementing the first stage of the Anatolian Travelers Project as a classroom exercise has provided information on a variety of aspects of the project that have helped us identify future avenues of research and study. We acquired important information about the online mapping process with historical texts, about the logistics of managing the task as a class exercise and of using digital tools in a classroom setting, and about the individual

experiences of students learning about the past through mapping. Experimentation was enriched by the variety of the students' academic backgrounds and the freedom with which they could each make choices during mapping. Although geographically constrained, the travelers' accounts themselves ranged widely in terms of information recorded and narrative structure. The students each made decisions on the criteria for inclusion of sections of each text and on how to visualize the features mentioned. Since the original authors never intended the mapping of these texts, we encountered some general, overarching issues when mapping the narratives. The students' learning outcomes varied; we determined that some aspects of the assignment were effective, but plan to redesign others in preparation for offering this type of assignment in future classes. Here we revisit the four learning objectives for the assignment, as outlined above, and review how the mapping texts assignment accomplished or fell short in achieving these outcomes. Finally, we consider how the assignment may influence future research projects carried out by the students.

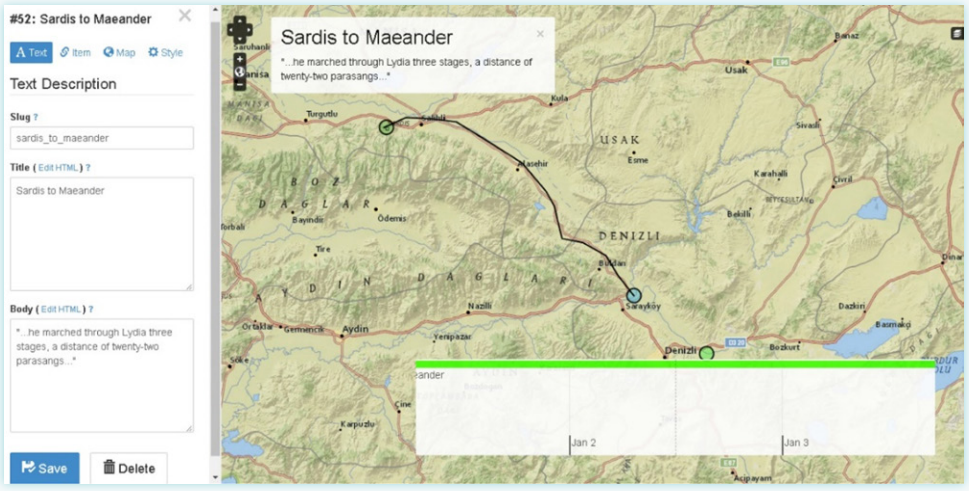

Figure 3. Neatline record view with HTML slug.

INTEGRATING HISTORY AND ARCHAEOLOGY

As the primary focus of the class was archaeological, this historical assignment provided a contrast with the other tasks completed during the semester. From a practical perspective, this began with the students selecting the texts they would map. Choosing a text was challenging for students who lacked prior experience with this region or its history, but online tools aided our discovery process. Google Books and Archive.org both contain many scans of pre-twentieth century accounts and enable full-text keyword searches. Students naturally gravitated towards accounts related to their own research interests, and this led to a diversity of text types, ranging from crusader annals (Magoulias 1984), to accounts following the path of the ancient author Xenophon (Ainsworth 1844), to site descriptions of the Seven Churches of Asia (Arundell 1828). For pedagogical purposes, however, it is appropriate to ask whether in future iterations of this assignment, it might not be more beneficial to encourage students to examine accounts outside of their personal research areas in order to facilitate exposure to new information.

Each account offered a different characterization of the spaces in which the author interacted with people, monuments, and the landscape itself. We sought texts that would lend themselves to the relatively easy translation of the narrative into a map, with enough information for visualizing the landscape. Not all accounts, however, contained a linear progression of movement from point to point, and some accounts contained more detail than others about the logistics of travel, such as place names, detailed route descriptions, distances traversed, and the time required for the traveler to move through these spaces.

Considering the varied academic backgrounds of the students involved in the project, treating these historical texts as repositories of data proved non-problematic. The ancient history students appreciated the chance to consider space from a textual perspective, while the archaeology students did not express any concerns about working with historical texts as an evidence type. Instead, a complaint raised by several students was their lack of familiarity with the context of the region—especially local toponyms or the history of visitation. Nevertheless, as most of the students conduct fieldwork in diverse worldwide locations, they recognized the value of the travelers' accounts as additional documentation to support landscape studies. Among the comments submitted by the students reflecting on this assignment, many raised new questions about the spatially and temporally distinct characteristics of this region that they had not previously considered. This appears to be

influenced directly by their ability to consider the thoughts of the people in the landscape reflected in the writing. One of the more welcome consequences of the assignment was the students' interest in locating and mapping historical accounts for their own regions. By equipping students with both the ability to use online mapping tools and the intellectual apparatus for reflecting on their visualization choices, this assignment has proven to have impacts outside of the classroom.

DIGITAL LITERACY

Getting students to think critically about digital tools was one of the most successful aspects of the assignment. The students are now aware of the possibility of undertaking a similar project in the future for their own research. Just as importantly, they know what resources are available for their assistance—namely, the digital humanities specialists at the library. Several students in the class have gone on to engage with other digital humanities projects and have become part of the wider digital humanities community at the University. Two students developed extra proficiency with this tool since they had the additional assignment of creating an online tutorial to explain the workflow to their peers. Overall, we experienced almost no technical problems that prevented students from being able to use Neatline on their own. The combination of multiple sources of help—from an in-class lab to the online documentation—facilitated student work on the project. The instructor was also available for answering questions at any time over the Slack messaging platform.

Another important learning outcome of this assignment was the students' exposure to the iterative development lifecycle of digital tools. Neatline satisfied many of our needs, but most students saw opportunities for improvements that would have aided our project. No tool is perfect, and we are very grateful to the Neatline team for their efforts. Nevertheless, the students' ability to communicate requirements to technical specialists is an important component of digital literacy and tool development. The Penn Libraries are currently working on implementing some of these upgrades and will share those enhancements with the community. Perhaps in greatest demand was a map legend that would enable us to display what the colors and shapes indicated for each map. The ability to toggle data layers would also be useful to allow a more dynamic viewing experience and to focus the viewer's attention on certain data. Additional label functionality, through which label size, position, and orientation could be chosen, would be welcome, both within the timeline and on the map. Students also discussed the possibility of bringing our data into a more precise software platform such as ArcGIS Pro for further analysis, so we are interested in seeing the development of a robust data export routine. A final consideration raised by students was the possibility of visualizing multiple maps simultaneously. Since we are producing multiple maps, one for each text, the ability to display these together as layers in a single map view would facilitate comparison between historical accounts and mapping choices made by the students.

Although we utilized the timeline feature in each map, some students also noted that the integration of the temporal dimension with the text and the map remained challenging. First, the timeline required absolute dates, and these were not always provided by the authors. In such cases, the student had to choose an arbitrary start date and assign the remaining days relative to that origin point. Even when the accounts provided temporal data, the occasional nature of their inclusion and their unreliability were readily apparent. Some texts, for example, specified times, while others only specified days. Many texts were inconsistent in how often they recorded time (hours of the day), and some texts did not record time at all. Further, the timeline plugin to Neatline only enables limited customization, leading to limitations in how we could visualize time. For instance, we could only display the time at one temporal scale per map, so if an author switched between reporting hours and days, the timeline would appear to stretch or compress the time.

VISUALIZATION DECISIONS

A major learning experience from this assignment was the opportunity to consider how we could visualize spatial elements described in a textual narrative on a 2D map. The Neatline record construct necessitates the partitioning of the continuous narrative into discrete units of data. Students located these units spatially and chronologically, and then decided how to visually represent them on a map in an attempt to reflect the author's original intent in recording the locations and to highlight what they believed to be important for future research aims. The popup box associated with each record enabled the presentation of additional descriptive information. Students

decided where to separate the data units and how much of the overall narrative to include in the exhibit, as well as, importantly, what to exclude. Some texts fit this model better than others. Linear accounts that provided precise details on sites, routes, and time proved well suited; on the other hand, a text like Ramsay's *A Historical Geography of Asia Minor* (1890) proved less so, as it consists mainly of an encyclopedic overview of each site, disconnected from its neighbors.

Because students were restricted to mapping only 30 records, this forced them to make decisions about the scale of the elements they would map and their representative geometries. All students visualized named sites—particularly towns, villages, and archaeological ruins—as points, symbolized by small circles on the map. Likewise, lines represented the routes between these "stops." Students tended to map toponyms, because proper names often denote a discrete entity that lines up well with a Neatline record, and because they are easily locatable on other maps, modern or historical. After these basics, the specifics diverge across our initial maps. Some maps include polygons of various shapes and sizes to visualize mountain ranges, lakes, islands, and entire geopolitical regions. Other students mapped ill-defined areas, including mountain ranges, with a point, symbolized by shapes including circles and triangles. Some students traced rivers as blue lines, though this was an arduous task, and these are hopefully already available from an Internet source as reusable geometry. The students often dealt with relative spatial relationships during the mapping process, where an author might indicate, for instance, that a certain place is located to the "left" of another place. These indications guided placement of the points and lines.

Symbol color in Neatline could easily be changed, allowing it to serve a variety of purposes, from differentiating sites visited from those only discussed, to separating horse-traversed routes from railroads, to distinguishing villages from natural features. Setting the transparency of geometries also enabled a better view of the basemap and offered another strategy for differential visualization. In terms of basemaps, students found the Stamen Terrain map (**maps.stamen.com**) to be most useful for viewing the landscape, as was OpenStreetMap for finding named locations. Kiepert's (1890) historical maps also helped guide the work, and could be used as a background via Mapwarper's Web Map Service interface.[2]

Sometimes students had to deal with specific peculiarities in an author's work. For example, in Richard Chandler's (1825) travel narrative, he points out what he believes is a previous traveler's incorrect description of the Maeander River's course. Chandler himself, however, appears to misidentify this river. The student digitizing this text recognized this inconsistency and chose to create a line geometry record, separate from the true Maeander River, to communicate this error to the viewer and show the discrepancy between Chandler's perception and the actual location. The choice to include this particular misattribution, among others, demonstrates the distance between representation and reality and emphasizes the interpretative element of transferring prose narrative into discrete data points.

From a pedagogical perspective, we found that providing creative freedom to the students was a successful aspect of this assignment. Students had a chance to make specific choices on how to visualize the various elements of the text. The choices were limited significantly by the tool, but the range of solutions they developed reflects their increasing digital skillset and diverse ideas. More importantly, it generated a thoughtful discussion about what "best practices" might be for mapping any historical text with Neatline. Although useful for the classroom setting, the variety of visualization approaches still presented a challenge to our ultimate goal of map publication. Our experiments will continue, but at this point we can suggest an initial set of standards for visualizing places in new texts. Points serve well to map locations such as villages, ancient ruins, and landmarks. They can also be used to document more ephemeral places important to the journey, such as river crossings or camping locations. Different shapes and colors can separate out different classes of places (Figure 2). Routes can be marked with thick, transparent lines to reflect uncertainty while still indicating connections. Natural features discussed in the text can be marked with less obtrusive, semitransparent colors. Mountain ranges can be indicated with edgeless polygons, and rivers with light blue lines. Such visualization selections might change in different situations, such as to conform to other basemaps. The initial zoom level for each element should

2. For example: **http://maps.nypl.org/warper/maps/27383#Export_tab**.

center on that element, but should be zoomed out far enough to relate the location to other parts of the text.

PERSPECTIVES ON SPACE

The hardest learning outcome to measure considers how students' conceptualization of space changed as a result of the assignment. We were likewise very interested in understanding how their ideas developed about past peoples' thoughts on space. As archaeologists and historians, we these two levels of perception are in fact deeply interconnected. Only through examining specific examples of observations made by individual students can we begin to approach an understanding of what they learned. These observations demonstrate the range of ways the students engaged with intersections of textual narrative and space. Interestingly, they also highlight how the students considered each traveler's own perspective on these landscapes as well.

While attempting to map Elliott's (1838) *Travels in the Three Great Empires of Austria, Russia, and Turkey* onto a contemporary road map, one student observed how differently the same place appeared to people who inhabited different mental worlds. The student was forced to navigate the distinction between primarily Biblical and classical place names provided in the travel account and the modern Turkish toponyms on the online map. The latter set of names might have been used locally in the nineteenth century, but the traveler's writing evidenced different priorities: Elliott was traveling through an ancient landscape superimposed upon the contemporary landscape. He rarely acknowledged that he was doing so, and so this process was not evident to the reader. Coming to this insight does not necessarily require mapping out the text, but the exercise established this fact clearly by forcing the student to explicitly consider how the author referred to the geography. On the other hand, the student found it relatively easy to locate most of the classical place names, reflecting the traveler's interests. For the most part Elliot was not trying to depict the region as it was in his own time, with its major Ottoman centers and landmarks. The Ottoman places were often locations the traveler passed through and referred to in offhand observations. These were typically minor villages that never achieved great historical importance and therefore may be absent from modern maps of the region. The Greek, Roman, and early Christian sites were, by contrast, genuine tourist sites, sanctified by their antiquity, and thus much easier for even a twenty-first-century reader to identify. Ultimately, these geographic practices make the Ottoman stratum of the landscape in Elliot's account fade even further into the background.

Another student recognized that certain elements of the landscape as described by his traveler required further research given the traveler's lack of interest in those particular features. In Thomas Smith's (1678) ethnographic travel account, *Remarks upon the Manners, Religion, and Government of the Turks*, he describes a castle near the ancient site of Sardis. At this castle, Smith chose to discuss only the ancient inscriptions preserved within the structure. Yet the castle in question was in fact a later Byzantine structure that employed reused ancient materials in its construction as spolia. When the student realized this, it completely changed his understanding of the space, its history, and the author's interaction with it.

In moving from the fluidity of the narrative texts to the structure of the records, no topic was more prominent in the minds of students than uncertainty. Multiple students made observations regarding the difficulties of mapping space when data were omitted by the travelers, such as precise route descriptions. Today such data might be gathered using satellite positioning systems with meter-level accuracy, but these texts cannot provide such detail. Locational information in a historical account often lacks clarity for a variety of reasons. Many factors can influence the author's description of the space, such as not having visited a place and relying solely on information from other sources, or even the author's desire to be deceptive in their presentation of space. Furthermore, the landscape itself has changed, especially due to twentieth-century industrialization, including the damming and control of rivers that previously flooded seasonally. The students experimented with a number of different visualization strategies to deal with the challenges of these uncertainties. There was a tendency to trace the modern road network when drawing route lines, thus applying the assumption that the historical and modern paths are similar. Some students indicated uncertainty by employing a range of different colors. Other students added question marks to the popup and timeline labels when the location was unclear. Perhaps the most useful strategy was to utilize the popup box itself to discuss the data, allowing for a more comprehensive presentation of the challenges and their possible solutions (Figure 4).

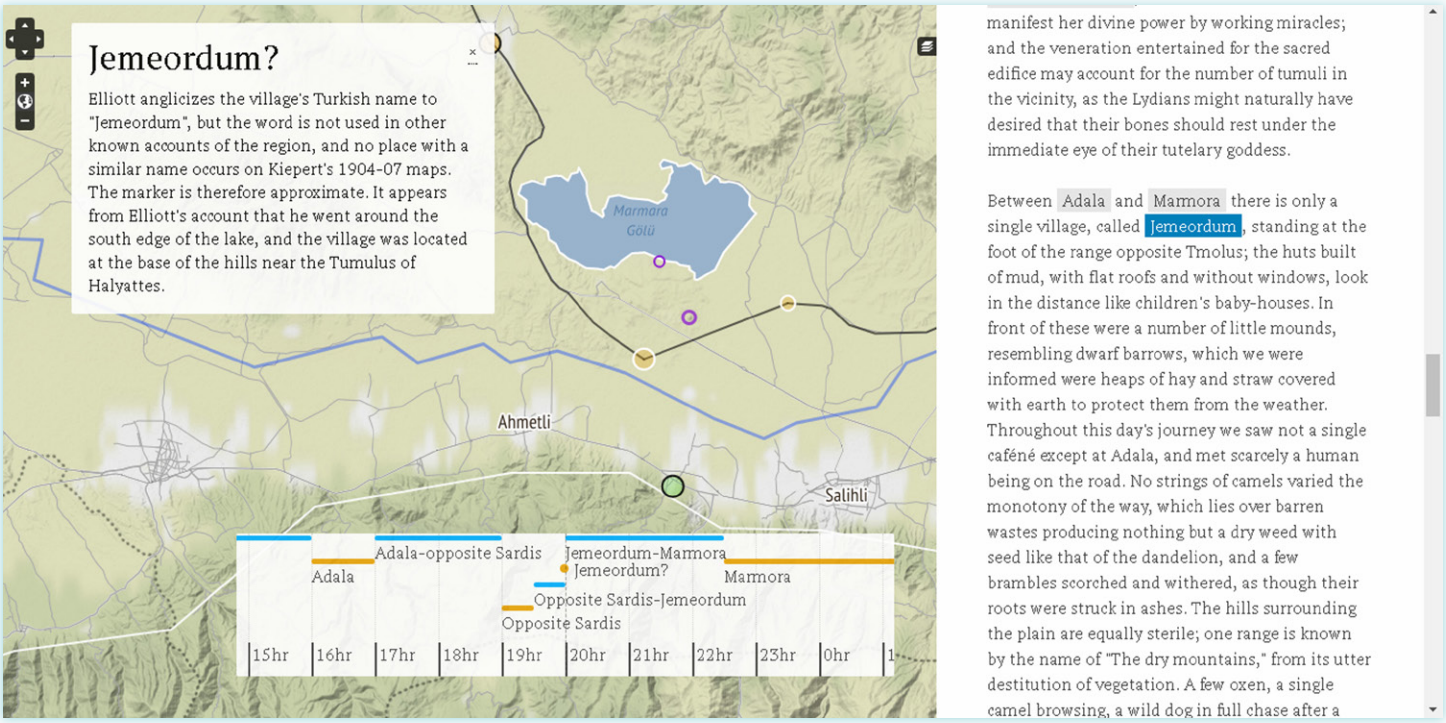

Figure 4. *Question mark and discussion concerning the location of Jemeordum in Charles Elliott's (1838)* Travels in the Three Great Empires. *Map by Bryn Ford.*

Given the course's previous focus on GIS software, multiple students contrasted this assignment with previous classwork using the tools provided in ArcGIS. In general, it is possible to use digital tools either to assist in a careful reading of the texts themselves or to engage in computationally driven analysis of the journeys the texts depict. However, these two goals require different tools. One virtue of our project was that the text-centered Neatline interface provided a platform for the former approach, giving us new ways to visualize the authors' literary landscapes—perhaps bringing us closer to the human aspect of the data than traditional quantitative GIS techniques. Accordingly, students tended to approach the maps in this fashion, focusing more on the "qualitative" rather than the "quantitative." Nonetheless, the latter approach still has much to offer, and we envision that combining quantitative techniques with the data collected in the Neatline platform could open new avenues of research.

Students also observed that rivers appear in the texts as both conduits and obstacles, as can be seen in the various difficulties in crossing them (see Figure 2). Most travelers mentioned rivers frequently, usually since they were central to their navigation through the river valleys of western Anatolia. Students recognized the rivers as part of the planes of movement and networks of locations that could be missed without a close reading and mapping of these travel texts. Multiple students found it valuable to map and consider the spatial relationships between the places that travelers visited as opposed to those they saw from a distance and those that they mention were nearby, but did not see—this is similar to the approach taken by Murrieta-Flores, Donaldson, and Gregory (2017) in mapping the English Lake District. This aids our understanding of individual motivations and conceptions of space, allowing researchers to go beyond the simple quantitative approach to mapping discrete points. In the end, this must all be judged against the fact that most of these authors actually did visit this real landscape.

Another student's map highlighted how engagement with the landscape varied according to the mode of travel. Davis's *Anatolica*, written in 1874 as the railroad was expanding into the interior of Anatolia, recounts a journey that mixed train and horseback travel. The student chose to visualize this with contrasting colors, making rail routes black and horseback routes red. The student also used points to represent each location mentioned in Davis's narrative. The resulting map (Figure 5) shows a remarkable increase in point density when Davis transitions from train to horseback. The student observed that the author engaged much more closely with the landscape from

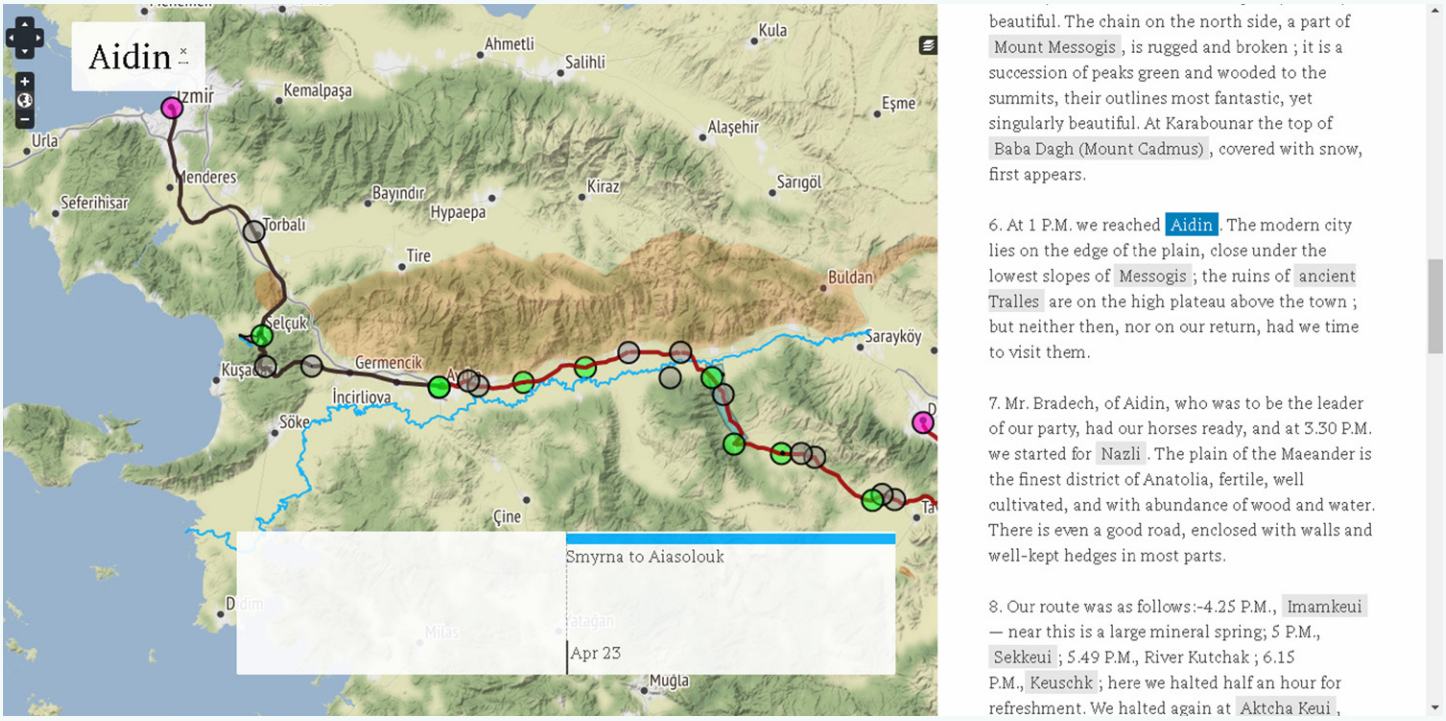

Figure 5. *At the city of Aydin (map center), John Davis disembarks the train and proceeds east on horseback through western Anatolia, visiting significantly more sites along the way, according to his 1874 work,* Anatolica. *Map by Helena Dominguez Del Triunfo.*

the latter mode of transport, and this added engagement translated to much richer detail in the text. This conclusion can be reached simply by looking at the map generated in Neatline, but the investigation can now be pursued in a quantitative fashion. With data from more texts, it might be possible to demonstrate in statistical form how substantially the railroad affected travelers' experiences of the landscape.

Multiple students reflected on the time dimension as part of this project. As mentioned above, we struggled with implementing time given the timeline's limitations and textual variety. One student wondered whether there might be a better way to understand and visualize the relationship between real time and narrative time. For example, does the amount of text written about a place reflect the amount of time spent at that place? Another student noticed that night and day would have been experienced quite differently by the travelers. She wondered if they actually experienced two landscapes, at odds with one another? For example, could extenuating circumstances, like the activity of "bandits," differ depending on the time of day? These types of questions did not result from our other archaeology-focused exercises in the class. We believe this reflects the importance of the students' interactions with the first-hand accounts of people in the historical landscape.

The project increased interest in further research on the routes for all students. This in turn encouraged additional interest in the class about the various approaches of landscape archaeology, in order to understand the differences between, for example, ancient Roman and modern road networks, or to investigate non-normative movement through the landscape, such as by pastoralists (Aston and Rowley 1974; Arbuckle 2012). One potentially fruitful approach would be further analyzing how people saw their surroundings on the ground, a process often studied with viewshed analysis in GIS, based on accurate digital elevation models of the terrain. We would like to try to compare these analyses with the travelers' accounts to see if visibility of places made a difference in travelers' decision-making.

FUTURE DIRECTIONS

We found the pedagogical opportunity of the Anatolian Travelers Project valuable in encouraging discussions about technological decision-making, the methods of map visualization, perceptions of space, and

the choices made by each student. This process of active mapping offered the students an opportunity to consider the valuations of space found in our texts and the difficulty of mapping those in truly representative ways. For classroom purposes, these discussions were an essential reflective exercise that pushed the students to think critically about space and to engage with theoretical and practical readings on the topic. We hope that a similar meta-narrative can be presented to public internet viewers of our maps in some way, such as through discussions of uncertainty, as mentioned above.

We have also reflected on how we might approach the assignment differently during another offering of the class. We would probably foreground questions about the historical landscape more explicitly. When a traveler moves through a landscape that seems to be full of history, where are these memories concentrated and how do they interact with or obscure the contemporary reality? Ideally, we would make better use of the chronological functionality of Neatline. Perhaps conceptualizing the temporal dimension historically would allow a different perspective that lets us think more about the role of memory in landscape. Plotting the timeline of the travelers' itineraries was important, but we also would like to find ways to capture *their* thoughts about time and space. There is also the possibility of color-coding different parts of the landscape based on the ancient periods that each traveler saw in them. For example, in some locations, a traveler may prioritize the Roman past, while in a different location, an Iron Age culture might be of more interest. In this way, the traveler not only moves through his (or, rarely, her) own time, day-to-day or hour-to-hour, but he also moves through historical periods in his mind, and we would like to find a way to visualize this.

The class provided several means of support for the students to be able to learn to use Neatline and create a map. However, most students were unable to produce a final product that was ready for online publication. The main constraint was, of course, time, since the assignment took place over only a single week. There was much for the students to do, from selecting a text, to finding the correct passage, to learning the tool, to making decisions about how to represent the text on the map. Without dedicating additional time to this particular assignment, and thus taking time away from building other skills, it would be difficult to develop fully finalized maps. Students in later classes, together with volunteers and a work-study student, were ultimately able to prepare ten maps for online presentation (**openarchaeology.org/anatoliantravelers**).

Here we have focused on the pedagogical aspects of our initial steps in the project. As the project proceeds, we hope to be able to also write about our reflections on the research results. In practical terms, the next step for the Anatolian Travelers Project involves further engagement from volunteers, students, and researchers in creating a larger dataset. This will enable us, and others, to use the data to diachronically explore the past in this region. By making all of these maps public, we hope both to provide a resource for other researchers and to encourage the further sharing of data amongst scholars. Finally, the open publication of these data in visual form and the results gleaned from them should serve as an excellent way to engage the public in this region's past through a new way of conceptualizing and visualizing these travels.

ACKNOWLEDGEMENTS

We thank the Penn Libraries, and especially Laurie Allen and Josh Berg, for supporting the web infrastructure for this project. The work outlined here would not have been possible without the pedagogical context of the Center for the Analysis of Archaeological Materials (CAAM) at the Penn Museum. Sami Suppes and Rory Palmer helped finalize many of the maps on the website. Lauren Aguilar helped lead the weekly class on this topic and created a tutorial to guide the students. We thank everyone who worked on creating maps: Petra Creamer, Helena Dominguez Del Triunfo, Emily French, Travis Lumpkin, Greg Maslow, Malkia Okech, Kristen Pearson, Janelle Sadarananda, John Sigmier, Michelle Terng, and Paul Verhelst. Finally, we express our appreciation for the valuable suggestions of two anonymous reviewers who helped us to focus and improve this article.

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PEER-REVIEWED ARTICLE

Mapping Syrian Refugee Border Crossings: A Feminist Approach

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The United Nations High Commissioner for Refugees calls the ongoing Syrian Civil War "the biggest humanitarian emergency of our era." Since 2011, over 5.4 million individuals have fled across borders throughout the region and further abroad into Europe. Western media have documented Syrian border crossings and stories through riveting journalism, interviews, photography, and maps. While the written and photographic reporting of Syrian stories use captivating imagery and testimonials to convey the traumatic experiences of individuals, these experiences are limited in the accompanying cartographic coverage. Instead, Western media's cartographic practices commonly aggregate refugees into flow lines, proportional symbols, and reference points, and frequently simplify border experiences into homogeneous, black line symbols. Flow lines, homogeneous border symbols, and other mapping conventions silence *the experiences of individual Syrians and negate emotions, perils, and geopolitical issues linked to border crossings. I ask the following research questions: How can the cartographic portrayal of Syrian peoples' border experiences be improved to more fully represent their experiences? Furthermore, how can a feminist perspective inform an alternative mapping of borders and border experiences? Through a feminist lens, I have developed an alternative mapping technique that emphasizes borders as a theoretical and conceptual advancement in cartographic design and border symbolization. By rendering Syrian border stories and experiences visible with cartography, my work nudges critical and feminist cartographies forward and gives Syrians a geographic voice unavailable to them through conventional cartographies.*

KEYWORDS: feminist cartographies; cartographic design; Syria; border symbolization; critical cartography; mapping stories

INTRODUCTION

Since March of 2011, Syria has faced civil unrest, leading to what the United Nations High Commissioner for Refugees calls "the biggest humanitarian emergency of our era" (UNHCR 2014). UNHCR reports that nearly 470,000 lives have been lost, roughly 6.3 million Syrians have been internally displaced, and over 5.4 million Syrians have fled to neighboring countries—Turkey, Jordan, Lebanon, and Iraq—and beyond to the European Union (UNHCR 2017; UNHCR 2018; Human Rights Watch 2016). Thirteen and a half million people are in need of humanitarian assistance (OCHA 2018). These numbers, however, only document registered refugees. The total number of Syrians abroad is believed to be much higher.

Leaving Syria in hopes of international support and protection was, and continues to be, the only viable option for many Syrians. Even though the trek to Syria's borders is dangerous and expensive, relocating to a foreign country often outweighs the cost (UNHCR 2014). Whether crossing legally or illegally, the stories and experiences of border crossings vary from person to person (Yuval-Davis and Stoetzler 2002), while the geopolitics surrounding borders and mass refugee movements are complicated and constantly fluctuating. Borders frequently open and close due to international pressure, perceived security threats, and lack of infrastructure and resources (Diener and Hagen 2012; Jones 2012).

Besides formalized and more traditional international borders, such as the one between Syria and Turkey, Syrians fleeing the country also cross or encounter many non-traditional borders—borders that are invisible on the landscape. The first crossing is often made at the boundaries of the home. Leaving one's home, belongings, and livelihood can be difficult, but violence and unrest drive many to cross this first border. Other such non-traditional borders include, but are not limited to, neighborhoods, rebel- and government-controlled areas, hospitals, social circles, and the body (Antonsich 2011; Näre 2014; Salamon 2006).

The written and photographic reporting of Syrian border stories by Western media uses captivating imagery and testimonials to convey the traumatic border experiences of individuals. The accompanying cartographic coverage is comparatively emotionless. Many of the maps published in Western news media utilize homogeneous border symbolization and aggregate refugees into choropleths and proportional symbol maps, losing their individual experiences (New York Times 2014; Kelly 2015b). Even maps that highlight multiple individuals and their stories often rely on identical representation strategies, neglecting the uniqueness and subjective experiences of each individual (Sullivan 2013; Kelly 2015b). The use of flow lines—smooth and uninterrupted arrows connecting two known locations—is also problematic. They cross borders effortlessly, making the journey appear fluid and unburdened. These cartographic techniques erase individual experiences, dangerous perils, and legal issues linked to border crossings. While conventional techniques are familiar and useful, there remains a need for maps that more accurately portray refugee experiences, particularly experiences of borders and border crossings.

With the exception of geopolitical reference maps produced by organizations like National Geographic or Rand McNally, border lines generally lie beneath thematic data, particularly refugee displacement data (Kelly 2015b). Borders are often placed at the bottom or near the bottom of the visual hierarchy, receding into the background as part of the base map or reference material. Often defaulting to thin, solid black lines, cartographers typically symbolize borders homogeneously (Kent and Vujakovic 2009; Kelly 2015b).

In this project, I ask the following questions: How can the cartographic portrayal of Syrian peoples' border experiences be improved to more fully represent their experiences? Furthermore, how can a feminist approach inform an alternative mapping of borders and border experiences?

These questions are purposely broad. Feminist mapping praxis recognizes the subjectivities and possibilities built into design and is less focused on identifying a narrow or universal solution. As such, I will offer one possible mapping solution to initiate conversation and bring feminist ideas and borders literature into cartographic practice and border symbolization. More specifically, I will expand the use of conventional cartographic language and visual variables to reflect individual and aggregated experiences of borders as a means to bring refugee stories back into the map.[1]

To illustrate feminist practice in the rethinking and designing of alternative border symbols, I will later present Amal's border story, as told in 2015. Amal is Syrian, a husband, a father, and a physician who encountered and experienced multiscalar borders—neighborhoods controlled by the Assad regime, the walls of his home, his body, and the Turkish border with Syria—in various ways. As such, a thin, black line on a map does not accurately reflect his experiences with each border. Afterward, I will present a mapping technique that aggregates the border experiences of seven interviewees. It is in this context that I negotiate the symbolization of borders and rethink "the line" as a narrative technique bound in experience.

MAPPING BORDERS AND THEIR STORIES

By one definition, *borders* signify "limits and discontinuities in space" (Popescu 2011, 161). We conventionally think of borders not only as limits and discontinuities but also as modes of organization and separation (Diener and Hagen 2012). These delineations typically appear permanent and static in the map. Yet with a passport, a train ticket, or maybe a smuggler, borders quickly become permeable and experienced. Borders literature has debunked the notion of spaces being strictly "trapped" by borders (Agnew 1994; Agnew 2009). Borders and territory

1. For the full project, see Kelly (2015b).

are not fixed units (Elden 2013): they evolve and fluctuate, opening and closing based on security or geopolitical issues (Diener and Hagen 2012; Jones 2012). Borders are often undefined and heavily contested (Moore and Perdue 2014).

Although lines and sometimes points are convenient symbolization choices, Rumford (2006) and Newman (2006) are quick to point out that borders have their own spatiality and dimensions. Borders literature often frames them as *borderlands* or *borderscapes*—areas, not lines (Anzaldúa 1987; Rajaram and Grundy-Warr 2007; Diener and Hagen 2012). Anzaldúa (1987), for example, acknowledges the hybridity of the Chicana identity within the US and Mexico borderland region. Typically, though, cartographers do not follow suit, conventionally drawing borders as lines. Despite this uniform presentation, individuals experience borders in multiple ways (Yuval-Davis and Stoetzler 2002). Furthermore, borders literature extends the conversation to non-traditional borders, otherwise known as socio-spatial borders or contact spaces, including the home, social barriers, and the body (Antonsich 2011; Näre 2014; Salamon 2016).

While borders have a rich history in geopolitical scholarship, they also have a rich presence in past and present cartography.[2] Political and administrative borders are traditionally used as units of analysis for thematic mapping or as units of organization for mental mapping and understanding the world. These borders can be quickly downloaded from sources like the United States Census Bureau and utilized for geospatial analysis and mapping.

The evolution and production of borders in cartography, and the roles of maps in international and domestic politics, have been examined by Black (1997), who pays particular attention to the mapping of borders and frontier zones beginning with Egyptian maps of gold mines and Roman cadastral maps.[3] Maps and borders became increasingly important in the nineteenth and twentieth centuries with the rise of imperialism, nationalism, and war, as power became territorial and "required knowledge [or] locational specificity" (Black 1997, 135). As such, many contemporary maps remain trapped in a Westphalian model of world politics, identity, nationalism, and the *us* versus *them* mentality. Cartography adds to this territorial understanding (often inadvertently) by reinforcing borders in a visual way.

Historically, geopolitics and maps have gone hand in hand because maps are the "perfect symbol of the state" as they continually reinforce each other through sovereignty and the "boundedness" of the borders that maps depict (Moore and Perdue 2014, 893). The use and influence of geopolitical maps have been well documented and critiqued by contemporary theorists. Furthermore, geopolitical maps have been problematized and deconstructed as sources of power, hegemony, visibility, and masculinity (Harley 1989; Wood and Fels 1992; Black 1997; Kwan 2002a).

Given the stigma surrounding their use and implications, political geographers have limited their utilization of traditional geopolitical maps and "geopolitical cartography has never been recovered" (Moore and Perdue 2014, 894). Moore and Perdue challenge researchers to find alternative ways of mapping that more accurately reflect contemporary geopolitics. From a critical geopolitical standpoint, they visualize the contested territory and lived realities of individuals in the Kashmir region, challenging the conventional, state-centric ideal often depicted in maps (898).

The use of visual variables to symbolize borders has also been examined in relation to visualizing uncertainty by MacEachren (1992, 13–14), who proposes color saturation and focus or crispness as optimal visual variables for representing uncertain spatial information. Both of these can be easily and effectively applied to border symbols. In practice, however, international borders in EU topographic maps and maps published by Western news media outlets are most often depicted as solid black lines accompanied by categorical tint bands or color highlighting (Kent and Vujakovic 2009; Kelly 2015b).

Cartography's role in solidifying our understanding of borders has also been explored by artists, who can contest conventional border representations and reveal hegemonic discourses, border complexities and experiences, and embodied borders. Guidice and Giubilaro (2015) examine the imagination and production of borders through art, contending that conventional borders are limited in their

2. In this paper I draw predominantly on literature discussing international, social, and embodied borders and borderlands. For discussion of "natural" or environmental borders such as ecotones and their cartographic depiction, please see: Küchler (1988), Rossum and Lavin (2000), and McColm (2012).

3. Black (1997) also recognizes the influences of Chinese and non-Western cartographies in productions of power, politics, and borders in Western cartography. See Black (1997, 26–28) for more details.

symbolization and dimensionality because they are commonly simplified into lines on a map. This simplification is a "clear power strategy developed by the nation-state to define and manage its space" (Guidice and Giubilaro 2015, 81). Continuous lines are convenient symbols for borders because of their perceived permanence and uncontested fixity; they appear static, essential, and unexperienced.

Dashed lines are also used to symbolize borders, albeit with a different message. Gaps and dashes disrupt continuous lines and present a sense of fluidity, contestation, and impermanence. Guidice and Giubilaro (2015) present artists who transform understandings of borders and representation through imagination, dis-bordering, and worn realities. However, they focus solely on the transformation and the symbolization of borders in media such as artwork, literary landscapes, iconography, and film, thus neglecting cartography.

André Reyes Novaes (2015) explores the intersection of map art and critical geopolitics at Colombia and Venezuela's shared border. Both Novaes (2015) and Black (1997) point out that maps have shaped representations and conceptualizations of the state and have instilled imagined divisions between countries. The static visual representation of borders in maps contradicts critical, geopolitical understandings of dynamic and experienced borders.

Novaes (2015) studies this visual representation challenge in *Projecto Mapa*. Artists from the region were presented with a map that merged Colombia and Venezuela into one imagined country—and were asked to create new maps showing the open, transnational relationship between the two countries. *Projecto Mapa* failed in its goal of creating a borderless map. In the absence of provided borders, artists routinely replicated conventional border delineations—although with new symbolization techniques (stitched lines and doves representing peace). The redrawing of the border between Colombia and Venezuela reflects strong national identities and imaginations. Novaes concludes that, "borders remain important [and mapped] in our *borderless* world" (Novaes 2015, 138).

The cartographic representation of border experiences can also be informed by literature on maps and storytelling. While maps ground stories in space and help "decipher" landscapes, they have also been explored not only as supplements to the story, but as primary, powerful, and "compelling forms of storytelling" (Caquard 2011, 136; Reutzel 1985; Wood 1987). The "story map," defined by Robert Macfarlane (2007, 145) as "deep maps . . . that acknowledge the way memory and landscape layer and interweave" emerged from these conversations of power, storytelling, and narrative (Caquard 2011). Narrative mapping combines story and discourse that "transcends mere description [story] . . . by shaping it with meaning" (Pearce 2008, 21; Chatman 1978). Contemporary mapmakers have re-explored cartographic language and narrative to map stories that reflect and emphasize experience, albeit in different ways (Lynch 1960; Pearce 2008; Kwan 2008; Nold 2009; Pearce and Hermann 2010; Knowles, Cole, and Giordano 2014).

With the development of Web 2.0 and interactive mapping, story maps have also been utilized online by news media sources, data journalists, and novice mapmakers (Crampton 2009; Esri 2012). *The New York Times* (Ashkenas et al. 2014), *The Washington Post* (Sullivan 2013; Karklis et al. 2018), and *National Geographic* (Salopek 2015) are three notable online sources that are on the cutting edge of story mapping and data visualization. These media outlets, among many others, approach visual storytelling in innovative ways as technology continues to evolve. Borders, border stories, and their depiction in maps, media, and visual stories are *highly* relevant today. As such, understanding and rethinking border symbolization in print and online mapping is paramount.

CRITICAL AND FEMINIST PERSPECTIVES ON MAPPING

The rise of critical and feminist perspectives in the social sciences in the last three decades has directly challenged conventional cartographic methods (Harley 1989; Crampton 2011). Feminist perspectives are diverse. Yet, there is common agreement that complete objectivity or truth cannot be fully achieved, and all knowledge is situated in personal subjectivities and social contexts (Haraway 1988; Harding 1986; Kwan 2002a; D'Ignazio and Klein 2016). Although several scholars and mapmakers have methodologically explored feminist

standpoints in cartography, the representation of difference and subjective experiences has often been limited (Kwan 2002b; McLafferty 2002; D'Ignazio and Klein 2016). Using feminist theory as a framework, I draw on four particularly relevant themes: *the body, intersectionality*, *reflexivity,* and *transformation*.

Research and theory on the *body* is complex and as a result, there is no widely accepted definition of the body (Longhurst 1997; Valentine 1999). In feminist research, however, the body can be recognized as a geographic location, the "closest in" and most intimate geography (Rich 2003, 212). Transfeminist poet, Joy Ladin (2014), recognizes the body and identity as "expressions of a single self," limited by language, and in the case of mapping, representation. Furthermore, the body can be viewed as "tactile space" that is bound and bordered, separating the internal from engagements with the external world (Valentine 1999, 331; Salamon 2006). This is especially relevant to mapping, as cartographers typically depict the body as a point or line, rather than an area (Kelly 2015b). Additionally, individual bodies are frequently left unspecified, undifferentiated, and "colourless" in many cartographic depictions, leaving them appearing homogeneous (Rose 1993, 31). These techniques silence the experiences of and interactions with the body. Similar to D'Ignazio and Klein (2016), feminist perspectives in mapping recognize differentiated bodies and affective experiences as instrumental to visualization.

Like feminist understandings of situated knowledge, bodies are also situated because they are unique and complex. Cartographers and data visualization experts often rely on categorical data, aggregating bodies and individuals into groups or binaries based on gender, ethnicity, nationality, or religion, to simplify a map's message (D'Ignazio and Klein 2016). In reality, an individual may identify with multiple, entangled categories. A feminist approach recognizes that the body and the individual are nuanced and deeply complex, with many, often intersecting identities (Crenshaw 1991; Mohanty 2003). *Intersectionality* refers to power differentials that are multidimensional and shaped by intersecting notions of "race, class, gender, sexuality, ethnicity, nation, ability, and age" (Crenshaw 1991; Collins 2015, 2). By recognizing intersectionality, cartographers can avoid binaries, overgeneralizations, and the categorization of individuals by focusing on the complexities, pluralisms, and subjectivities of individual identities, experiences, and knowledges (D'Ignazio and Klein 2016).

Cartographically, categories are frequently used to reduce complexity and communicate a message or story in a map more readily. When asked to create bodily categories, Mohanty suggests looking for "common difference" between individuals, a strategy that simultaneously recognizes alliance and division across groups, allowing aggregation or grouping through reflexive practice (Mohanty 2003, 503). Mohanty, for example, uses this framework to recognize the differential impacts of race, class, and gender on women in "Third World" contexts, yet simultaneously recognizes their commonality, as systems of power maintain dominance across contexts (2003). Further, common difference acknowledges that "the differences and borders of each of our identities connect us to each other" and requires "informed, self-reflexive" solidarity and practice (Mohanty 2003, 530).

How have cartographers incorporated intersectionality into practice? Pearce and Hermann (2010)'s *They Would Not Take Me There* features multiple voices overlaid on a map of Samuel de Champlain's travels in North America, including those of Champlain and the indigenous peoples he encountered. Several sequential insets recount narratives and lived realities simultaneously. Although difficult to digest in one take given its complexity, they place several intersectional experiences in the map.

Another possible cartographic example of intersectionality and common difference is the work of Kevin Lynch (1960) in *Image of the City*. Lynch, an urban planner, used cognitive mapping to understand how individuals experience the city. In his approach, Lynch worked across scales—the individual and the aggregate—beginning with maps sketched by participants of their urban experiences. He then quantified and aggregated his participants' experiences into a single map. Lynch used ordinal symbolization to reflect the degree to which city elements were experienced by the aggregate. Lynch was able to create common difference in his aggregated maps because he understood each subjective experience of the city first.

Feminist literature also addresses the responsibility of scholars and cartographers to recognize any potential influence, bias, or subjectivities in a given project (England 1994; Mohanty 1988; Mohanty 2003). Also known as *reflexivity*, this is an inward-facing reflection on one's own positionality and recognizes that all knowledge stems from somewhere (Kwan 2002a; Haraway 1988). As such, a reflexive approach to mapping contextually situates or

grounds the project and emphasizes the integrity of the knowledge producer or mapmaker.

Researchers and scholars often incorporate a reflexivity or positionality statement at the beginning of their work. Cartographers, however, are less likely to document their subjectivities and bias in the map. Pearce (2008) is explicitly reflexive in writing about her map, *Framing the Days*, but is also indirectly reflexive in the map itself, by separating her own voice from the voice of her map's subject—a fur trader traveling through the Great Lakes. Pearce marks this distinction by using two contrasting typefaces: a sans serif typeface for the fur trader's voice and a serif typeface for her own voice. This technique quickly and effectively informs the reader who is speaking and recognizes Pearce's position as cartographer outside the story.

Inclusion and transformation are additional theoretical concepts within feminist theory. Inclusive feminism emphasizes the incorporation of marginalized groups into roles predominantly held by white, heterosexual men. In contrast, a transformative approach dismantles social constructions such as gender (D'Ignazio and Klein 2016). Similarly, a transformative approach to cartography first deconstructs the map and then restructures how it is conceptualized. Cartographic transformation rethinks, redefines, and re-visualizes the map, its marks and symbols (Cresswell 2013).

Borders, border stories, and cartographic symbolization provide a unique framework to map Syrian refugee border crossing experiences. While each subarea has a rich and evolving cartographic history, their intersection has not been previously explored. Additionally, a feminist perspective adds an additional layer of individualized experience and complexity to the map page. By focusing on the intersectionality of refugees and their stories as well as the reflexivity of the cartographer, individual experiences can be prioritized and separated from the voice of the mapmaker. With this lens, I navigate the experiences of traditional and non-traditional borders, including the body, and cartographically rethink and transform border symbolization as a new narrative mapping technique.

METHODS FOR PERSONAL MAPS

AMAL'S STORY

In the spring of 2015, I conducted a series of semi-structured interviews with Syrians and humanitarian workers in the region (Kelly 2015b). Our conversations centered on the Syrian crisis, personal stories, and border insight or experiences. Here, I present Amal's story, a personal account of life in Syria during the conflict. His story includes encounters with various types of borders inside and outside of Syria. Additional stories are available online (Kelly 2015a) and in print (Kelly 2015b).

Amal is a physician, a husband, a father, and a Syrian. He taught at a medical school before the revolution began. Amal played an important role as a physician during the first years of the civil war, often working for one or both sides of the multifaceted conflict. He fled Syria in 2013 and now resides in Turkey without his wife and daughter. Amal's story centers on various borders, as well as safety, family, mobility and his experiences as a physician during the crisis.

Amal was not politically active in the conflict at the beginning of the revolution because of previous brutal experiences with the Assad regime. A significant event called him to the field:

> After the famous "Central Square" massacre in my own city Homs, I found myself obligated to help the civilians and work secretly in local field hospitals. People did not trust going to the governmental hospitals, fearing of arrest, torture, and even execution. I continued to work secretly, while the situation continued to get worse. The peaceful revolution slowly started to turn into what looks like a civil war . . ..

The revolution erupted throughout his city with continued shooting and bombings. Fear was evident in his household too. He said:

> My wife . . . had to quit her laboratory specialty training, and my daughter, who was only two and half years old, could not stop crying every time she heard a shooting or a bomb near our home. For those reasons and others, I had to

> make my wife and daughter flee the country toward UAE [United Arab Emirates] in May 2013.

Amal's wife and daughter crossed Syria's border alone as Amal stayed behind to continue providing medical aid.

Eventually, the Syrian government regime took over his city, which he called the "most active war zone." A total siege limited Amal's mobility and he was "unable to move in and out easily." Areas controlled by the regime were informally bordered, preventing his movement. Although informal and non-traditional compared to administrative boundaries, regime-controlled areas presented very rigid and real boundary lines with consequences.

With restricted mobility, Amal continued to work as a physician in the field, feeling obligated to aid both sides of the revolution. His dual responsibility, however, was difficult in practice:

> While medically helping both sides of the war felt the right thing to do, this very issue placed additional pressure on me. Not only I had to avoid disclosing my [role] in helping the rebels from the government, but also I had to face increasing scrutiny from the rebels because of my help to the other side, namely the *Shabiba* [government thugs].

Working in this borderland, aiding both sides, was also extremely dangerous, and eventually forced Amal to flee. He said:

> I received multiple threat letters, not only concerning myself, but also concerning my parents and my siblings. In fact, I was physically hurt in one incident. Eventually, the pressure pile so high on me, I had no other way to survive exception running away, and so I did. I secretly managed to travel to Turkey.

In Turkey, Amal began working with an international NGO and continued his work as a physician helping Syrians abroad. Although Amal left Syria, a part of him remains transnational. He ended his story with this sentiment:

> Although I have physically moved out of the country . . . my heart and soul remain attached there, where I have the rest of my family suffering the daily bombardment and shooting from the Syrian government.

AMAL'S MAPS

After completing, transcribing, and analyzing my seven interviews, including Amal's, I began the process of mapping. Before making a single mark on the page, I became completely immersed in the stories by not only reading the interview transcripts, but also listening to the recordings.

Borders and border crossings began to emerge. I coded themes and identified border experiences that were specific to each individual and those that overlapped between stories. Before turning to mapping software, I identified the progression of events as told by each participant (narrative ordering) to organize their stories and encounters with borders (Figure 1).

Next, I turned to mapping software (Esri's ArcMap). I began with one story and mapped the sequence of events using international boundaries and place names for geographic context and chose flow lines to depict movement, following traditional cartographic conventions (Figure 1). I quickly became dissatisfied with my symbolization choices, as the symbols I was choosing did not match the stories I was hearing in the recordings. My conventional techniques removed key events and silenced the emotions and experiences within the story. Many borders and experiences like those of Amal's district and his body, for example, were rendered invisible because there wasn't a shapefile available or geographic information attached.

After listening to the first story multiple times, I iteratively re-symbolized the marks on the map, with each attempt trying to create a more truthful depiction or symbol of his story.

Through each iteration, I learned more about each border experience and what was needed in the symbol and the layout. Continuing to the other interviews, I gradually refined my symbolization techniques in each map until I found a useful design and layout (Figure 2). The map elements in the layout are discussed in detail below, beginning with the central map (Figure 2, map element 1).

Borders are often encountered in different ways by different people. In conventional cartography, these disparate

Progression of Events and Border Stories

1. When the Syrian revolution erupted in March 2011, I was holding a teaching position in Aleppo School of Medicine, and preparing for a PhD advance degree in histopathology. My previous experience with the Syrian regime's brutality prevented me initially from direct involvement in the revolution.

2. After the famous "Central Square" massacre, in my own city Homs, I found myself obligated to help the civilians and work secretly in local field hospitals. People did not trust going to the governmental **hospitals**, fearing of arrest, torture, and even execution.

3. I continued to work secretly, while the situation continued to get worse... Eventually, the government managed to have a total siege over **the Old City**, which was the most active war zone then. I was no longer able to help over there.

4. My wife had quit her laboratory specialty training, and my daughter, who was only two and half years old, could not stop crying every time she heard a shooting or a bomb near our home... For those reasons and others, I had to make my wife and daughter flee the country toward **UAE** in May 2013.

5. My **own district** was under a sub-total siege and I was unable to move in and out easily.

6. I had to treat both sides of the war, the **rebels and the Shabiha**. My medical ethics and humanitarian side forced me to do so... While medically helping both sides of the war felt the right thing to do, this very issue placed additional pressure on me. Not only I had to avoid disclosing my role in helping the rebels from the government, but also I had to face increasing scrutiny from the rebels because of my help to the other side...

7. **I** received multiple threat letters, not only concerning myself, but also concerning my parents and my siblings. In fact, **I** was physically hurt in one incident.

8. Eventually, the pressure piled so high on me, I had no other way to survive except running away, and so I did. I secretly managed to travel to **Turkey**... where I continued to work in humanitarian aid to my own people.

9. Although I physically moved out of the **country**, but my heart and soul remain attached there, where I have the rest of my family suffering the daily bombardment and shooting from the Syrian government.

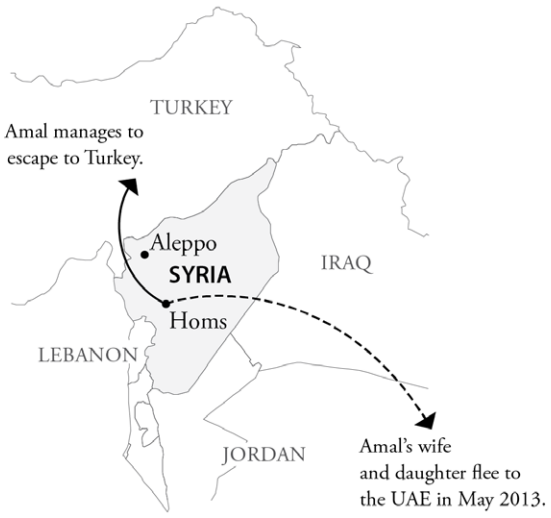

Figure 1. *Progression of events and border experiences from Amal's story. Borders are highlighted in bold in the left panel. The map on the right uses conventional mapping techniques, based on Sullivan (2013), to map out Amal's story.*

experiences would typically be collapsed into one line. I avoided aggregation by instead placing each border experience onto its own map page, making *all* borders and border experiences equally visible. Instead of focusing solely on traditional country boundaries (a very state-centric convention), *any* type of border experience is shown on the central map for its individual page. These individual pages show border experiences as told by each interviewee, and reveal non-traditional borders such as the home, the neighborhood, or the body, which may otherwise go unseen. The centrality of the featured border and the white space surrounding it focuses the reader's attention and brings each border experience to the forefront. Few features are symbolized other than the border, to highlight and communicate the intimacy and primacy of the experience—a technique adapted from Pearce (2008).

The borders displayed in the central map on each map page are symbolized in specific ways. Borders with definite geographic information attached, such as the Syrian border, the city limits of Damascus, or boundaries of a Zaatari refugee camp, are projected and displayed as spatially "accurate." Other, more abstract spaces with undefined locations such as an unnamed hospital, or the body, are displayed as hollow squares. Like geographically defined polygons such as the Syrian border, each square space is bounded with an abstract border. In other words, if a border did not have a corresponding shapefile (a digital file of

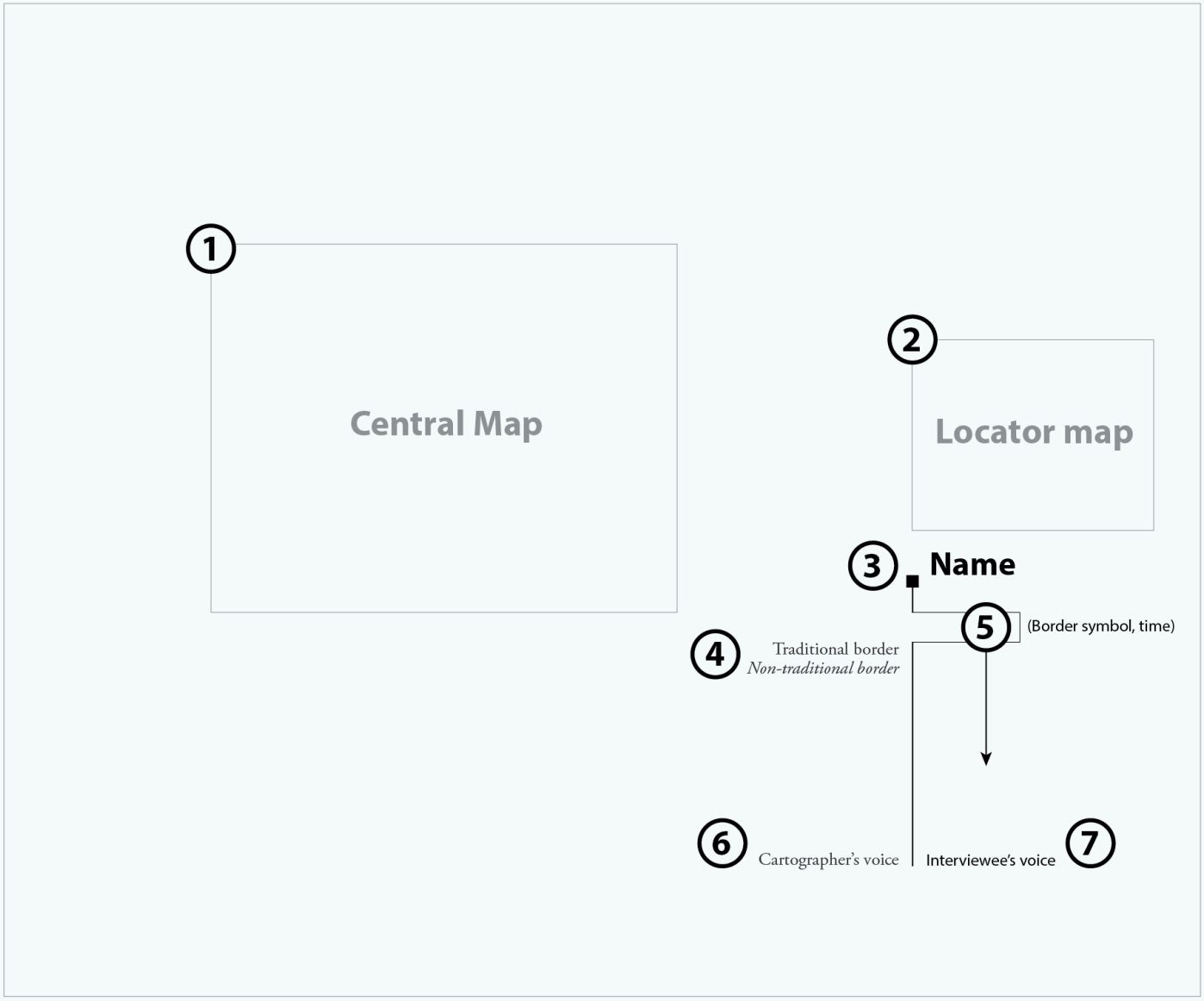

Figure 2. *Map layout schematic. Each map element is numbered and described in the text.*

coordinates for a specified feature), I defined the space and border abstractly. The abstract square shape was necessary because of its flexibility; it could be easily applied to variety of non-traditional borders. This technique enabled me to bring both non-traditional space and non-traditional borders, such as the body, into the maps.

Each border in the central map is symbolized according to the intensity of individual experiences and the border's porosity, using a bivariate scheme that relies on the visual variables of size and arrangement (Figure 3). I used the size (i.e., thickness) of the lines to demonstrate the intensity of an experience. For example, a line increases in size if the emotional toll of the experience increases. A line becomes thinner if the experience is understated or minimal. Using the interview recordings, the transcripts, and my notes as a guide, I gauged each interviewee's expression of a border and documented specific words, phrases, or the tone that defined each experience. I placed each word, phrase, or tone along the x-axis of the bivariate line scheme to reflect the intensity of the experience it described.

I then used the visual variable of arrangement (the combination of gaps, dashes, and solid lines) to symbolize the porosity of each border. Empty spaces between dashes suggest permeability and movement; the larger the space between each dash, the more porous the border. In contrast, solid lines suggest a barrier with limited mobility.

I recorded the words, phrases, or tone from each interview that described each border's porosity and placed each description along the y-axis of the bivariate line scheme (Figure 3). For example, the words "fluid" and "porous" were used in one story to describe the Syrian-Turkish border. I symbolized this border as a dashed line to reflect its fluidity. In contrast, the words "controlled," "barrier," or "strict" suggest limited movement and boundedness. Solid, impermeable line symbolization was used to illustrate such descriptions. The bivariate line symbolization scheme allowed me to simultaneously display both intensity of experience and porosity. Figure 4 displays the same symbolization scheme as applied to the Syrian border. From there, I assigned a symbol to each border experienced or described by the storyteller using this grammar.

Borders are typically labeled to provide spatial context for the reader. In the central maps (Figure 2, map element 1), each border is unconventionally labeled to correspond with the individual's subjective experience of the border. Similar to van Swaaij and Klare (2000), Huffman (2010), Pearce and Hermann (2010), and McClean (2017), the label—a simple word or phrase from the interview or story—connects the reader to the experience and in this case, the individual. The label dismantles the aggregation of experiences in conventional symbolization by removing uniform labels and replacing them with labels that render the individual visible, using their voice to acknowledge the border experience. This experiential labeling technique reinforces the meanings of the new line symbols previously discussed. Simply stated and in sum, the border is defined by the experience.

Each page has its own locator map in the right panel (Figure 2, map element 2), which serves two purposes: to orient the reader by identifying the border's approximate geographic location (if known), and to allow comparison. The locator maps highlight elements within each story by bringing place names or movement to the forefront in black. Supplementary information is then recessed using subdued grays. The locator maps are drawn with conventional cartographic techniques such as uniform lines for country boundaries, points for refugee camps, and flow lines to demonstrate movement and directionality. Although minimized and secondary in importance to the central map, the locator maps together with the central map provide a contrast between conventional representation of borders and what *can be done* to symbolize borders to more accurately represent experiences.

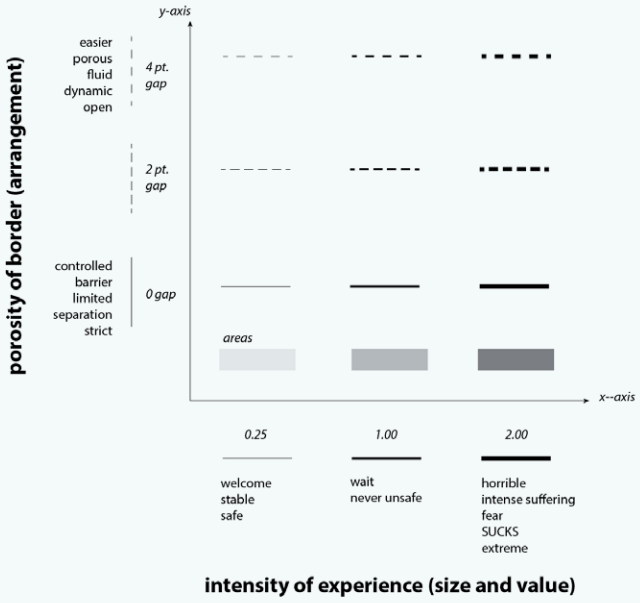

Figure 3. *Bivariate line symbolization scheme applied to each border.*

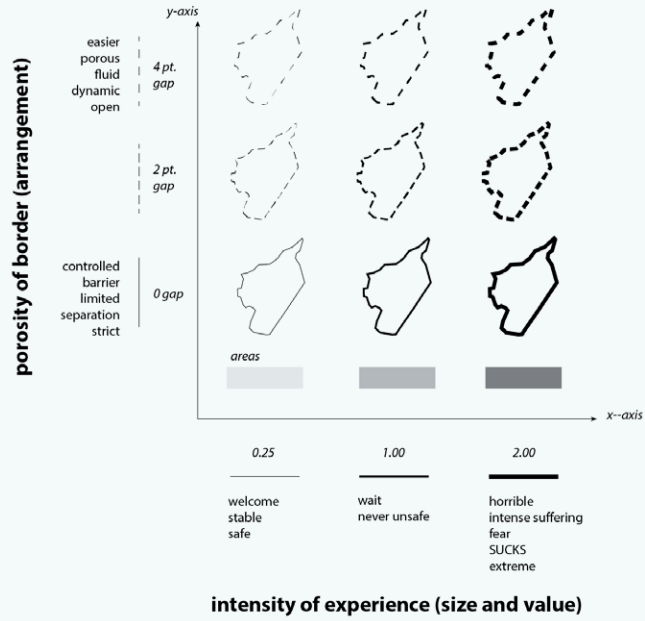

Figure 4. *Bivariate line symbolization scheme applied to the Syrian border.*

In the right panel, the name of the interviewee labels a point symbol (Figure 2, map element 3) at the start of the line in the lower right corner. This labeling strategy individualizes the point symbol. A thin vertical line extends from the point symbol to help organize the legend and narrative below. To the left of the dividing hairline,

I identified each border by name (Figure 2, map element 4). To the right, I illustrated the border symbolization (Figure 2, map element 5). Together, the label and symbol make up the legend. Traditional borders are labeled in roman type and non-traditional and abstract borders are italicized. The border is symbolized to the right of the dividing hairline to connect the symbol to the border type. As the reader turns the page, the legend also gradually descends, moving the reader through each story sequentially as told by the interviewee.

The hairline also separates two narrative voices: the interviewee's voice (Figure 2, map element 6) and my own voice (Figure 2, map element 7). The interviewee's voice is identified to the right of this line in a black, sans serif typeface (Myriad Pro). An excerpt from the interviewee's story is placed here to guide the reader through the story. The excerpts on each page build the individual's story and create a narrative arc. At times the excerpts provide cohesion and at other times, they fragment the story. Either way, the story is told through the lens of the individual. My voice provides an outsider narrative that is positioned to the left of the hairline and written in a gray, serif typeface (Garamond). My voice does not carry the story and instead provides ancillary information to support or direct the map reader. The goal of my commentary is to focus the reader but not speak for the individual, minimizing my voice.

The sequence of maps and the layout of the page are important to the overall sequence of each border story. Many of my interviewees' stories were not linear in their telling. Because of this, I had to reinforce continuity and a sense of journey in other ways (see Box 1 for a summary). Each border experience, for example, is presented on its own page. By advancing through a digital PDF or flipping the page in a printed copy, the journey—as told by the interviewee—advances and moves forward. This narrative ordering focuses on the individual and carries the reader through the story as told by the teller.

The fluidity of the story is reinforced in the layout of the page. The reader begins in the center of the page and transitions to the right panel. The right panel is read as the reader moves down the page. The legend follows this same downward motion with each page turn. This linear timeline is constructed and driven by the interviewee. Last, the interviewee's narrative, along with my voice, helps piece together the story and sequence of events. The interviewee's voice carries the reader through their narrative and journey, whereas, my voice "fills in the blanks" when necessary to help maintain some continuity and context.

1	Each border experience is presented on its own page. As the reader advances through a digital PDF or flips the page in a printed copy, the individual carries the reader through their story as they told it. This narrative ordering as opposed to chronological ordering focuses on the individual and how they told their own story.
2	The layout (Figure 2) guides the reader from the central map to the right panel, where the reader moves down the panel, building context and narrative.
3	The legend (border name and symbol) in the lower right panel shifts downward as the reader advances through the story.
4	Quotes from the individual are included in lower right panel to build narrative and context. The individual's narrative carries the reader through the page. The mapmaker's voice, distinguished using a serif typeface, provides context and continuity when necessary.

Table 1. *Cartographic techniques used to create a sense of linearity, journey, and narrative.*

PERSONAL MAP WALKTHROUGH

Here, I provide a brief walkthrough using some of Amal's maps (Figures 5–8). Though it does not cover Amal's story in its entirety, the walkthrough illustrates how this mapping technique works in practice. The rest of Amal's story, and additional mapped stories, can be found in the appended atlas, titled *Borders: An Atlas of Syrian Border Stories*.

The central map on the opening page of Amal's map series is blank and quiet, drawing your eye to the right panel (Figure 5). The locator map depicts Syria and highlights Aleppo, the city where Amal was previously living and working as a physician. Below is Amal's name. His name relates the forthcoming map series to Amal and his personal story. I briefly introduce Amal on the left side of the dividing hairline and Amal introduces himself on the right, describing his life at the beginning of the Syrian conflict.

The next map page presents the first border—an abstract square space outlined in the center of the page—discussed by Amal (Figure 6). The border is placed in the middle of the map page to draw your attention. Familiarity with the map key or bivariate line symbolization scheme informs you that this abstract border is heavily experienced (symbolized with the thickness of the line) and rigid (symbolized with a solid line as opposed to a dashed line). The whitespace surrounding the border focuses your eye and illuminates the border as well as its label, "people did not trust hospitals." To fully understand this border, transition to the right panel for context and narration. The locator map shows the location of the border displayed in the central map.

This border is located in Homs and is related to a hospital. You are reminded of Amal and his experiences by his name, which labels a point at the terminus of the dividing hairline. Next, you can identify the border as a hospital, written to the left across from the border symbol on the right. "Hospital" is italicized, reminding you that this border is a non-traditional border. Amal's voice appears last, describing this border and his experiences. Here, he describes his call as a physician to help Syrians affected by the ongoing violence and notes the fear of seeking medical attention in

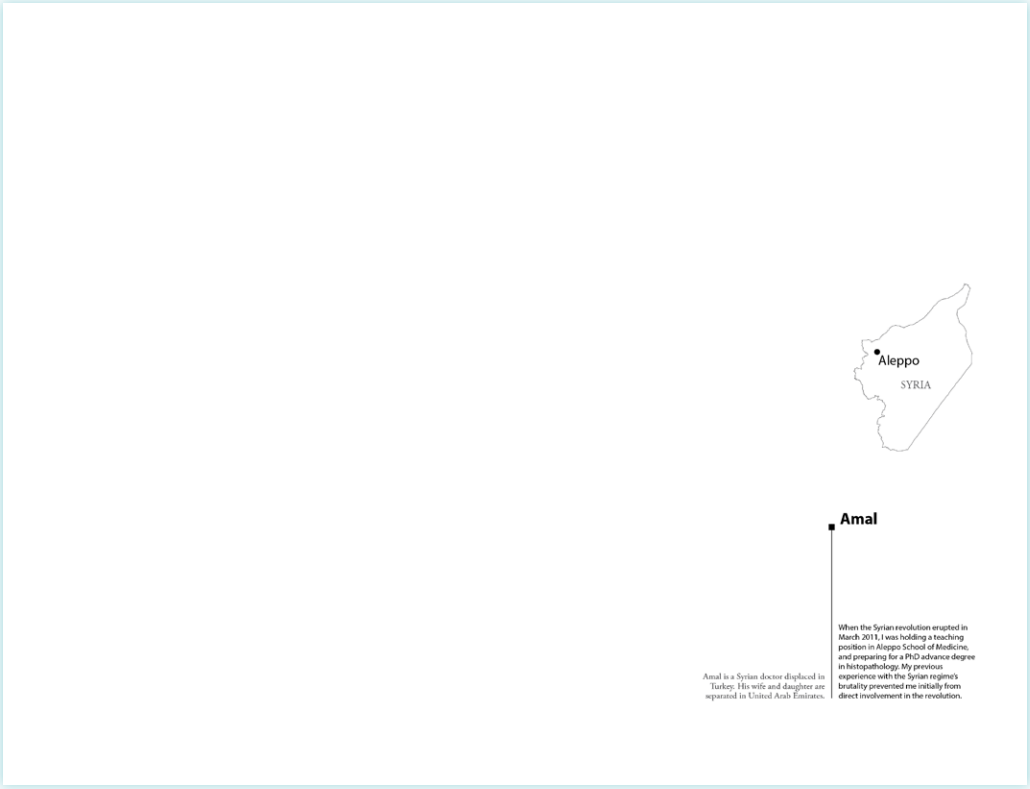

Figure 5. *Opening page of Amal's map series.*

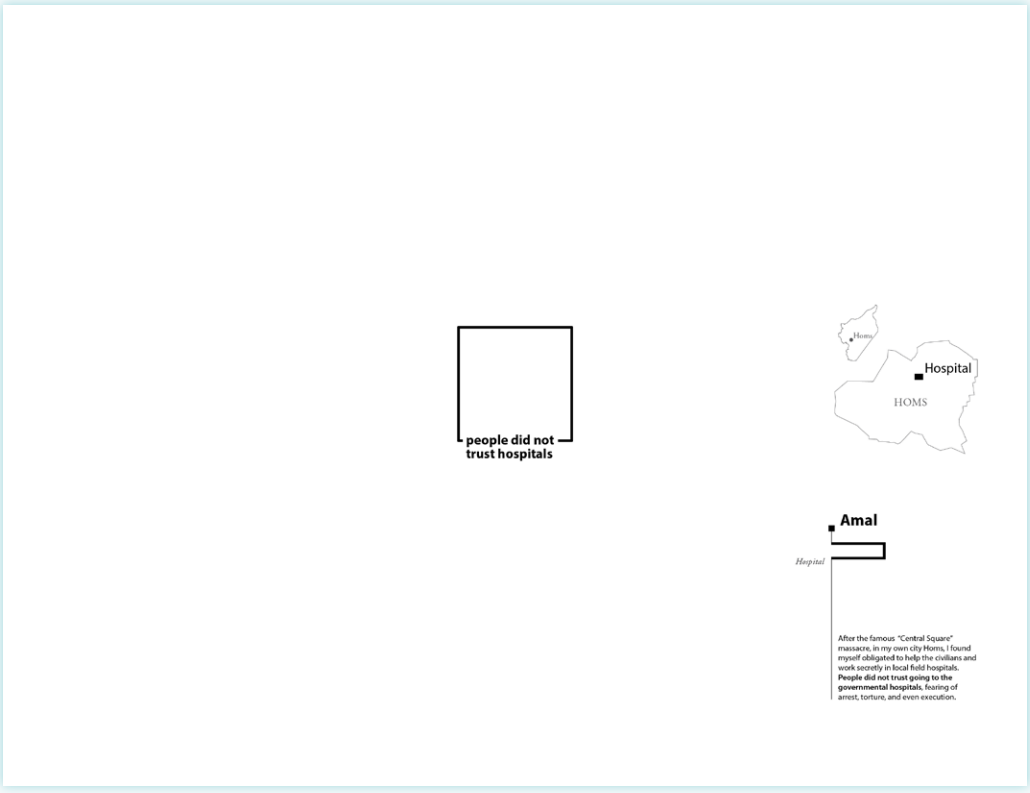

Figure 6. *Second page of Amal's map series.*

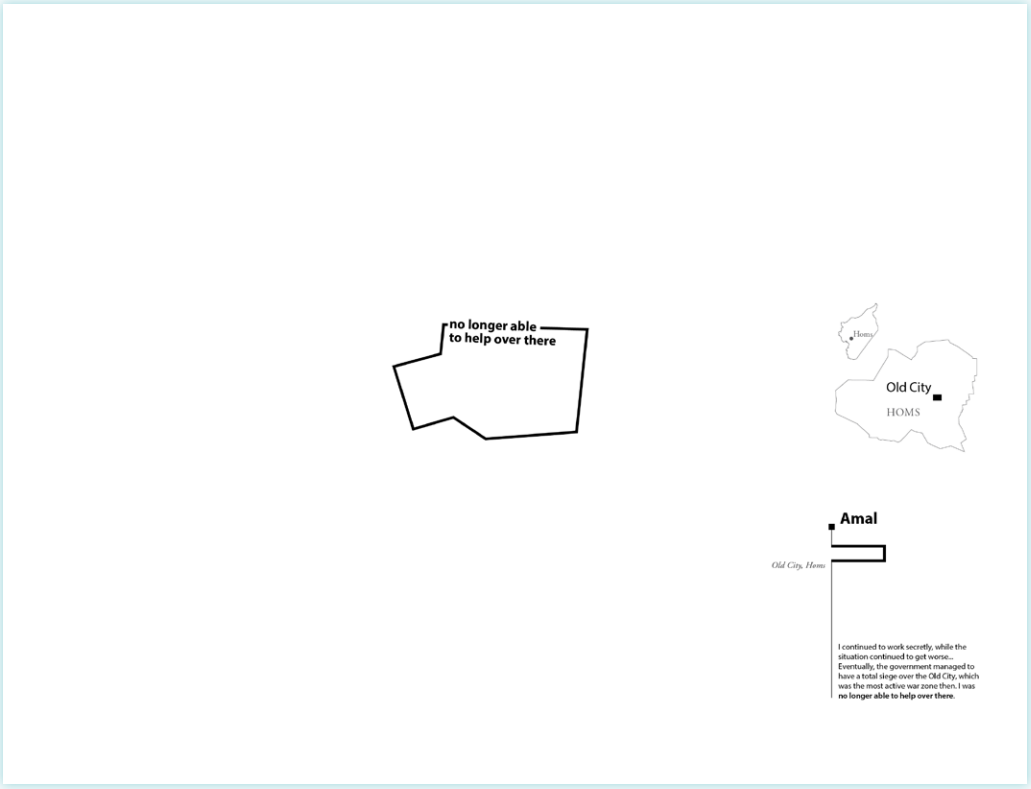

Figure 7. *Third page in Amal's map series.*

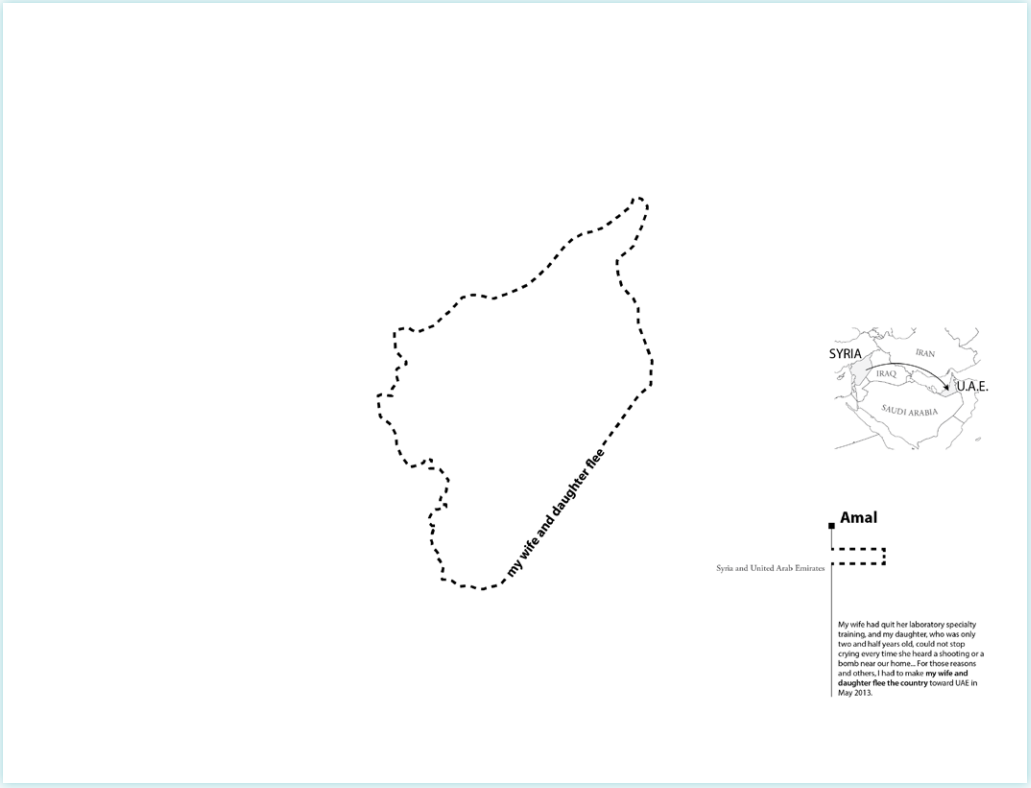

Figure 8. *Fourth page of Amal's map series.*

a government-run hospital. With the information provided in the right panel, the central map can be more easily interpreted and understood in the context of Amal's story.

As you move to the third map page, notice how the border changes shape, but the symbolization stays the same (Figure 7). The border label and content in the right panel also change. Beginning with the central map, we see a thick, solid borderline labeled this time with "no longer able to help over there." While the border symbolization is still the same, the experience written in the label is quite different. The locator map gives this border an identifiable location, the Old City in Homs, Syria. From the text below in the right panel, note that the border represents the Old City or the "most active war zone then" (Figure 7, right panel). This region of Homs is a non-traditional border (italicized in the right panel) with a defined location. Amal then describes the total siege and government control surrounding the Old City. Amal's mobility is limited as he is excluded from the space. The border is perceived as strict and impermeable (solid) but is dangerous when experienced (thick). Again, Amal's voice carries you through the map page.

The fourth page in the map sequence presents a new polygon shape (Figure 8).

Although irregular, this shape or border may be more familiar to you as it resembles an international boundary. This border is dissimilar to the previous two in other ways as well. The border is still thick and therefore intensely experienced; however, the line is also dashed. The dashed line elicits permeability and movement, unlike the previous two maps. Again, the border's label is unique to the border experience. This time it states, "my wife and daughter flee," which calls to mind movement. Returning to the right panel, you can further understand the border's geographical context given the locator map. The border is identified in roman type (not italicized) to denote the border as a traditional border representing Syria. Amal's voice continues to describe this border and his wife and daughter's passage through it.

Amal's story and experiences of borders continue through the remaining maps in the sequence. After "learning" how to read the maps with the available map keys, the repetition of the map layout design paces you through Amal's mapped story. Begin by examining the central map: its border symbolization and its label. What kind of feeling do you get when looking at the thickness, arrangement, and label of the line? Next, refer to the right panel, with the locator map for reference, and identify the border type. Is it traditional or non-traditional? Last, refer to my added narrative and Amal's voice at the bottom of the panel. While my voice provides contextual information, what is Amal telling you? His voice connects you to his story, his experiences, and the map. With these strategies, you can easily navigate Amal's story map along with other collected stories (Kelly 2015a; Kelly 2015b; Appendix).

METHODS FOR AGGREGATED MAPS

AGGREGATED MAPS

I BEGAN THINKING ABOUT AGGREGATION from the moment I began translating my seven interviews into map symbols. This cartographic translation, from the individual's story to the cartographer's symbol, aggregates the narrative by reducing the first-person account of the story to graphical marks. In cartographic practice, aggregation is a generalization technique that collapses multiple features from one dimension (e.g., points) into one feature from a higher dimension (e.g., polygons). I similarly use aggregation as a metaphor to demarcate the collapse of narrative detail within a single story or the collapse of multiple stories into a homoegenous, graphic form (Figure 9). Below, I detail my design process and present an aggregated map. In this section, I refer to two maps for each border: a small multiples map and an aggregated map (Figures 11 and 12, respectively).

After creating maps, as described in the previous section, for the stories of each of the interviewees, I began to explore aggregation as a means to collate these same stories into one graphic. First, I brainstormed several aggregating techniques, including merging multiple stories into one storyline, aggregating experiences with generalized symbols, collapsing features into different geometries (areas and lines to points), and quantifying experiences numerically. Next, I focused my attention on the individual story maps to explore common threads and points of differentiation. I began seeing overlap between the borders mentioned in each mapped story and started compiling all the individual maps sharing the same or similar borders. For example, 17 maps depicted the Syrian border and six maps illustrated the abstract space of the body. The same border could be described or experienced by the interviewees more than once in different ways. From this process, I developed nine border categories—Syria, Syrian-Lebanese, Syrian-Turkish, Syrian-Jordanian, United States, controlled areas, prison, Zaatari refugee camp, and the body—based on the geographic locations found in border stories, with the criteria that there had to be more than one map per category.

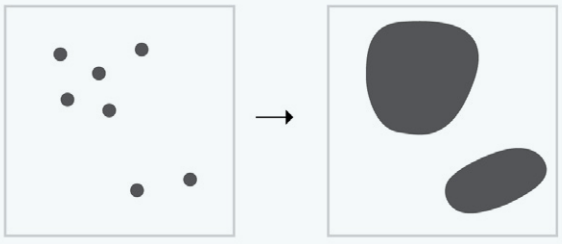

Figure 9. *Aggregation is a generalization operator that collapses multiple features from one dimension into one feature with a different dimensionality. In a similar way, aggregation can also take place when a story and its personal details are translated into (often) homogeneous graphic symbols.*

I then made a small multiples layout for each category. I copied all 17 Syrian border maps, reduced their scale, and arranged them onto a single page (Figure 11), maintaining the border symbolization chosen in the individual maps. I used generalization in two ways. Because of the reduction in scale, I simplified the linework of each border. Next, I simplified the experiential label. The original Syrian border maps were labeled with a quote from the interviewee describing their experience of the border. I generalized this label and the experience by shortening the label to one or two words. Some shortened labels work quite well, while others are more ambiguous.

The small multiples layout aggregates individual experiences, yet maintains the voices of the individuals, albeit to a lesser extent than the individual maps. I included the name of the interviewee with their corresponding map to connect the reader to the individual. This technique allows the reader to compare varying line symbolization and experiences between each person and map. While the linework depicting two different experiences is sometimes symbolized in the same way, the experience label on each map is different and provides a *glimpse* into individual experiences.

The small multiples are a powerful way for the reader to simultaneously visualize and understand the similarities and differences between experiences of the same border. When displayed together, the maps provide a broader perspective. In the bottom corner, a text description briefly introduces the border depicted on the page to guide the reader through the maps as well as teach the reader about the technique (Figure 11).

To create the aggregated map (Figure 12), I examined the border symbolization used in each small multiples map showing a particular border location, beginning with the Syrian border. I used median values of the 17 Syrian border symbols to determine which bivariate line symbol to choose (Figure 3). The median line weight and gap size for the Syrian border was a 2 pt line with a 4 pt gap between each dash. I next turned to labeling the line. This step was a challenge because the borders in the individual maps are labeled with a direct quote from the interviewee's border experience. Aggregating individual voices into one was an impossible goal for a couple of reasons. First, I did not want to prioritize one border experience over another. Second, I could not summarize the border experiences in words without aggregating even further. I opted instead to label the line with the border's name (for example, Lebanon) using a serif typeface (Garamond) in gray. These type specifications, similar to those used in the individual maps, designate the text as my voice, that of the cartographer. This technique is problematic because I completely removed the experiential labels. However, by switching the typeface, I demarcate my position as the aggregator. Although this labeling technique is a compromise, it forces the cartographer to be accountable. It also expands border identification and labeling to non-traditional borders. Many non-traditional borders are not recognized as borders at all, and without a label, they are silenced. A simple label brings these borders to the forefront and makes them visible on the page.

For the aggregated maps, I used a layout similar to the one used for the individual maps (Figure 2) with a few minor variations. I used a locator map to ground the reader and provide geographic context. The locator map uses conventional techniques that allow the reader to compare the aggregated map and symbolization with conventional techniques.

Below the locator is a square point symbol. In the aggregated map, this symbol is labeled "Interviewees" to acknowledge their collective experiences and perspectives. The point symbol is attached to a dividing line below. As in the individual maps, I identified each border by name (left side) and by symbol (right side) across the dividing line, connecting it to the central map. Traditional borders such as the Syrian border are denoted using roman type, and non-traditional borders such as the body are differentiated with italics. In contrast to the individual maps, I also provided the aggregated line symbolization specifications to directly identify the median values assigned to the border symbols.

Throughout the maps in the atlas, the dividing line separates voice, with my voice to the left (an outsider perspective written in a grey serif typeface) and the voice of the interviewees to the right (a first-hand account of border crossings written in a black sans serif typeface). Because the stories are aggregated, I did not use the interviewees' voices to guide the reader because I did not want to prioritize one experience over another. Instead, I relied on my voice to summarize their stories and provide an idea of how the border can be experienced in various ways.

This pairing of small multiples to show common difference, and an aggregated map to show a generalized border story, was then repeated for each border category. The small multiples layout is strategically displayed first to expose the reader an overview of *all* of the experiences of one border type. The small multiples and the written narrative help the reader interpret the second map (the aggregated map), its symbolization, and the varying experiences embedded in each border. Together, they demonstrate differentiation as well as similarity and parallels between border experiences.

AGGREGATED MAP WALKTHROUGH

Here, I provide a brief walkthrough of the aggregated map series (Figures 10–12). This walkthrough does not cover the aggregated map series in its entirety but should be used to help guide you through the remaining pages. Similar to the individual maps, the opening page of the aggregated map series is sparse, with the exception of the right panel (Figure 10). Look to the right panel for geographical context provided in the locator map and the introductory text below.

The following pages in the map sequence alternate between two map types: the small multiples and aggregated maps. Each border discussed in the interviews is presented using both map types, beginning with the Syrian border (Figure 11). The small multiples allow you to compare and contrast individual border experiences. This is an intersectional approach to mapping borders, which recognizes the similarities and discontinuities between border

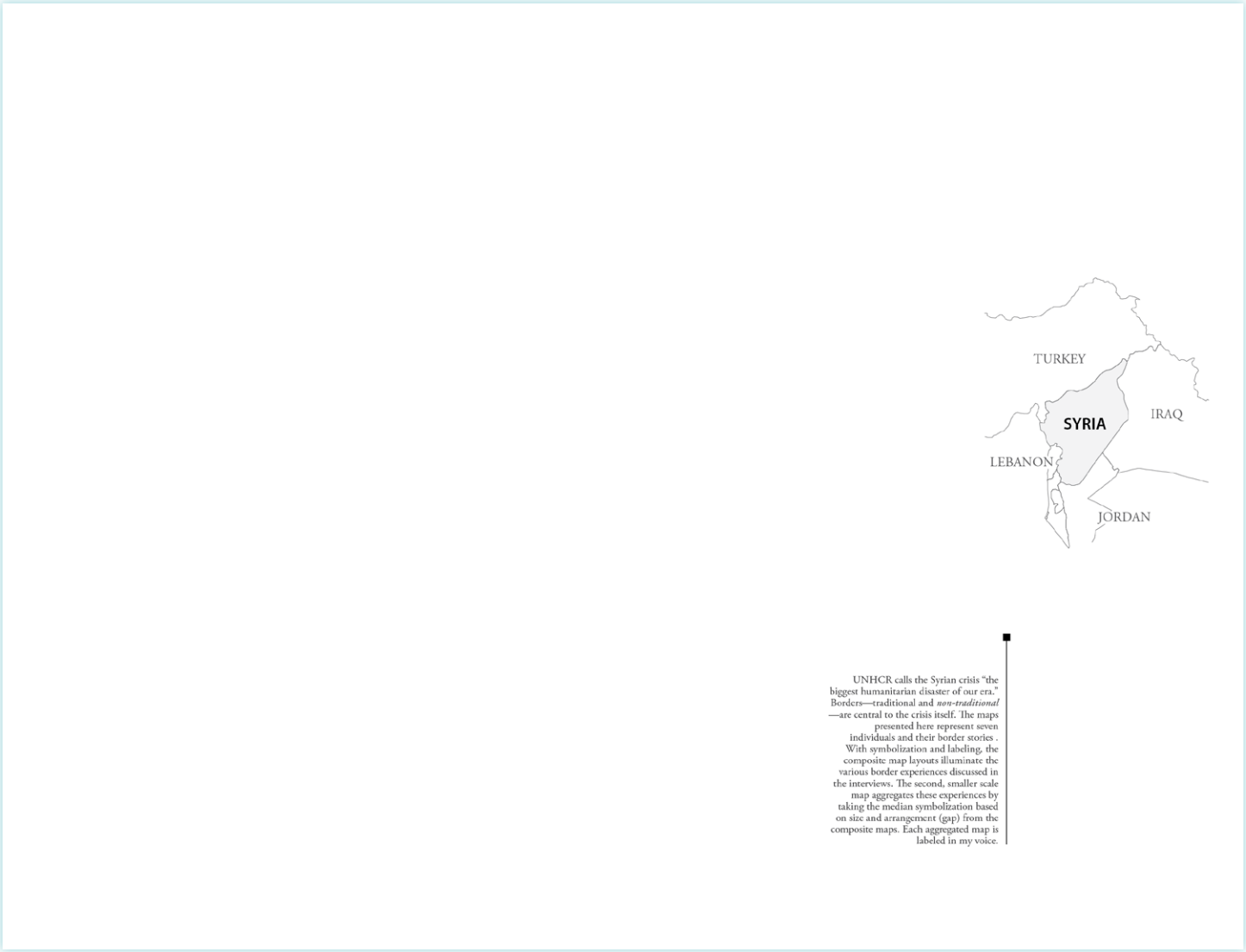

Figure 10. *Opening page of aggregated map series.*

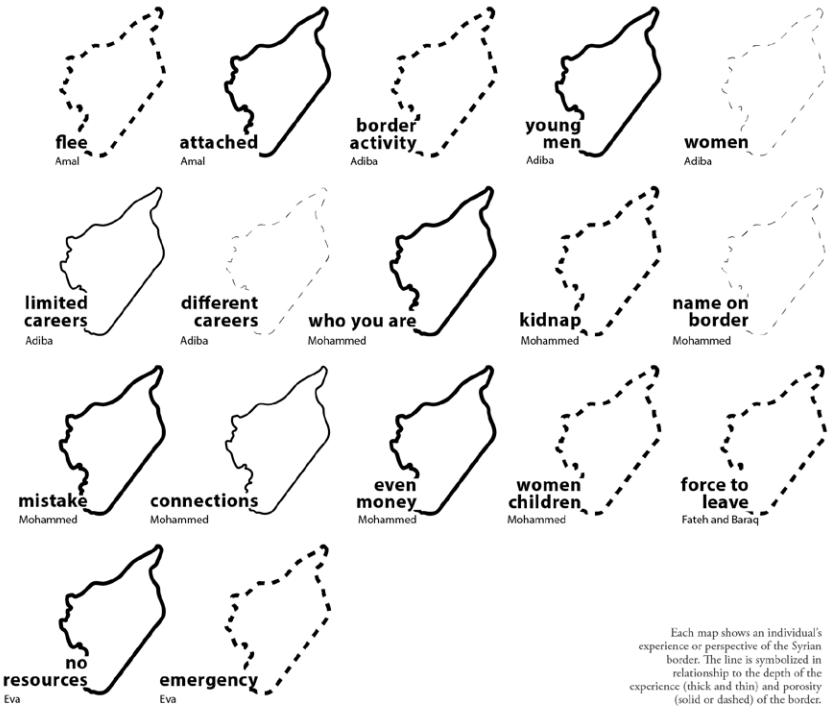

Figure 11. *Small multiples on the second page in the aggregated map series. The small multiples provide a visual comparison and illustrate the complexities, similarities, and intersectional differences between individual experiences. The small multiples are paired with the aggregated map (Figure 12) to simultaneously recognize individuals and multiplicity of experiences in aggregation.*

experiences and revised map symbolization. Each border is uniquely symbolized and labeled. Adiba's perspective in the top-right corner is symbolized as a thin, dashed line and is labeled "women." This map is very different than Eva's border, symbolized in the bottom-left corner with a thick and impenetrable line related directly to the lack of resources to leave the country.

Next, examine the aggregated map of Syria (Figure 12). Notice the layout is similar to that of the individual maps. Focus initially on the central map: its border symbolization and its label. Refer to the right panel for locational information, the summarized symbolization specifications, and contextual information provided by my voice at the bottom of the dividing hairline. The aggregated map collapses the individual experiences of particular borders into one map, a useful, and at times necessary, technique.

With this strategy, you can easily navigate the remaining pages of the aggregated map sequence available in the Appendix. The repetition of the map layout paces you through collective border experiences.

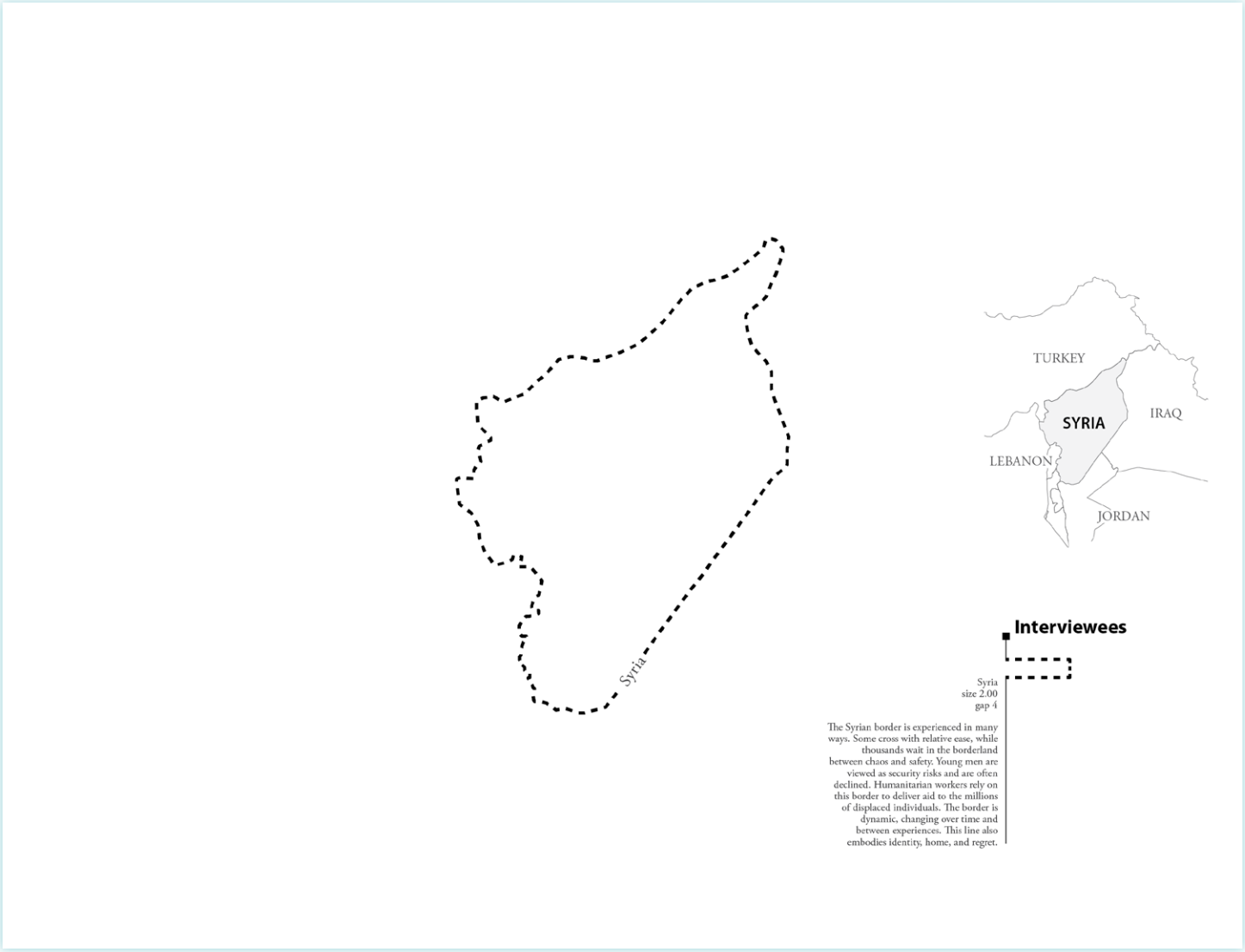

Figure 12. *Aggregated map on the third page of aggregated map series. When paired with the small multiples (Figure 11), the aggregated map is meant to show an overview that typifies the border symbolization in the small multiples. Similar to Mohanty's (2003, 503) "common difference," this contrasting pairing simultaneously recognizes the individual and the multiplicity of experiences in aggregation.*

DISCUSSION

I developed an alternative mapping technique to open new possibilities for border symbolization, guided by feminist theory and individual experiences. My goal was to enhance the cartographic presentation of the stories of Syrian refugee border crossings described by Amal and my six additional interviewees, to more fully reflect their border experiences. To do this, I relied on my primary source interviews and relevant literature in the fields of feminist theory and border studies to guide my iterative mapping process. Here, I discuss the successes and limitations of the maps in light of this background material, beginning with borders.

BORDERS DISCUSSION

Borders are central to the discussion of Syrian experiences and the ongoing conflict. From leaving one's neighborhood, to being trapped in one's home, to leaving the country, Amal and my other interviewees identified and highlighted different types of borders they encountered. These borders included formal borders such as the Turkish border and informal borders such as regime-controlled neighborhoods, rigid and consequential. Less obvious borders, such Amal's body when he was physically injured, were also made visible through mapping. Borders are the

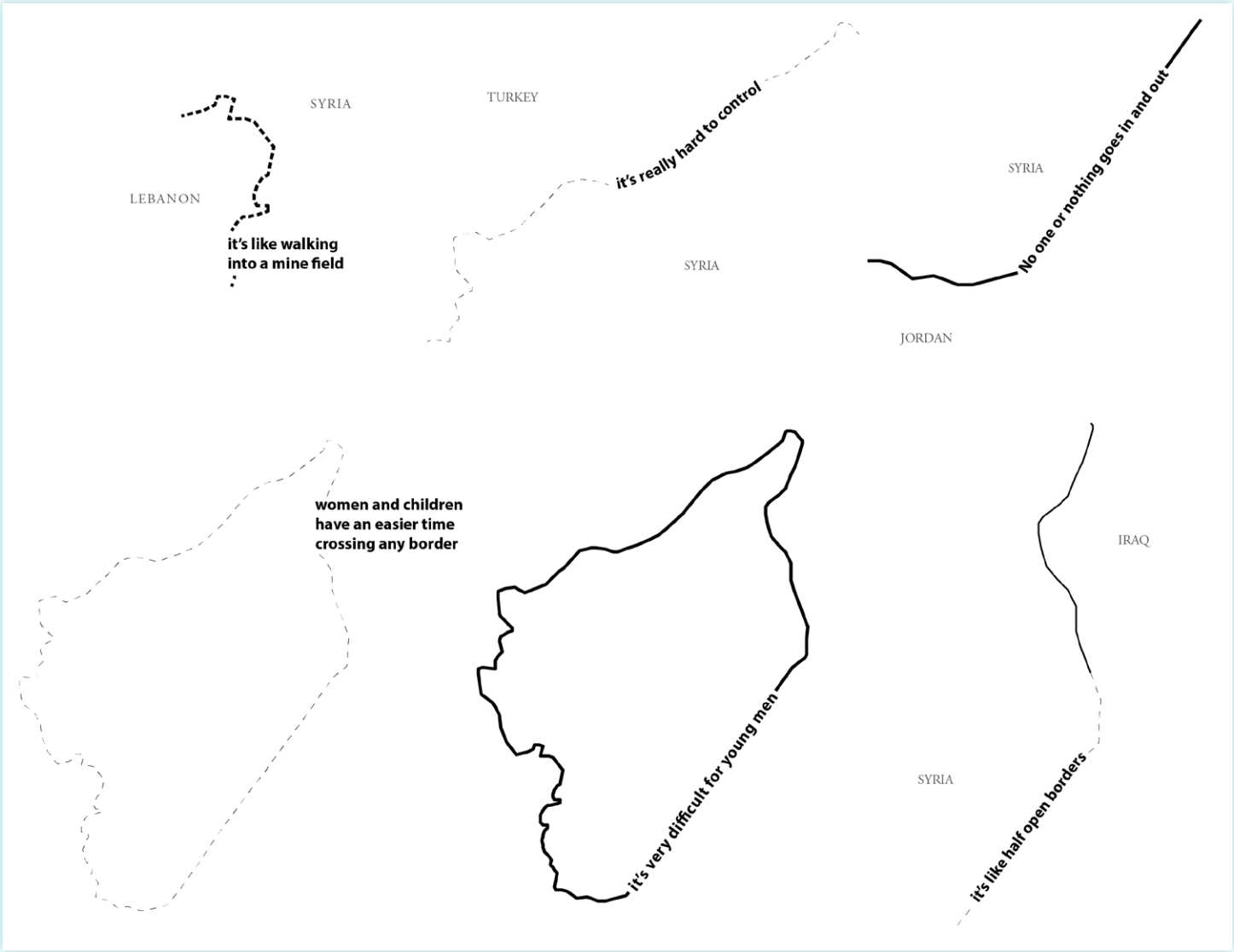

Figure 13. *Differing line symbolization based on Mohammed's and Adiba's description of each border.*

central focus of this feminist mapping project and the main focus within each map layout.

Borders and cartography have a rich, interwoven history (Black 1997). Cartographers' emphasis and reliance on symbolizing traditional borders reinforces the *territorial trap* that all state boundaries are fixed, homogeneous, and equal containers of the state (Agnew 1994 and 2003). Borders are neither solid, equal, static, nor rigid, nor are they experienced in the same ways. My alternative mapping technique aims to dispose of this state-centrism by removing homogeneous symbolization. I developed the bivariate line symbolization scheme seen in Figures 3 and 4 to reflect these dissimilarities and discontinuities.

Mohammed is another person I interviewed and asked about Syria's borders with neighboring countries. He is an activist and relocated refugee living in the United States. Given his personal experience and professional expertise working in humanitarian relief, he described the Syrian-Turkish border as relatively open and "hard to control" and the Syrian-Iraqi border as "half open" and "fairly controlling" (Figure 13 and Appendix). In contrast, he described Syria's border with Lebanon as "a mine field" and stated that "no one or nothing goes in and out" (Figure 13 and Appendix).

Another interviewee, Adiba, noted that different groups experience Syria's borders in different ways (see Figure 13 for examples). For example, women with children generally have an easier time crossing all of Syria's borders. In contrast, men, particularly young men, have a more difficult time crossing because they are considered high-risk or are called to serve the military. In summary, Syria's borders

vary drastically at both the geopolitical and personal levels. Mohammed and Adiba's stories, and the bivariate symbolization scheme, illustrate each border accordingly (Figure 13). Doing so "untraps" international borders and the map cartographically.

Similar to the work of Guidice and Guibilaro (2015) and Yuval-Davis and Stoetzler (2002), my interviews uncovered hidden narratives and complexities of individual border experiences. I expanded this work by translating these experiences into symbols and marks on the map, challenging cartographic conventions. With a few exceptions, I chose lines to depict borders in the central maps because of their familiarity and usefulness to the reader (Guidice and Giubilaro 2015, 81). My interviewees frequently referred to their experienced borders as lines or barriers. Early map drafts experimented with dimensionality, symbolization,

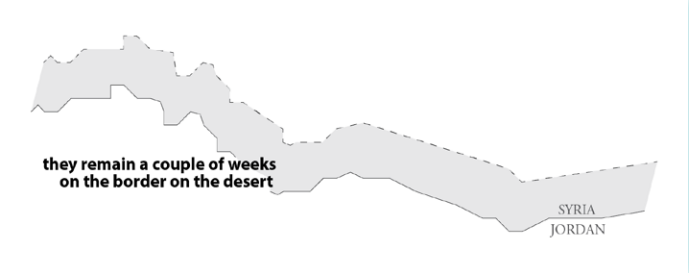

Figure 14. *Borderland or area symbolization based on Fateh and Baraq's description of Syrian-Jordanian border.*

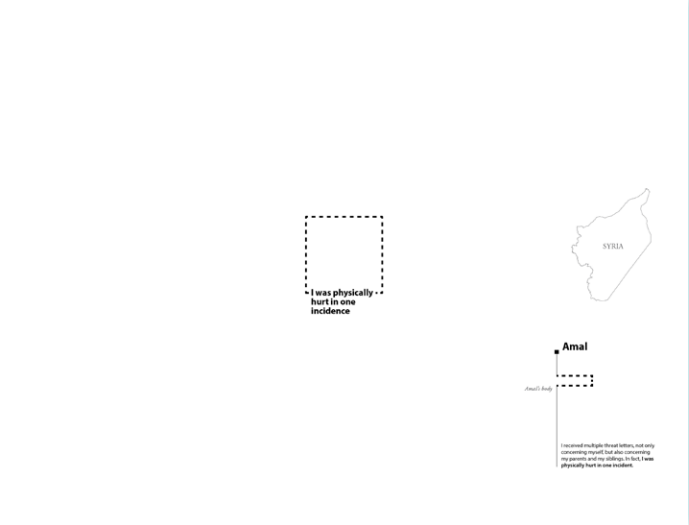

Figure 15. *Non-traditional borders without specified geographic coordinates are often left unmapped (in this example, Amal's body). The border is made visible with an abstract square space and, like traditional borders such as Syria's border with Turkey, it is symbolized using the bivariate symbolization scheme in Figure 3.*

and abstraction, but I kept returning to the line. I then explored, reimagined, and reshaped conventional line symbolization, embedding new meanings to reveal the possibilities of mapping the intensity of experience and porosity of the border simultaneously. The bivariate line symbolization scheme adopted in this atlas highlights nuanced and varied experiences. Although cartographically subjective (like every design decision), my symbolization choices were guided directly by individuals' border stories. Excerpts from my interviews were placed along the x-axis and y-axis of Figures 3 and 4 to classify each border symbol. The symbol choice and added experiential border labels provide a vivid encounter with Amal's story and border experiences.

Borders are "no longer simply lines on the map" (Rumford 2006, 161–162); they are borderland regions or critical zones of hybridity, confluence, exchange, and connectivity (Anzaldúa 1987; Rumford 2006). To reflect this graphically, I expanded the dimension of the lines to areas when described by the interviewee. For example, Fateh and Baraq described Syria's border with Jordan as an area with over 1,000 refugees waiting in limbo for clear passage. Instead of lines, I re-envisioned these borderlands using polygons to denote areas. Like the lines, I used arrangement to show porosity around the bounds of the border area. I then added changes in value in the intervening space to show intensity of experience (see areas in Figures 3 and 14). The darker the area, the more intense the borderland experience; lighter areas correspond to less intense experiences.

In addition to traditional borders, I also mapped non-traditional borders or contact spaces (Antonsich 2011; Näre 2014). Many of these non-traditional borders were identified in my interviews. Amal, for example, recognized the critical societal barriers between hospitals run by the Assad regime and the general public's fear of using the facility. Other non-traditional divisions include but are not limited to the body, the home, and controlled areas such as cities or neighborhoods.

One of the most important differences between traditional and non-traditional borders is their geographic "exactness." Traditional borders, such as Syria's international boundary, or the Damascus city limits, have specific geographic coordinates available for download and display. In contrast, non-traditional borders do not always have a precise location and a corresponding digital file. Borders

or other features that lack geographic information are generally not mapped, rendering them invisible in the map (Kelly 2015b). For borders with unspecified coordinates, I used squares to show undefined, abstract space (Figure 15). This technique revealed non-traditional borders that would otherwise go unseen. By treating non-traditional borders the same way as I would a traditional border, I identified, symbolized, and equalized the importance of *all* borders and border experiences.

FEMINIST THEORY DISCUSSION

Feminist theory played a significant role throughout the design process. I sought to ingrain the theoretical concepts of the body, reflexivity, intersectionality, and transformation into the maps (see Table 2 for a summary). Although I could not fully translate each concept into the maps, these areas of literature are critical to re-envisioning the map, its symbols, and its overall purpose.

While mapping, I focused on the simplest and most direct definition of the body: the body as "the geography closest in" (Rich 2003, 212). This definition allowed me to examine the stories told by my seven interviewees, looking for these intimate geographies, including experiences (Amal's physical injury), perspectives (Amal's recognition of public distrust of hospitals), and feelings (Amal's internal struggle treating both sides of the conflict).

Theoretical Concepts	Cartographic Design Decisions
Body	• Incorporate the intimate geographies of bodily experiences, geographies often unmapped • Symbolize bodily borders (and other non-traditional borders) as bounded space using abstract square shapes • Symbolize bodily borders in terms of intensity of experience and porosity using a bivariate symbolization scheme • Place individuals and their experiences in the center of the page using border symbolization • Label borders based on individuals' experiences to embody the "line" • Reveal and emphasize individual bodies by labeling a point feature in the right panel • Rely on the individual's voice in the border label and right panel to carry the narrative
Intersectionality	• Create individual maps for each person and *all* border experiences, traditional and non-traditional • Illustrate the intersectional identities and differing experiences of each individual using the bivariate line symbolization, experiential labeling, and narrative text • Recognize the similarities and differences (common difference) between individuals by utilizing a consistent layout and symbolization scheme • Show common difference and experiences of similar geographies through small multiples and an aggregate map pairing (Figures 12–13)
Transformation	• Expand border symbolization by embedding additional levels of meaning (intensity of experience and porosity) into the line • Extend border symbolization across lines and polygons • Include non-traditional borders generally silenced by conventional mapping techniques • Include individual bodily borders as abstract square spaces • Place border labels and added narrative pieces • Open the conversation with the reader and personally connect with the reader by providing a map walkthrough to guide the reader through the maps and their interpretation
Reflexivity	• Include positionality statement in text (see reflexivity statement in the Appendix) and map form • Demonstrate the reflexivity of the map itself through iterative mapping, transparent process, and documentation • Separate the cartographer's voice from the individual's voice using serif and sans serif type styles, respectively • Encourage other cartographers to be reflexive in their own work

Table 2. *Summary of feminist theoretical concepts and their cartographic implementation in the map.*

Although attempts have been made in the last ten years to map personal and emotional geographies (Griffin and McQuoid 2012), personal geographies and the individual body are often not mapped in Western media (Kelly 2015b). As cartographers, we have a tendency to aggregate bodies (Sprunk 2010; Kelly 2015b). Contemporary media frequently aggregate bodies into points, lines, or areas, neglecting the subjective, personal experiences of those involved (Sprunk 2010, 289). Individual experiences are lost, while a generalized reference or thematic map remains.

Valentine (1999, 331) calls the body a "tactile" bounded space that is "always sensing and actively engaging with itself (the inside) and the world (the outside)." Because of the complexity of the body and differences between bodies, I choose the square as an abstract space (not a point or line) to show this intimate boundary (Figure 15). I then symbolized these body squares or non-traditional borders using the bivariate line symbolization scheme found in Figure 3. Literature related to the body and subjective experience helped inform the development of this symbolization scheme.

Why the square? An abstract shape was imperative because an iconic symbol would present the body in a very prescribed way. The two icons on the right of Figure 16 depict the body in a conventional, heteronormative way. These icons also presume able-bodied figures and neglect individual identities and subjectivities. The square was a deliberate choice because it shows the body as a bounded area or space. In part, the square was also an aesthetic choice. A circle or triangle could just as easily have been assigned as the body, but the square looks and feels like the built environment or a built border wall.

The artist Zarina also uses a square in her piece "House with Four Walls" (Samantrai 2004). She notes that the square or *char diwari* (four walls) is a "complicated idea because it is used in so many contexts" (Samantrai 2004, 180). Four walls can depict the home but can also be embodied.

Figure 16. *Various body icons.*

In addition, the four lines making up the square must be understood by the reader based on the "walls of his/her own experience" (Samantrai 2004, 184). The square is malleable and can be stretched to fit non-specific locations in addition to the body. This is why *all* non-traditional borders, including the body, are symbolized as abstract squares. The size of the square remains constant to further equalize each border experience. Scaled squares would necessitate a hierarchal or ordinal structure that would prioritize some experiences over others.

I graphically expressed the body in other ways too. As mentioned, each border was labeled based on an excerpt from the individual's story. Each border *embodies* the individual and his or her border experience by placing an interview excerpt directly on the line. Although excerpts were subjectively chosen by the cartographer, this technique makes the body visible within each border in the center of each map page. I also used a point symbol at the beginning of the dividing hairline to represent the individual telling the story (Figure 2, map element 3). I focused attention on the body by labeling the point symbol with the individual's name. The point symbol and its corresponding name are visible on each map page. In doing so, the reader is constantly reminded of the individual telling the story. This technique connects the central map and the text to the storyteller. The central map and voice belong to the experience and perspectives of the individual, the body.

Individual identities are complex, messy, overlapping, and do not always fit into tidy categories such as Syrian, man, or physician (D'Ignazio and Klein 2016). In each interview, I focused on intersectionality or the "complexities, singularities, and interconnections" between individuals (Mohanty 2003, 523; Crenshaw 1991; Collins 2015). Intersectionality is illustrated cartographically in several ways. First, by making individual maps similar to Amal's for multiple interviewees, I was able to introduce each interviewee along with relevant personal details and symbolize borders specific to the individual. Each border is symbolized using the bivariate line symbolization scheme seen in Figures 3 and 4. As such, the individual's voice and experience are embedded within the line. Second, the experiential labels and narrative text in the lower-right panel expand the reader's understanding of the individual's border experience. The individual's identity and intersectionality are critical to understanding each border experience. As readers sequence through the maps, they continue to learn about the complexities of each individual and their

stories through border symbols, border labels, and narrative text.

Generalization and aggregation are not completely avoided. For example, I used a standardized layout and a prescribed symbolization scheme for each individual map. These techniques are useful for producing clean and consistent design, but they limit the expression of unique identities and intersectionality. I relied on "common difference" to balance the complexities of individuals with commonality between individuals (Mohanty 2003, 503). The theoretical framework of common difference was useful as I created nuanced, intersectional, yet consistent symbolization. In sum, it's important to acknowledge the effects of generalization and aggregation and work towards alternatives that recognize common difference.

The power of this approach is strikingly apparent when the same border experienced or described by several interviewees is presented in the small multiples layout. Figure 11—small multiples of the Syrian border—shows the same line re-interpreted through several individual experiences of a particular border. In it, six of the 17 maps of Syria symbolize the border as a thick solid line (an impermeable, yet heavily experienced border). On the other hand, each border experience and label is subjective and is therefore, individual. The solid, thick border described above can be contrasted with the thin, dashed symbol in the upper-right frame. The individuals in each map come from various walks of life. Some remain in Syria's neighboring countries; others are working as activists further abroad in the United States. They are, however, *connected* by having experienced the same border. In addition, some individuals experienced the Syrian border in similar ways. Side by side representations or small multiples demonstrate simultaneously the intersectional differences as well as connectedness between shared or similar experiences and geographies.

The maps developed in this study are produced by a transformative mapping approach that deconstructs and redefines the map and border symbolization by focusing on experiences (Cresswell 2013; D'Ignazio and Klein 2016). My approach expands border representation beyond international boundaries by incorporating non-traditional borders and borders lacking precise locations. In addition, my maps re-envision borders with voice and subjective experience.

This approach deconstructs and rethinks the power and silencing effects embedded within conventional border representation (Cresswell 2013; D'Ignazio and Klein 2016).

Scale, certainty, and anonymity of my interviewees were significant challenges to address when designing my transformative approach. My primary goal was to prioritize and enhance the intimacy of individual borders and experiences. In some cases, like in the map of the entire Syrian border (Figure 8), the precise location where Amal's family crossed the border was unknown—the location was either a detail left out in conversation with my interviewee or was left intentionally undisclosed for anonymity and safety purposes. To accommodate this uncertainty and capture Amal's experience and separation from his family, I symbolized the entire Syrian border. This, however, produced an unavoidable scale tension between intimate individual experiences and the geography of the border. When locational and contextual details were available, I was able to incorporate them cartographically to more precisely portray the border and border experiences.

Finally, transformation of the mapped space relies on readers' interpretation of the line symbolization, experiential labels, and narratives. This technique calls the reader to each border experience and provides the necessary legends (Figure 2–4), tools (map walkthroughs), and questions to aid interpretation. However, the story really takes shape by inviting the map reader into a conversation (Pearce 2008).

Reflexivity in relationship to feminist research asks the researcher to recognize their positionality, subjectivities, and biases (England 1994). The same approach applies to cartographers and mapping. From the beginning, I needed to remain aware of my own positionality as an outsider to the Syrian refugee crisis. This allowed me to recognize the limits of my perspective as well as the limitations of my mapping effort (Appendix, Positionality section). Even with the best intentions, my cartographic decisions will never truly capture Amal's or the other interviewees' border experiences and perspectives. Documenting positionality and acknowledging shortcomings—available in the Appendix—is crucial to mapping experiences and stories other than your own, especially those that include traumatic, personal, and ongoing situations.

Reflexivity can be practiced cartographically through an iterative and self-aware mapping process. Through each mapping iteration, I needed to remain aware of my

position as well as the impacts of my maps and symbol choices. What's working? What power dynamics are at play? What's not working and why? As a cartographer trained in Western mapping traditions, I began mapping with conventional techniques and then worked forward by continuously questioning and editing the map. I documented my process and symbolization explorations along the way to track the technique's trajectory. I sought feedback from peers and colleagues throughout and finally, I formally documented my process.

Transparency, iteration, and documentation of process were instrumental in maintaining my own reflectivity as well as the reflexivity of the maps (i.e., where they came from and how they came into being). I struggled, for example, with narrative text because I wanted to limit my narrative input and concentrate solely on mapping the story at hand. In the end, my voice was necessary at times to supplement the narrative because the map reader wasn't present during my interviews with Amal and others involved with the Syrian conflict. I needed to fill in the blanks and guide the reader. In addition, I was forced to recognize that my interpretations were changing and generalizing each story. By acknowledging my changing positionality throughout the process, I was able to see for myself the necessity and value of incorporating both voices.

While discernible and expected in feminist academic writing, cartographic reflexivity is often less visible in the map itself. How do cartographers demonstrate reflexivity with graphic marks on the map page? Similar to Pearce (2008), I integrated but separated my voice (the cartographer) from my interviewees' voices both in space on the map page and in style—serif for my voice on the left and sans serif for the interviewee's on the right of the dividing hairline (Figure 2, map elements 6 and 7). Cartographic reflexivity, however, is an area of research begging further questioning and conscientious undertaking by all cartographers.

CARTOGRAPHIC DESIGN DISCUSSION

This study developed from my dissatisfaction with conventional mapping techniques, particularly the techniques used by Western news media outlets, which push borders into the background and remove the body and personal experiences (Kelly 2015b). It must be noted, however, that my dissatisfaction derives from applying a specific theoretical lens, a lens focused on border literature, feminist theory, and critical mapping practices. As such, I recognize that the intentions of other cartographers portraying border experiences and the functions of their maps are likely different than my own.

Aside from providing a description and walkthrough of Amal's story and my alternative mapping technique, this study did not take the experience of the map reader into account. While beyond the scope of this paper, this limitation is valid and points to future research directions. How do map readers perceive and understand unconventional mapping techniques? How do unconventional mapping techniques become conventional, familiar, and understood

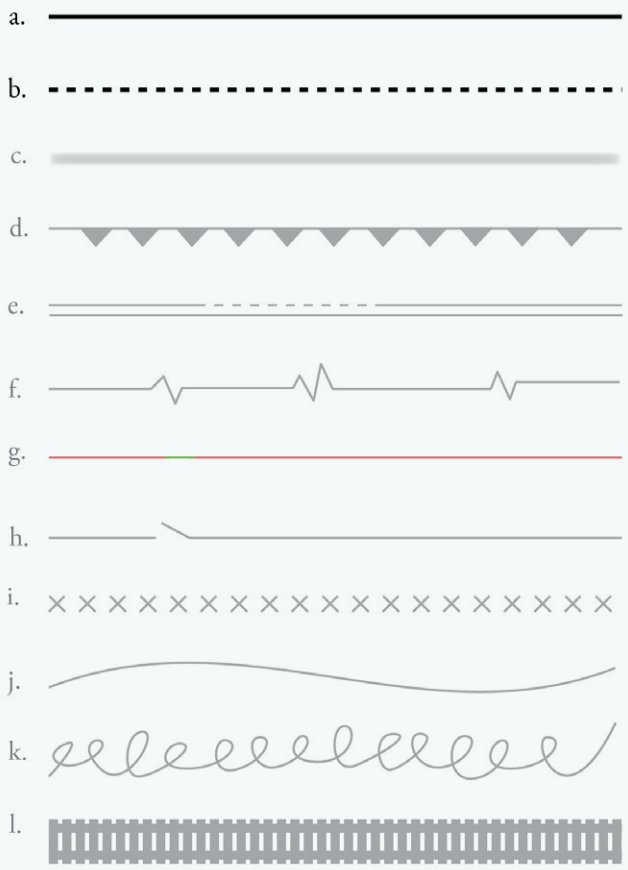

Figure 17. *The visual variables size (a) and arrangement (b) are just two design possibilities. Alternatives include blurred lines to show uncertainty (c), triangle shapes to depict directionality (d), double lines to illustrate two border encounters (e), and associative lines that use a heart monitor as a metaphor to show physiological response to border lines (f). Additional design strategies include the use of hue to demonstrate access (stop/go) or emotion (positive/negative) (g), and a range of associative and iconic depictions like a door (h), a series of "x" characters (i), wavy lines (j), barbed wire (k), and fencing (l).*

by the map reader? User studies would be an appropriate next step to understand the usability of this technique.

Furthermore, my feminist mapping technique is just one alternative; many static and interactive design opportunities are possible. I focused on two visual variables—size and arrangement—in my border symbolization. These are just two of several visual variables or cartographic buildings blocks used to encode map symbols with perceivable meaning (Slocum et al. 2009; Figure 17). Size and arrangement are, at times, limiting; both, for example, lack a clear depiction of directionality (is the individual enclosed or excluded, and in what direction are they moving?). Figure 18 suggests alternative designs using labeling and symbolization techniques that suggest varying accessibility and the position (inside/outside) of the individual. In the aggregated maps in this atlas, borders like the Syrian-Lebanese border are presented as one section of the overall Syrian border, in order to recognize variations. I completed a sketch mapping study (Kelly 2016) which proactively reassembled these border symbols into a map mosaic to geographically locate experiential differences and alternative symbolization along Syria's borders (Figure 19). This mosaic further explores the breadth of visual variables for border symbolization (Kelly 2016). Additional analysis of the visual variables, as well as the dimensionality (points, lines, and polygons) and directionality of border symbols and labels, is needed to truly rethink all the possibilities of border representation. Last, I relied on four cartographic techniques for emphasizing the narrative chronology in this atlas (described in Table 1), but there are a variety of techniques that could have been incorporated, like an accumulation of borders or an extension of the timeline (Figures 20 and 21).

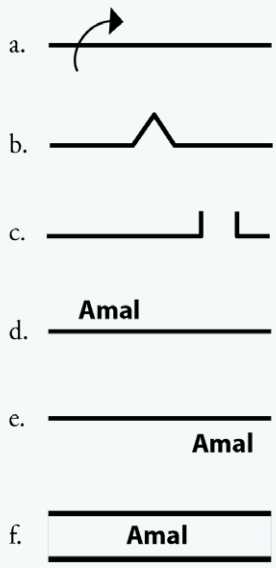

Figure 18. *Other potential border symbolization and labeling designs.*

Finally, my interviews with Amal and other Syrians and humanitarian workers were integral in the development of my alternative mapping technique. Due to time constraints and the scope of this project, they were unable to participate further. Going forward, I plan to increase the involvement of interviewees in the mapping process through participant mapping and by iterations of formal feedback. Additional interviewees across varying case studies would also strengthen the utility and applicability of this cartographic technique across all border scenarios.

CONCLUSION

The Syrian refugee crisis is one of the most critical and underfunded humanitarian crises in recent history. As of November 2019, the conflict continues into its eighth year due to the sheer complexity of the conflict. As nearly 5.4 million have fled across borders within the region and further abroad into the European Union, host countries and cities struggle to cope with the influx of Syrians (UNHCR 2018). Another 6.3 million Syrians are internally displaced amidst major cities under siege and in complete ruin (UNHCR 2017). As the crisis continues to unfold, and as Syria eventually rebuilds, the needs in the region will only increase.

I have developed an alternative mapping technique to open new possibilities for border symbolization, rooted in individual experiences and feminist theory. My goal was to enhance the stories of Syrian refugee border crossings as described by Amal and six other interviewees (Appendix), and to more fully reflect and visualize their experiences and intersectionality cartographically. To do this, I relied on my primary source interviews and relevant literature in the fields of border studies and feminist theory to guide my iterative mapping process.

This project contributes to and expands the field of cartography by integrating border studies and feminist theory into mapping. Using this interdisciplinary lens, I focused on the symbolization of borders and rethought "the line" as a new narrative mapping technique that emphasizes experience. My final mapping technique complements and broadens contemporary journalistic mapping and supplements story and narrative mapping literature and practices.

Figure 19. *Collectively Mapping Syria's Border (Kelly 2016).*

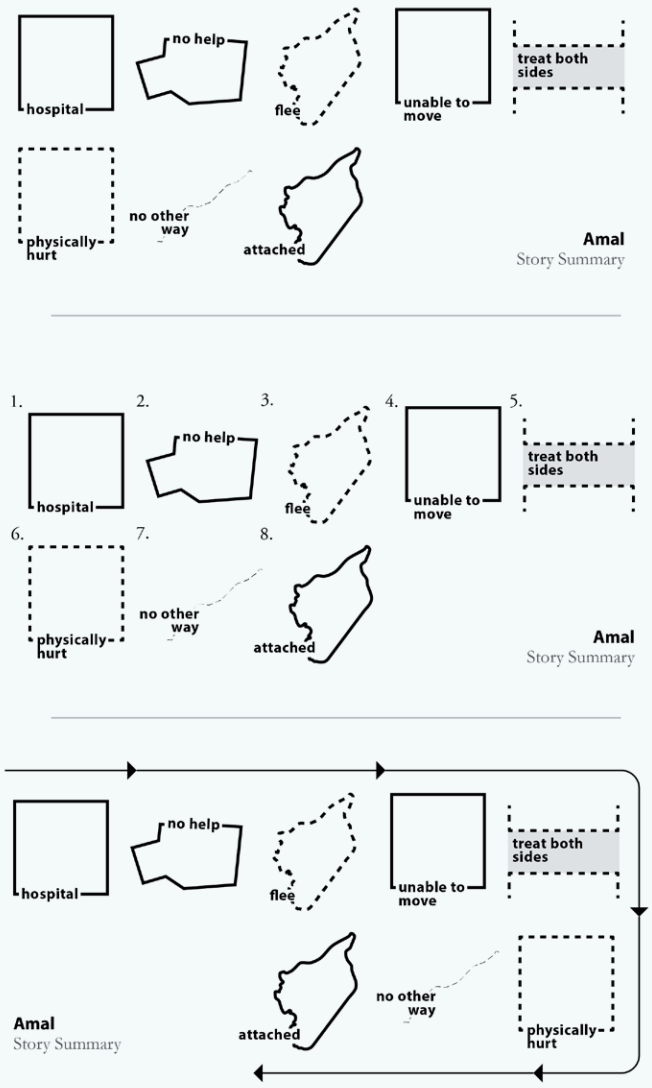

Figure 20. *Possible design solutions to support linear narration can take various forms, including locational sequencing, numbering, and directional arrows.*

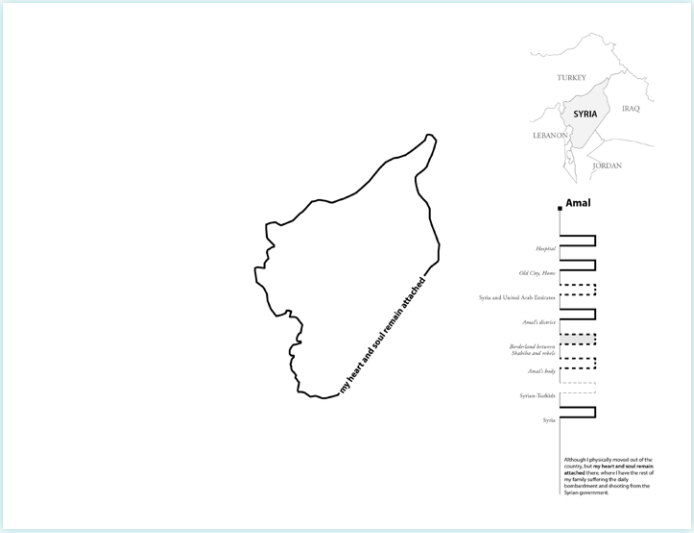

Figure 21. *Possible design solution to show linear narrative and sequence of border experiences by accumulating border experiences within the timeline.*

As mentioned, my technique is just one alternative approach. While imperfect, it does nudge feminist cartographies and border symbolization forward by questioning and transforming our conventional mapping practices. Similar to Danny Dorling's take on using cartograms to map census data, the "main disadvantage is that they [this technique] are unfamiliar, but we do not learn from familiarity" (1993, 171). By focusing on *new,* unfamiliar border symbolization, I expand and transform our cartographic vocabulary to reflect the subjective experiences of those crossing each border. It is my hope that this expanded vocabulary gives Syrians a geographic voice as yet unavailable to them through conventional cartographic techniques and homogeneous border symbolization.

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DOI: 10.14714/CP93.1567

Capture and Release: The Story of the Russian Military Topographic Map Collection

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The map collection of the Herman B. Wells Library at Indiana University (IU) Bloomington contains approximately 400,000 sheet maps covering nearly every country in the world. While the state of Indiana is a major focus of the collection, it also has strengths in Eastern Europe and Central Asia. In particular, the Russian Military Topographic Map Collection is of great value to IU's reputable Russian and East European Institute, and its Central Eurasian Studies program. As a result, the IU Libraries were awarded a Council of Information and Library Resources (CLIR) Hidden Collections grant in 2018 to fund the digitization of this collection.

The Russian Military Topographic Map Collection (**go.iu.edu/2aJ4**) contains over 4,000 maps depicting Eastern Europe, western Russia, and the Caucasus at scales of 1:25,000, 1:50,000, and 1:100,000. These maps were made by the Russian military for internal strategizing and tactical use in the field, and were considered top secret. The maps were published between 1883 and 1947 by a variety of agencies, including the Main Geodesic Department (Главное геодезическое управление), the General Headquarters of the Red Army (Генеральный штаб Красной Армии), and the Military Topographical Management (Военно-Топографическое Управление). While Soviet military topographic maps from the Cold War era are abundant, it is rare to find pre-World War II maps of this area at such detailed scales (see Figure 1). As Alexander Kent, author of *The Red Atlas: How the Soviet Union Secretly Mapped the World*, noted in his letter of support for the digitization project:

> The period in their collection ranges from Tsarist Russia through the birth of the Soviet Union and Stalin's decree to map the world. Of especial interest is the large-scale pre-war mapping of the Soviet borderlands, which is very rare indeed. Topographic maps were considered secret documents in the Soviet Union and large-scale maps of the era are scarce; exporting topographic maps of Russian territory at scales larger than 1:200,000 is still prohibited in that country.

Figure 1. *1:25,000 large-scale map of Tilsit, East Prussia, Germany (now Sovetsk, Kaliningrad Oblast, Russia). Individual buildings can be clearly seen.* **purl.dlib.indiana.edu/iudl/images/VAC9619/VAC9619-003613**.

In the years surrounding World War II, many of these maps were captured in the field by opposing forces, including German and American troops. After capture, the maps were stamped with the names of the various organizations that received them, such as the University of Berlin, the US Army Map Service, and the Central Intelligence Agency Map Library (see Figures 2–5). Some maps are marked "Секретно" (Secret) and others bear stamps from Nazi German institutions with swastika insignias. These myriad stamps offer a unique visual history, allowing us to trace the how these maps traveled from Russian troops in the field to Bloomington, Indiana.

After the war, the maps were eventually sent to the Library of Congress. Indiana University's collection was established from a cataloging exchange arrangement with the Library of Congress. IU Map Librarian Dan Seldin, participated in the Geography and Map Division Special Project in the late 1990s. This was a summer internship program, in which map librarians and catalogers would spend a summer processing and cataloging maps at the Library of Congress's Geography and Map Division (**loc.gov/loc/lcib/0109/intern.html**). In exchange, the interns would be invited to select duplicate maps from the Library of Congress collection to take back to their home institutions. Seldin chose the Russian military maps to complement IU's academic and disciplinary strengths.

ONLINE ACCESS TO THE COLLECTION

The Russian Military Maps project was funded in 2018 by CLIR as part of its "Digitizing Hidden Special Collections and Archives" program, which is designed to enable new scholarship by improving access to unique materials, and is supported by The Andrew W. Mellon Foundation. As part of the grant, the collection is being digitized, fully described, georeferenced, and made publicly available through the IU Libraries' Image Collections Online (ICO), a repository service for the preservation and publication of digital image collections curated by IU and affiliated cultural heritage institutions. ICO provides collections managers with the ability to showcase image collections using a standards-based cataloging tool and web publishing mechanism.

As part of the digitization process, we are creating detailed descriptive metadata for each map. Metadata includes typical fields such as publisher and date, and also provenance information created by transcribing the stamps on the

Figure 2. *Stamp from Geographisches Institut der Universität Berlin on a map of Łomazy, Poland.* **purl.dlib.indiana.edu/iudl/images/VAC9619/VAC9619-002739.**

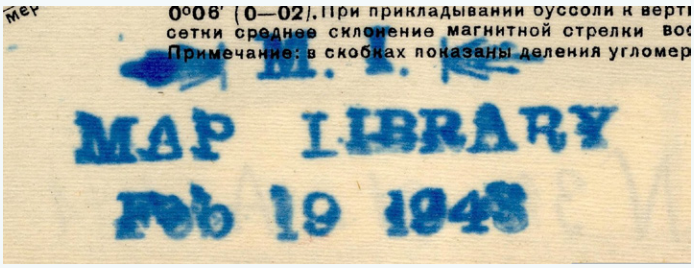

Figure 3. *"M. I. Map Library" stamp on a map of Nida, Lithuania.* **purl.dlib.indiana.edu/iudl/images/VAC9619/VAC9619-000275.**

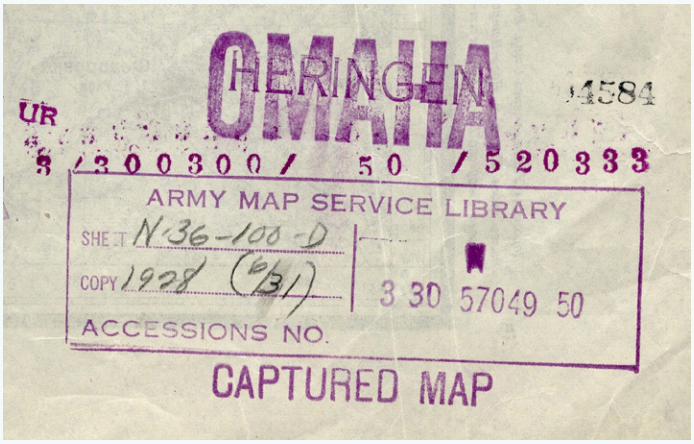

Figure 4. *Army Map Service Library stamp on a 1928 map of Antonovka, Belarus. Also stamped "Captured Map."* **purl.dlib.indiana.edu/iudl/images/VAC9619/VAC9619-001496.**

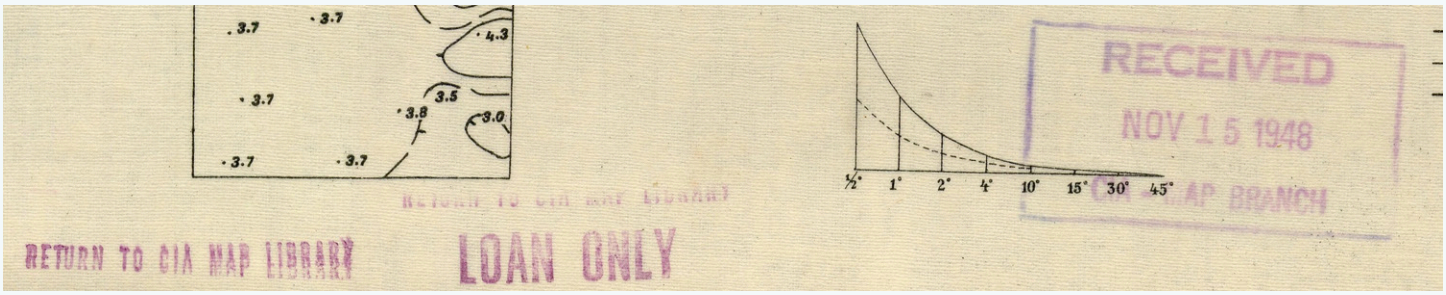

Figure 5. *CIA Map Library Stamps on a map of Orlino, Russia.* **purl.dlib.indiana.edu/iudl/images/VAC9619/VAC9619-003312**.

maps. In addition, our metadata specialists provide metadata in the original Russian as well as English, allowing researchers to search in either language. These maps cover a part of the world that has seen dramatic shifts in political boundaries since their creation. To aid in discovery, both historic and contemporary place names are included in the metadata, allowing us to describe maps of Belarus that cover areas that are now in modern day Poland, for example.

RESEARCH IMPACT

Changes in political boundaries, war, forced resettlement, and demographic shifts permanently changed Eastern Europe. These maps provide scholars with a unique historical view of the pre-World War II landscape. Given that the geographic area covered by these maps would later become part of the Soviet sphere of influence, the existence of these maps provides evidence of intentional action, or, at the very least, special interest on the part of the Soviets in this borderland region.

We have documented nearly 80 reference emails since the initial maps were published in 2014. To date, the questions we have logged reveal that researchers have been interested in locating historical places no longer in existence (or whose names have since changed), in combat strategies, and in remote sensing. By and large, those who specified their research interests were investigating lost settlements. Others have indicated interest in historically-based research on military or combat strategies and how those strategies are revealed in these maps. As we increasingly make maps from this collection available online, we will continue to track reference and research inquiries to have a better understanding of how these maps are being used in historical, socio-cultural, and military scholarship.

FUTURE PLANS

While the project's enhanced metadata greatly increases discoverability of these maps, we also wanted to create a geographic finding aid. As part of the grant project, GIS specialists are georeferencing each of the 4,000 maps and creating GeoTIFFs both with and without the map collars. Future plans for the project include creating an interactive index map that links to individual map records in ICO, as well as download links to the GeoTIFFs. We will contribute this index map to the "Clearinghouse of Indexes to Paper Map Sets," maintained by Chris Thiry at the Colorado School of the Mines (**bit.ly/33Awsiy**). In addition, the project GIS Specialists are in the process of creating country-level raster mosaics in areas where we have contiguous coverage. These raster mosaics will eventually be hosted to provide users with a Web Map Tile Service (WMTS) that can be used in web maps and GIS as baselayers.

Intriguing as it is to trace the journey of these captured maps over time, it does not bring us much closer to understanding the set as a whole. Since these maps were dispersed by warring interests, a complete collection is not likely to exist. However, once the Russian Military Maps index is completed, it will help us, and/or researchers, identify areas that are missing in Indiana University Libraries' collection. Other institutions who hold maps like these could use the index to prioritize digitization and online access for those parts of their collection that could complete the story.

DOI: 10.14714/CP93.1575

Mapping in Monochrome: Finalists from MonoCarto 2019

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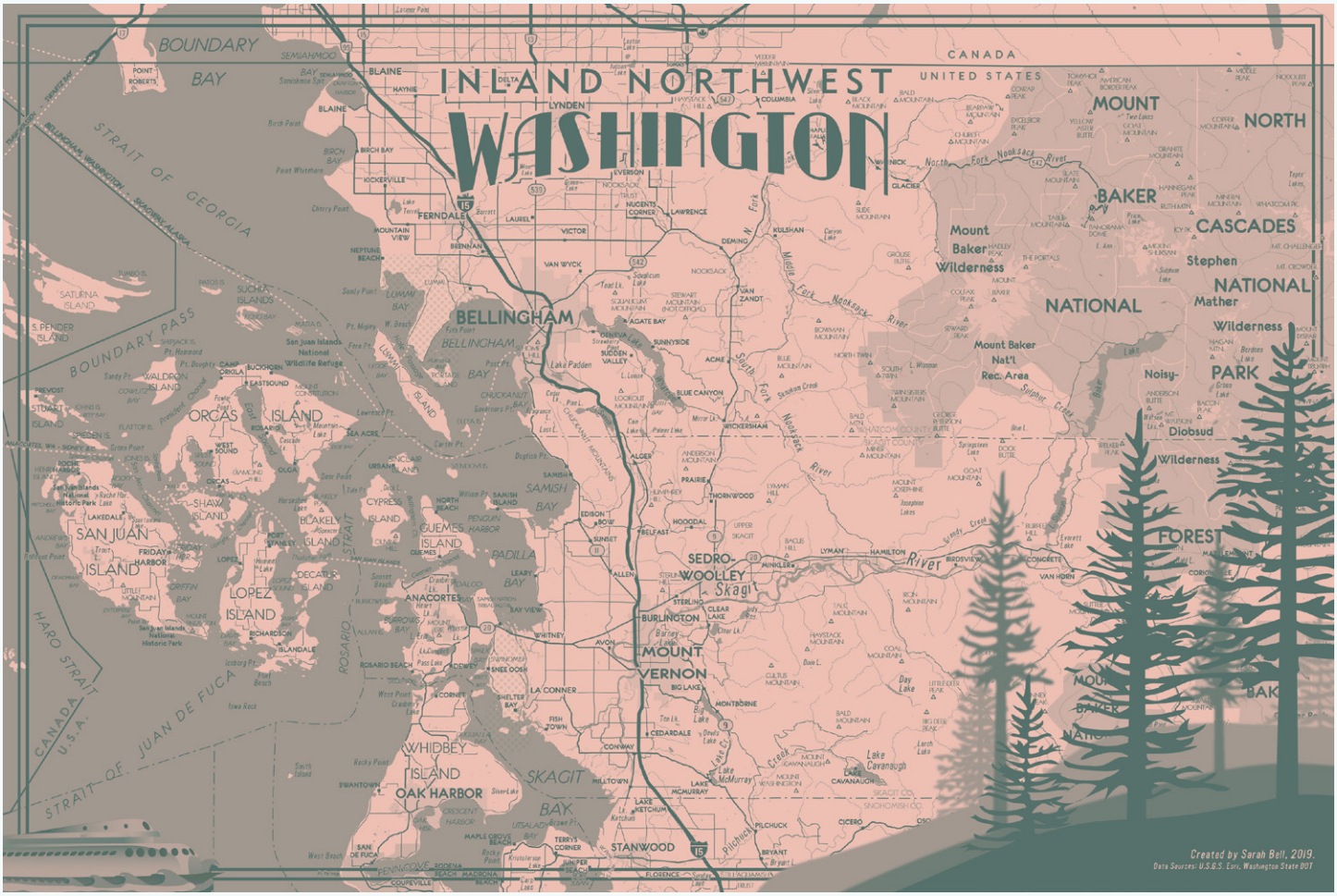
INLAND NORTHWEST WASHINGTON ART DECO MAP, BY SARAH BELL



"Even within the constraints of a single color it manages to deliver a lot of information in a clear way without seeming too cluttered." — Hans van der Maarel, MonoCarto 2019 competition judge

In 2019, Daniel P. Huffman organized MonoCarto, a map design competition with one primary stipulation: participants could only employ one foreground color, one background color, and any mixtures in-between. This initial foray was an unqualified success; over 150 cartographers from around the world submitted maps to be judged by a panel carefully selected by Huffman to represent the range of perspectives in today's field. This edition of Visual Fields exhibits selected finalists, and coincides with an in-person exhibition at the 2019 NACIS Annual Meeting in Tacoma, Washington. The author of this piece, Visual Fields section editor Jake Coolidge, also served on the judging panel.

For many cartographers, a monochrome design challenge arises from limitations imposed by the medium—the client needs a map for a book she's writing, and the publisher's budget only allows for printing with black ink; or, maybe a map will be circulated in classrooms and must still convey its message after it's been reproduced on a photocopier. The examples from recent history are varied, but could be typically boiled down to a common bottom line: full-color lithography is expensive, and printing in one color provides significant reductions in cost.

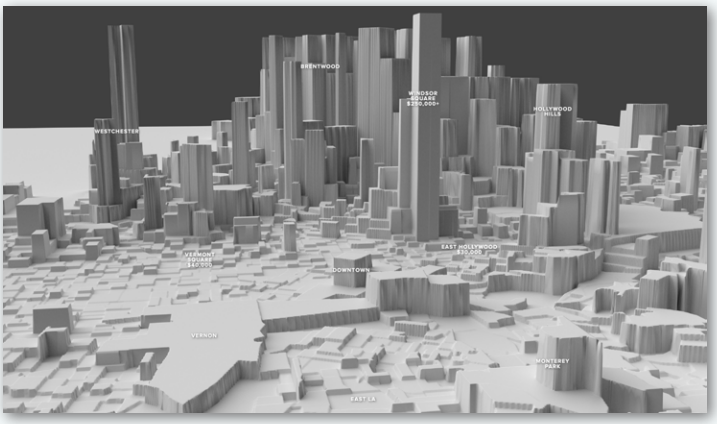
Now that most maps are designed for screens first and foremost, and distributed online, we can reconsider the role, the affordances, the power of monochrome maps in a digital, color-saturated medium. In a talk given at the NACIS meeting in Norfolk in 2018 (**youtu.be/ptKDS1Z8Oro**), Huffman expressed dissatisfaction with the arbitrary use of color. With so many colors at the cartographer's disposal, the thoughtful use of other visual variables, including texture, saturation, and value, is often lacking. Huffman implored cartographers to restore intentionality to the use of colors in maps, and in doing so, restore colors' power as cartographic symbols.

A great monochrome map will not leave the viewer wanting for more color—instead, with that one selected color, the cartographer can express specific aspects of the depicted geography with great acuity. It is a special sort of cartographic challenge that can spark a designer's creativity in new, unanticipated ways. And as Huffman noted, monochrome maps are innately more accessible, as they convey the same amount of information to viewers with color vision impairments and those who perceive the full spectrum.

It might be worth noting that monochrome is not strictly black on white. Returning to its print antecedent, monochrome can be black ink, printed at varying densities, on white paper, but it can also be blue ink on cream-colored paper, or reddish-brown ink on a manila folder. Black-on-white is well represented in these selected maps, but we also see white-on-black, as well as blue-, red-, or green-on-white, and in the case of Sarah Bell's striking Inland Northwest Washington Art Deco Map above, the design simulates green ink printed on pink-tinted paper. Huffman was clear in permitting the use of simulated paper colors at the contest's beginning.

The finalists displayed here embrace the limitations imposed by monochrome, and in doing so, provide fine examples of creativity in layout design, typography, and map symbolization. Explore the entries on the following pages and find inspiration for your next monochrome mapping project. Accompanying each entry is a quote from the MonoCarto 2019 panel of judges; to read the complete commentaries, visit Huffman's blog: **somethingaboutmaps.wordpress.com/monocarto-2019-winners**.

THE TOPOGRAPHY OF WEALTH IN LA, BY NICK UNDERWOOD



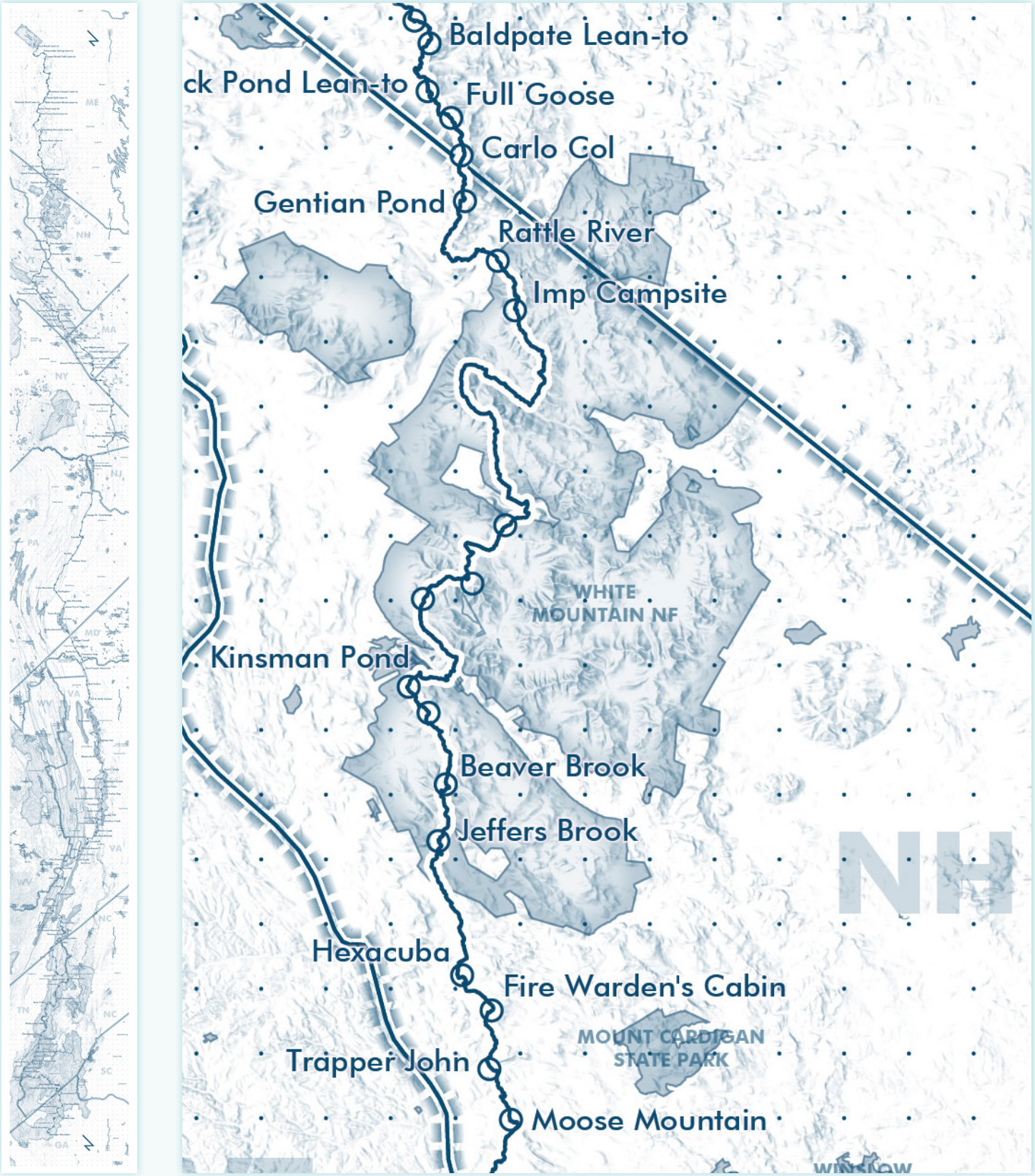
Shown are stills from an interactive visualization, which can be viewed here: nunderwood6.github.io/topography_of_wealth.

"The minimal presentation (note the stark grey sky in the background) offers a sort of early CGI feeling. But I'm not sure it needs more than that; color might simply muddy the clarity of the shapes. Some light and shadow is all that's needed to see what's going on."
— Daniel Huffman

THE SUM OF ITS PARTS, BY PETE KING

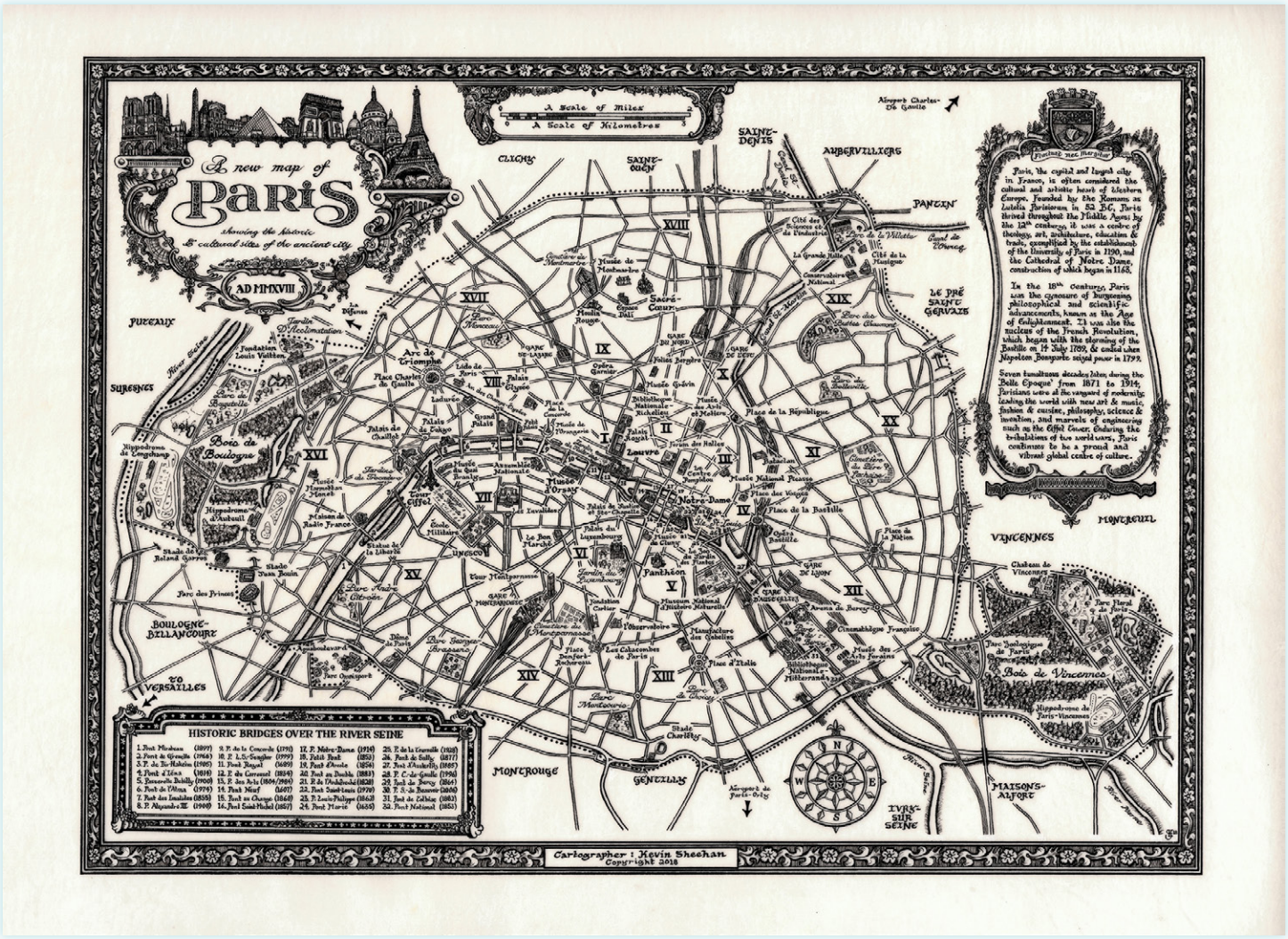
"The simple and straight-forward design of "The Sum of its Parts" is a map where the content drives the palette, rather than where the palette drives the content." —Ginny Mason

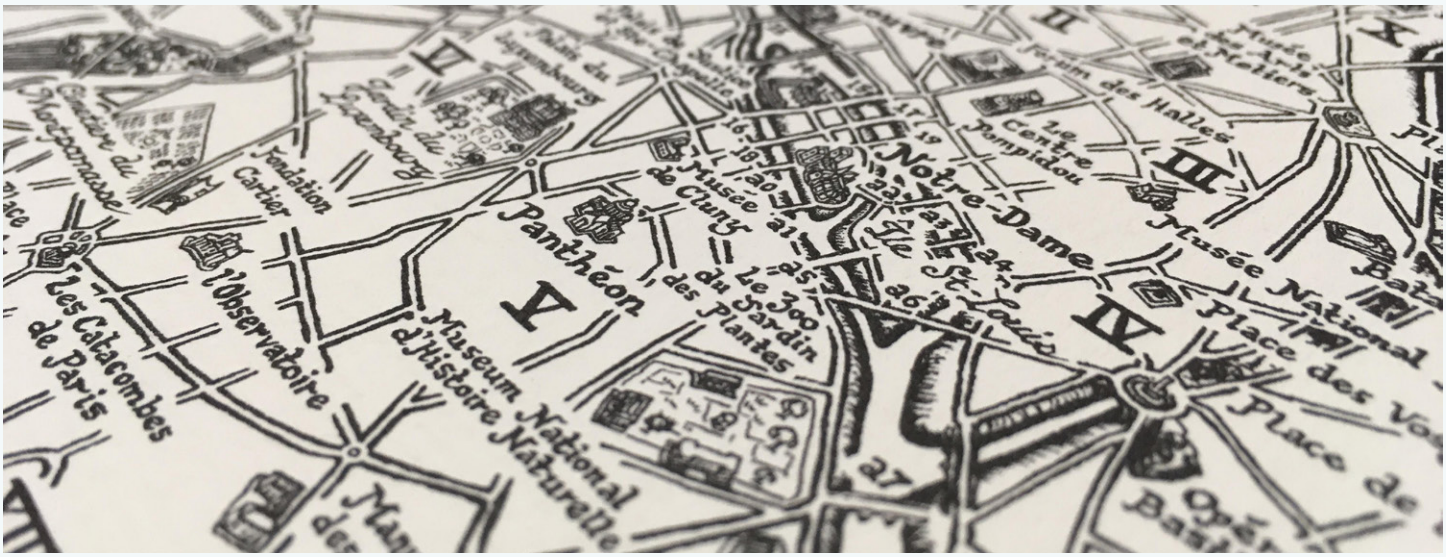
APPALACHIAN TRAIL FOLD OUT SHELTER REFERENCE & JOURNAL-ATOP ADVENTURE MAP, BY JOHN NELSON AND ERICH RAINVILLE —



"The fact that it is monochrome seems entirely appropriate as we are missing no information that is relevant to the imagined journey; and no doubt its monochrome-ness adds to its beauty." —Arzu Çöltekin

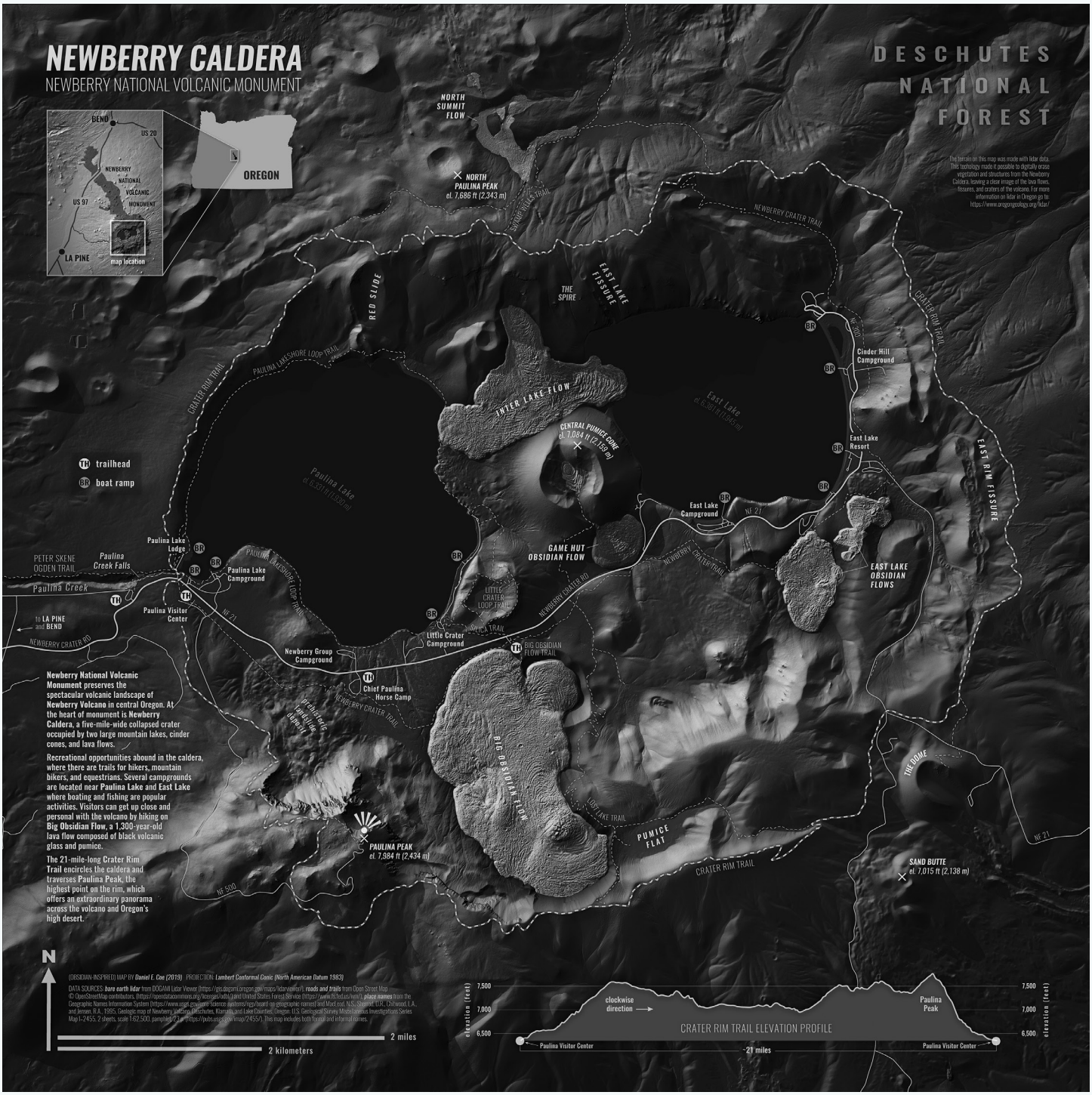
THE PARIS MAP, BY KEVIN SHEEHAN





"Purely monochrome in ink and calf vellum, this stunning illustration of Paris displays true craftsmanship." —Sarah Bell

NEWBERRY CALDERA, BY DANIEL COE

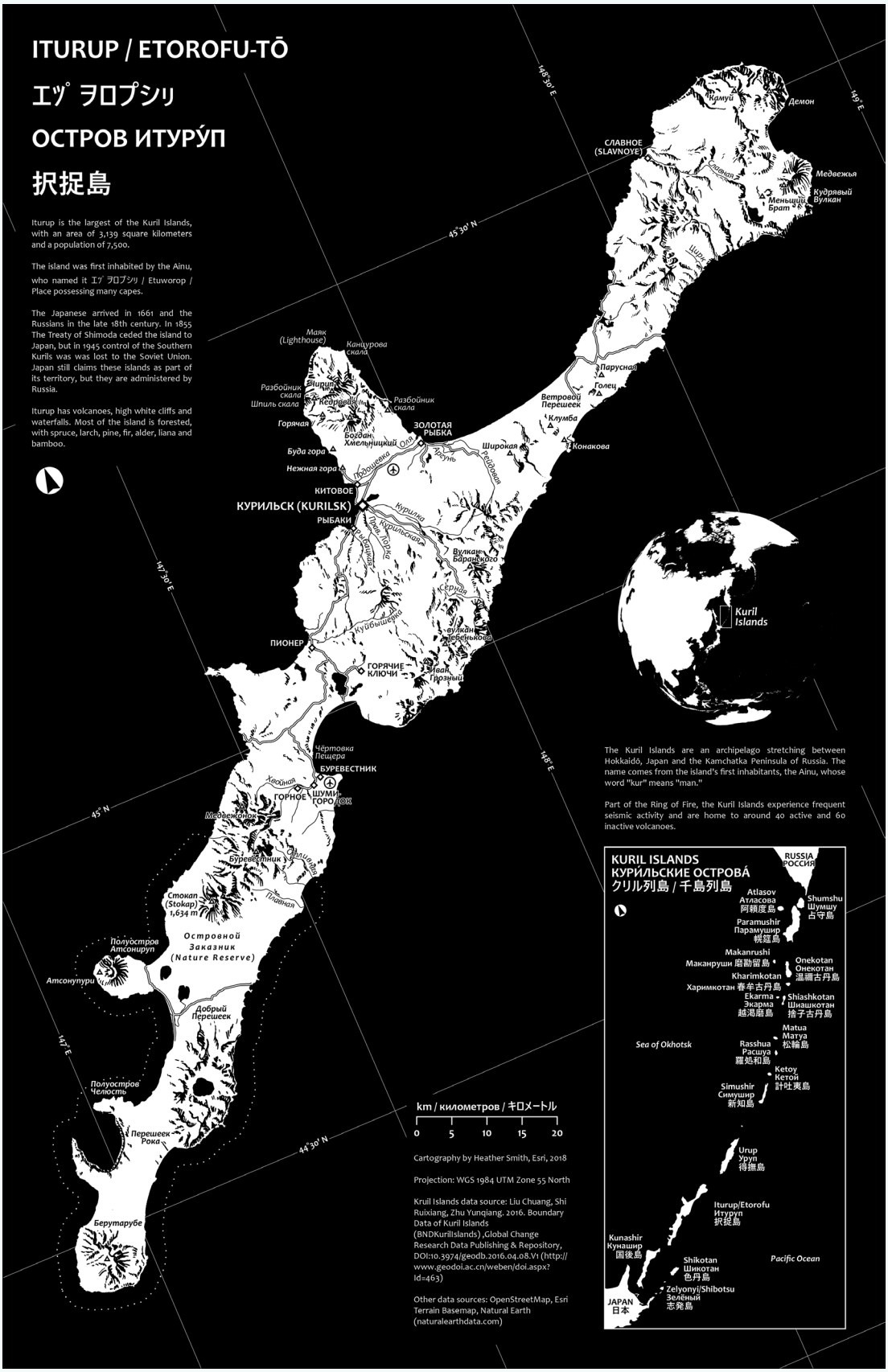


"The author has shown monochrome is not always a limitation in cartography, but at times an asset that can enhance the relationship between reader and nature, making this one of the best examples of contemporary monochrome maps." —Brooke Marston

FLOW MAP OF THE GRAND RIVER, BY WARREN DAVISON

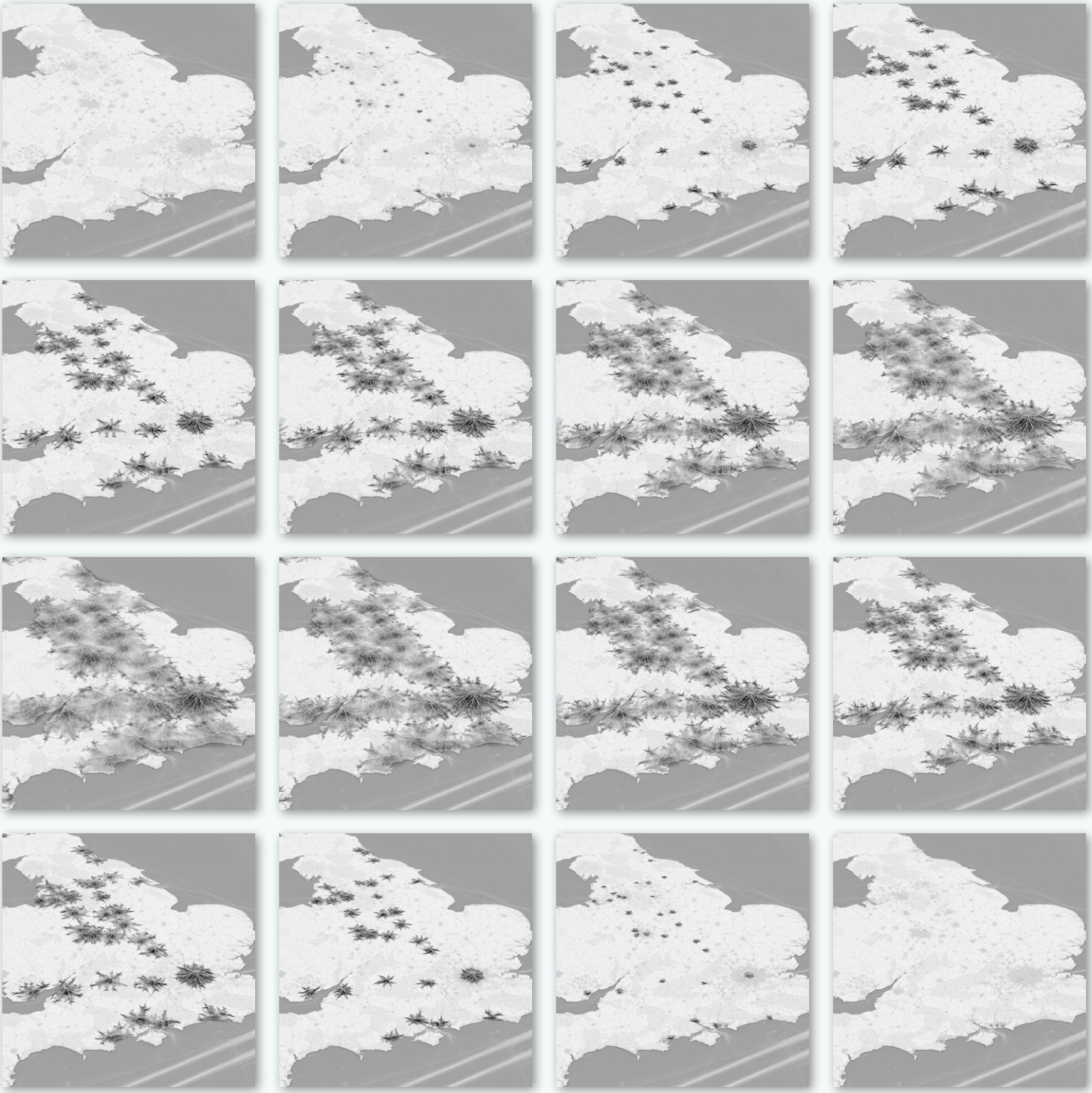
"By primarily using lines (of various thicknesses and dot/dash patterns) as the central graphic system, the map can remain monochrome while offering optimal readability. It is a very beautiful map." —Xemartin Laborde

ITURUP, BY HEATHER SMITH



"The stark black and white contrast provides a fantastic figure-ground relationship, while careful attention to line weights really makes the various map features stand out." —Martha Bostwick

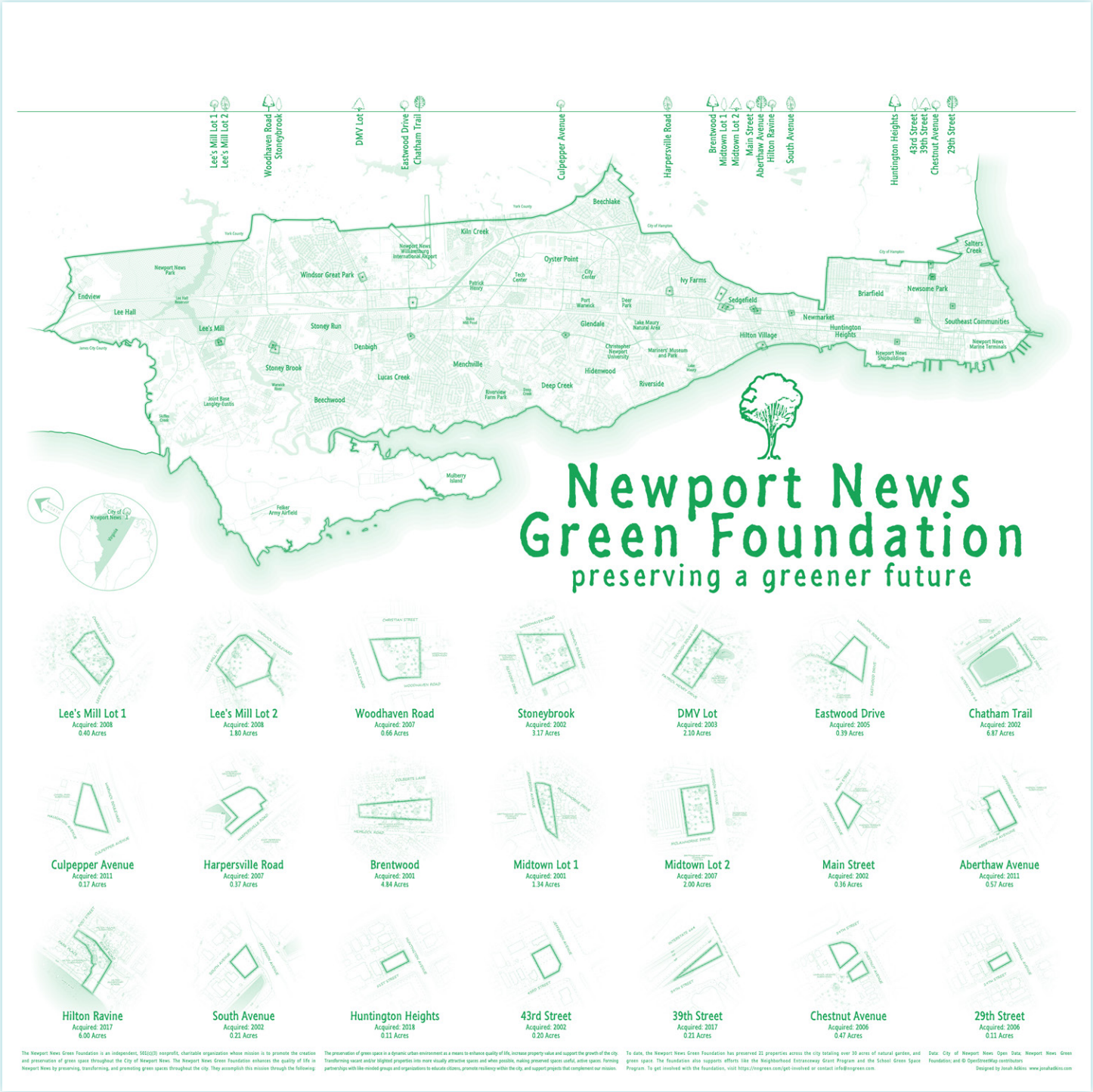
MONOCHROME DRIVE TIME MOUNTAINS, BY CRAIG TAYLOR, ITO WORLD



Shown are stills from an animated visualization, which can be viewed here: www.dropbox.com/s/4q4dnz6jonnv7oh/BD.mp4?dl=0.

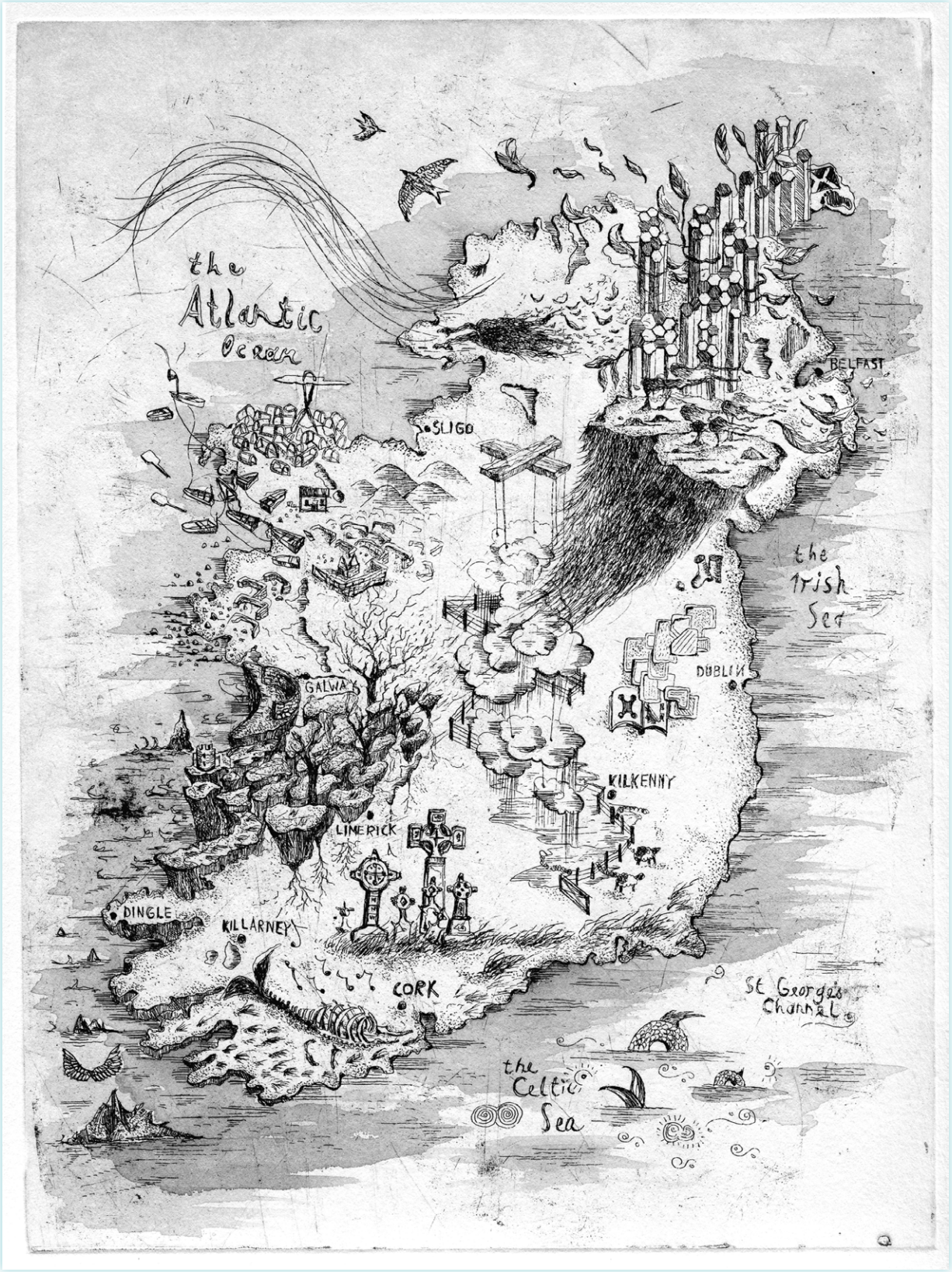
"Craig's design decision to size the roads according to their width and likely traffic volumes produces a map whose appearance also references the small blood vessels that feed into larger ones to bring life to the body. The balance of greyscale variations provides enough contrast to clearly delineate the growth and diminishment of the mountains along the road networks and focuses the reader's attention within the changing scene. Finally, the measured pace of the animation contributes to the sense of a living, breathing commute." —Amy Griffin

NEWPORT NEWS GREEN FOUNDATION, BY JONAH ADKINS



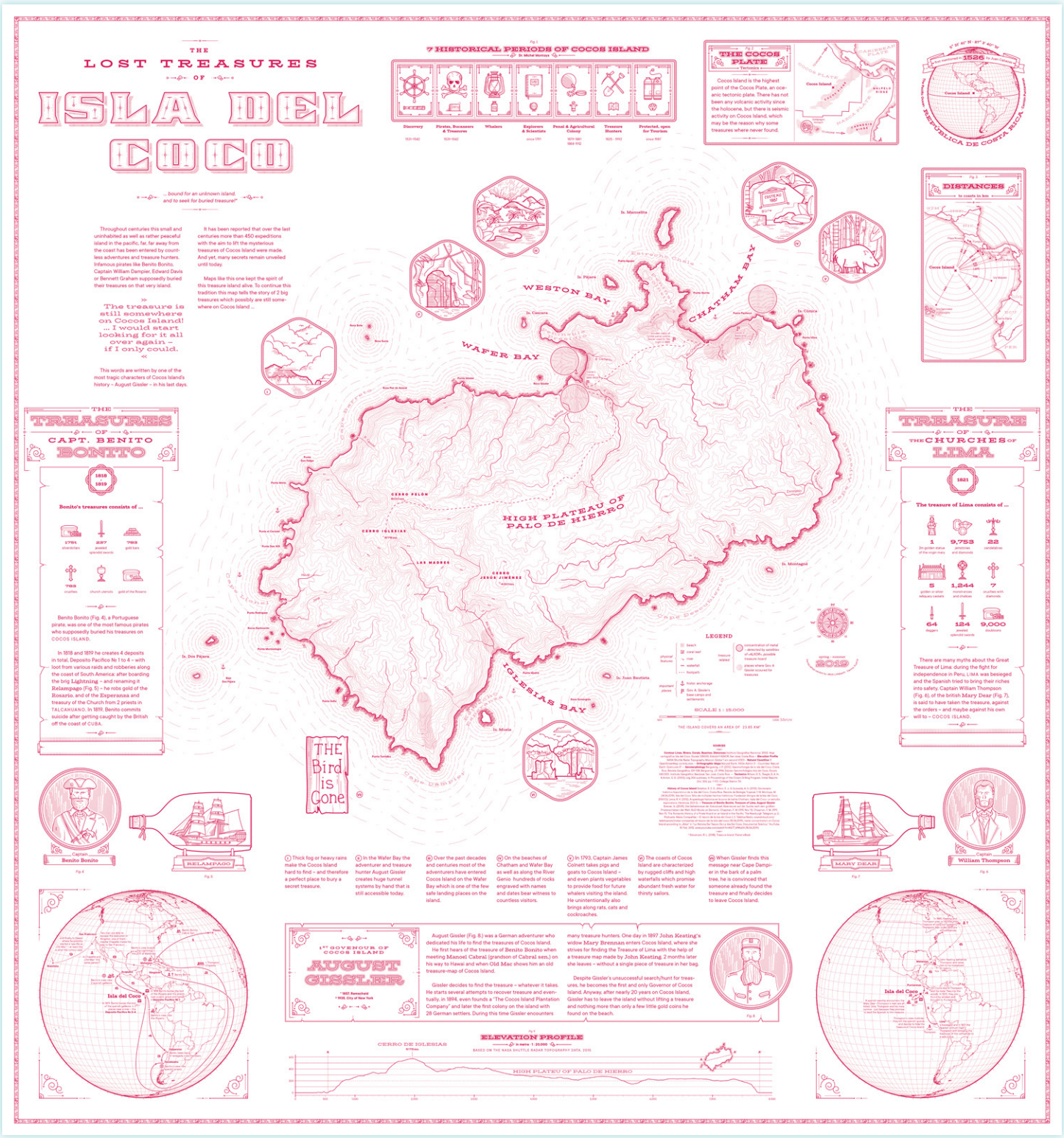
"It is a good map of the achievements of a local non-profit. The general conception and layout are elegant and understated, and the map should be inexpensive to print." —Mark Denil

IRELAND, BY ALEX HOTCHIN



"The mixture of a solid fill to frame the coastline, and the variation in density of textures and patterns helped differentiate complex illustrations from each other, making this a detailed but easy-to-absorb map in monochrome. I kept getting lost in this map in the best way possible, noticing the intricate illustrated details of symbols and physical features. And that coastline. . . I notice new details every time I look at it." —Lauren Tierney

THE LOST TREASURES OF LA ISLA DEL COCO, BY JAKOB LISTABARTH, UNDER THE SUPERVISION OF MANUELA SCHMIDT

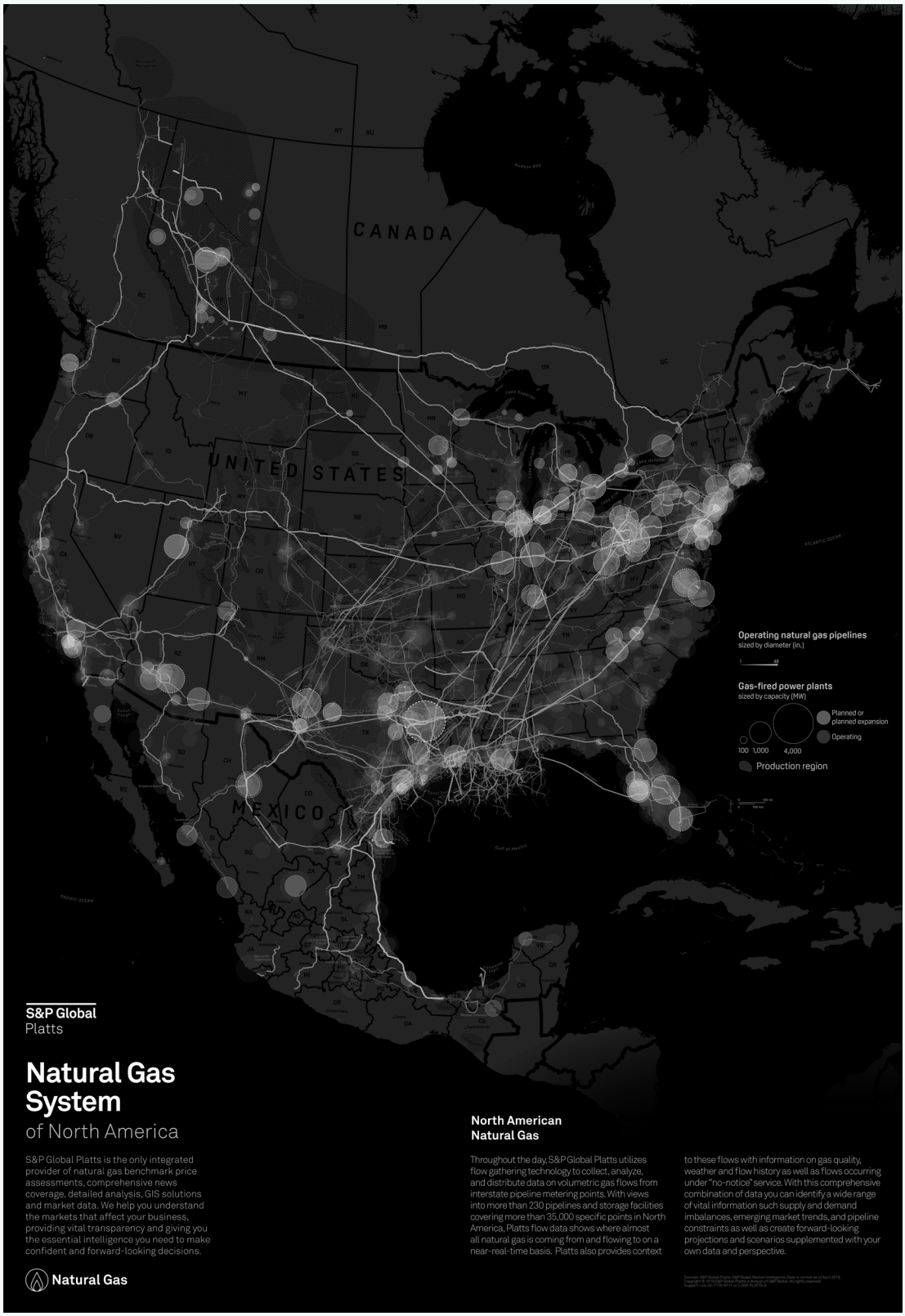


"Continuous monochrome is tough enough, but Jakob Listabarth takes the challenge even further and uses this map's sole ink at 100% strength only. He is only able to distinguish feature types from each other using line weight, dot/dash patterns, and hachure shading. This he does excellently, and I continue to be impressed by how much information is shown, and how clearly each layer is distinguished from the others when they are all, after all, exactly the same version of magenta." —Daniel Huffman

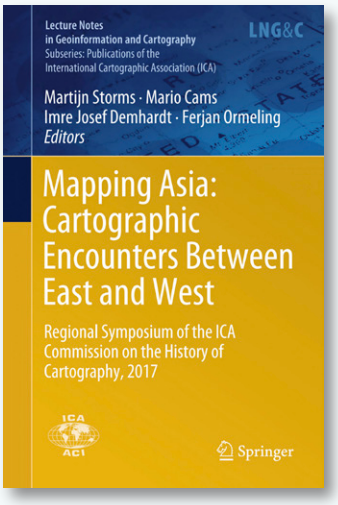
PERU: A RELIEF MAP, BY SHANNON GONZALES

"This map pleased me because of its perspective projection. This view brings realism, makes the exaggerated relief appear more 3D, and offers a horizon that gives the impression that we are looking at Peru from space. The use of this map projection reminds me of Richard Edes Harrison's impressive orthographic maps" —Xemartin Laborde

NATURAL GAS SYSTEM OF NORTH AMERICA, BY JOSIE SAJBEL



". . . we're used to seeing such maps with loads of color as the cartographer tries what they can to discern one element from another. In this map the margins of error are tiny, slightly more or less transparency on the circles would have made them indistinguishable, a notch up or down on the gradient applied to the pipelines would have resulted in a messy tangle of lines shining through. . . . My favourite maps are those that appear effortless to all but the most specialist readers who can appreciate the many, many tiny tweaks required to create them. In that regard this map really delivers." —James Cheshire



MAPPING ASIA: CARTOGRAPHIC ENCOUNTERS BETWEEN EAST AND WEST

Edited by Martijn Storms, Mario Cams, Imre Josef Demhardt, and Ferjan Ormeling

Springer International Publishing, 2019

299 pages

Hardcover: $219.99, ISBN 978-3-319-90405-4

eBook: $169.00, ISBN 978-3-319-90406-1

Review by: Jasmin Khangura

Mapping Asia: Cartographic Encounters Between East and West is a collection of sixteen research papers that were presented at Leiden University Library as part of the Regional Symposium of the ICA Commission on the History of Cartography in 2017. The focus of the conference—and consequently of the book—is the interaction and exchange between Asian and Western cartographic practices.

The book starts off with "The Topographic Survey of the Netherlands East Indies, Batavia 1864–1950," an essay from one of the editors, Ferjan Ormeling. It begins by describing the topographic surveys compiled by the Royal Netherlands East Indies Army between 1864 and 1886. The maps in this series received several world prizes at world exhibitions, due largely to the advanced reproduction process employed in their publication. The Royal Netherlands East Indies Army itself, however, was dissatisfied, and the maps subsequently went through a number of revisions. The army's mapping brigades were originally staffed almost exclusively by Europeans, but as the years went by, more and more local surveyors were employed, and by 1950 the entire survey had been transferred to Indonesian authorities.

In the next essay, "The Importance of Diacritics on Dutch Historical Map Toponyms in Java, Aceh and Nias," Albina Apriadsa, Ari Cahyono, and Rossaydiana Apriadna make clear the importance of diacritics—the marks below or above a letter—to mapping a diverse country like Indonesia, where over 700 languages are spoken. Diacritics were used extensively on official Dutch East Indies maps from about 1900 through the 1920s, but were phased out in the 1930s. The authors examine the effect this omission of diacritics has had on the present-day spelling and pronunciation of toponyms, and suggest the use of the International Phonetic Alphabet as a way to preserve the spelling and pronunciation of the many languages in Indonesia.

The third essay is "Buginese Charts: Typical Cartographic Encounters Between East and West?" by Marco van Egmond, and focuses on a chart of the East Indian Archipelago written in Buginese, a language spoken in southern Indonesia. He compares this map with two other Buginese charts. The author concludes that the Buginese charts are a "hybrid" mix of Western and Indigenous cartography. Van Egmond believes that the charts were likely drawn by indigenous cartographers, who based their work on d'Après de Mannevillette's 1745 survey map of the East Indian Archipelago.

Next, Tsung-jen Chen revisits the popular Selden Map—likely produced in the early seventeenth century and depicting China, Korea, Japan, and parts of Southeast Asia. In "A Collage of Many Things: Rethinking the Making of the Selden Map," Chen concludes that the Selden Map was not created from first-hand knowledge, but was instead created using a variety of maps, charts, and information from both European and East Asian sources.

"Jesuit Contribution to the Mapping of the Philippine Islands: A Case of the 1734 Pedro Murillo Velarde's Chart," by Mirela Altić, discusses how Velarde made the most detailed and accurate map of the Philippines up to that time. Altić stresses Velarde's rejection of the then-current Spanish representation of Philippines as part of the Americas, and substituted a conception of the Philippines as a separate entity.

Following this is Peter Kang's "Naming and Re-naming on Formosa: The Toponymic Legacies of the VOC Cartographies on the Eighteenth and Nineteenth Century Western Maps." Kang explores how the toponyms found on seventeenth century Dutch East India Company (Vereenigde Oostindische Compagnie, or VOC) maps continued to be used on Western maps for the next two centuries. The survival of these toponyms alongside later geographical information is examined using maps depicting the island of Formosa—modern-day Taiwan.

Sayoko Sakakibara then discusses how the traditional Buddhist worldview of many Japanese was overturned in the mid-sixteenth century by their encounter with European geography in "Localizing Asia: Mapping Japan, Asia, and Europe in the Early Modern World." There were three sacred countries in the Buddhist worldview: China, India, and Japan; the first two remained always at the center. The European worldview was somewhat different, and while some Japanese were reluctant to adopt it, others, like the geographer Nishikawa Joken, saw it as a chance to depict Japan as more than geographically peripheral to India and China.

In the eighth essay, "Gyoki-Type Shape: Representation of the Japanese Archipelago in East-Asian and Western Maps," Ekaterina Simonova-Gudzenko discusses the work of Gyōki Bosatsu, a Korean monk who was said to have founded mapmaking in Japan, and the influence his geographic representation of Japan exerted on both East Asian and Western representations of the Japanese archipelago. The unique characteristics of "Gyoki-type" maps are illustrated; for example, showing Japan with 66 named provinces and giving the number of districts in each is a typical "Gyoki-type" map feature. Evidence of their widespread use is noted on a variety of maps through numerous photographs.

Radu Leca contributes an analysis of nineteenth century Japanese maps in the collection of Leiden University that focuses on the exchanges of geographic knowledge that took place both between the Europeans and Japanese, and within each group. In "Maps as Knowledge Vehicles: Insights from the Collections of Leiden University Library," the author notes that maps were part of a system of reciprocal gift-giving traditions for both the Europeans and Japanese. Furthermore, both mapmakers and map users recognized their common interest in the increase of geographic knowledge and understanding.

Then, in "The Use of Japanese Early Modern Maps by Western Cartographers During the Nineteenth Century," Kunitada Narumi and Shigeru Kobayashi focus on how a 1779 map of Japan by Sekisui Nagakubo—the earliest accurately detailed Japanese map widely available in the West—contributed to the 1827 nautical chart of Russian navigator Adam Johann von Krusenstern.

A seventeenth century Chinese map by the lesser known scholar Cao Junyi is analyzed by Gang Song in "Relocating the 'Middle Kingdom': A Seventeenth-Century Chinese Adaptation of Matteo Ricci's World Map." Cao's map is a hybrid of two very different cartographic traditions—European and Chinese—and Song contends that it demonstrates that there was not a simple give-and-take relationship between Jesuit scholars—such as Matteo Ricci—and their Chinese counterparts. In his discussion of the mutual influence of Chinese and European cartographers, he also examines the ways Chinese cartography influenced Ricci: for example, Ricci's use of Chinese pictorial symbols and relocation of the prime meridian from the Atlantic to the Pacific.

In "Cartographic Accuracy and the Myth of Manchu Origins on the 1719 Overview Maps of the Imperial Territories," Fresco Sam-Sin writes about how Elhe Taifin, the fourth Khan of the Daiqing Empire, made use of a series of territorial "Overview Maps" as an element in an imperial, identity-building narrative.

The Royal Geographic Society solicited advice from the geographer William Huttman soon after the signing of the 1842 Treaty of Nanjing and the opening of five Chinese coastal ports to foreign trade. Huttman delivered his recommendations in 1844, in which he especially advised the use of Chinese geographical works that had been prepared using firsthand accounts. Ines Eben von Racknitz discusses Huttman's suggestions in "Mapmakers in China and Europe 1800–1844: The Perspective of William

Huttmann, Royal Geographical Society," but was not, unfortunately, able to find out if the Royal Geographic Society had acted on them.

In the fourteenth essay, "From 'All Under Heaven' to 'China in the World': Chinese Visual Imaginations from the Nineteenth and Early Twentieth Centuries," Laura Pflug examines how increasing globalization in the late nineteenth and early twentieth centuries forced Chinese intellectuals to come to terms with non-Sinocentric worldviews. Pflug discusses the ways in which this reconciliation process took place, using a sizable number of visuals to illustrate how the cartographic representation of China changed over time.

Pflug's essay is followed by "A Disastrous Project: C. P. Keller and the Fortification (Plans) of Bimilipatnam" by Jeroen Bos. In the mid-eighteenth century, the Dutch East India Company commissioned the engineer Coenraad Pieter Keller to draw up fortification plans for the Indian village of Bimilipatnam. Keller produced a general overview map of the town and its surroundings, plus an annotated plan of the proposed fortification. Although at first appointed to oversee the work, Keller was later blamed—perhaps unfairly—for two construction collapses, just as he had been blamed for cost overruns on earlier projects.

Finally, in "Inventing a Cartographical Image for Postcolonial India: European Models and the Politics of National Identity," Arundhati Virmani looks at S. P. Chatterjee's 1957 publication of India's first post-independence atlas. The atlas consisted of twenty-six pages, each with a different map, and was intended to help establish a unified identity for the new nation among both Indians and others. This intention was also served by the decision to publish in Hindi—one of the new country's two official languages, alongside English—despite the fact that, as Virmani notes, the script was unfamiliar at the time even to most people who spoke that language. In addition, Virmani also points out how much the production of the atlas drew upon foreign institutions and people trained in Britain and Europe. Chatterjee himself had trained in France and was an active participant in international cartographic conferences.

The collection of sixteen essays in *Mapping Asia: Cartographic Encounters Between East and West* provides a rare cross-disciplinary analysis of the impacts that Western and Eastern cartography had on one another between the sixteenth and twentieth centuries, and also sparks interest in examining further such encounters. Understandably, one book can only cover so much.

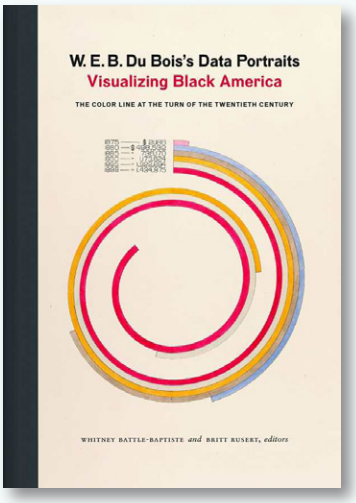
The editors provided a preface, which sets the scene for the essays, but did not provide any concluding remarks. A wrap-up chapter or epilogue would have been helpful in highlighting what the editors deemed to be the most important takeaways from the collection.

While *Mapping Asia* is unique in not solely focusing on the contributions of Western scholarship, there are some essays in which the Western influence on cartography dominates and the Eastern/indigenous contribution is barely mentioned. One example is Jeroen Bos's article, where the Indian village of Bimilipatnam serves only as a backdrop for Keller's military engineering.

The book has plenty of color images; however the maps are very small and not clearly reproduced. This is to a certain extent understandable, as it is difficult to fit large illustrations on a small page, but in the twenty-first century it is not clear why high-resolution images of all the maps are not available online. Peter Kang was the only author to post URLs of high-resolution digital copies of the maps he discussed. Panning and zooming through the maps was very helpful, and I had a much better understanding of his article because of it.

At $220 for the hardcopy, and $169 for the eBook, this title is exorbitantly priced—especially for students and young professionals. However, some or all of these essays may be freely accessible through university libraries. *Mapping Asia: Cartographic Encounters Between East and West* is an original collection of essays that is neither organized nor written for the general public. The essays are academic articles intended for academic use by university professors, researchers, or students. That said, for those academicians with an interest in Eastern and Western cartographic history, this book is an invaluable resource.

DOI: 10.14714/CP93.1555



W.E.B. DU BOIS'S DATA PORTRAITS: VISUALIZING BLACK AMERICA

Edited by Whitney Battle-Baptiste and Britt Rusert

Princeton Architectural Press, 2018

144 pages

Hardcover: $29.95, ISBN 978-1-61689-706-2

Review by: Brandyn Friedly

Straight away, the brightly colored infographic on the front cover of this slim, 7 by 10-inch hardcover volume grabs your eye, rivets your attention, and draws your hand to pick up and open *W.E.B. Du Bois's Data Portraits*. The first glimpse of that "unusual and complex configuration of the spiral diagram" that is "simultaneously easy to read and hypnotic" (*caption* Plate 25) stops you in your tracks with questions about the story to be told inside.

> *W.E.B. Du Bois's Data Portraits* collects the complete set of infographics for the first time in full color, making their insights and innovations available to a contemporary audience while exploring their context in social and design history. (back cover)

The stunning spiral diagram on the front is just one of the sixty-three data portraits, or "infographics," created by Du Bois and his team as part of the American Negro Exhibit at the Paris *Exposition Universalle* in 1900—an exhibit "dedicated to the progress made by African Americans since Emancipation" (8).

Opening either cover, the endpapers display all sixty-three infographics as small multiples, each popping off the bright white page background. This view of the whole collection offers a quick overview of the diversity of chart types, the vibrancy of the graphics, and the unified visual aesthetic Du Bois and his team employed in telling the narrative of African American progress. Each of the small images on the endpapers is numbered, to make it easy to find its full-page reproduction in the Plate section of the book. These reproductions allow close, detailed reading, and each is accompanied by sharp analysis by designer Silas Munro.

In their Introduction, the editors give a broad overview of the historical context within which the American Negro Exhibit was assembled, their motivations for highlighting Du Bois's data visualizations, and the goals they sought to achieve by presenting this book to contemporary audiences over 100 years after the exhibit was first displayed. This essay provides contextual background that helps bring the visualizations alive for a contemporary audience, and appears with an interdisciplinary set of three more essays preceding the reproduced infographics: a social history of the exhibit by sociologist Aldon Morris, an analysis by cultural historian Mabel O. Wilson of the cartographic imaginary employed, and Silas Munro's "Introduction to the Plates." Here, alongside his individual Plate captions, Munro's insightful comments frame Du Bois's graphics within design history.

The historical context and goals of the American Negro Exhibit are critical to understanding the logic behind Du Bois's data visualizations. Fewer than forty years after the end of slavery, and only four years after *Plessy v. Ferguson* legalized racial segregation, "the installations that comprised the American Negro Exhibit were meant to educate patrons about the forms of education and uplift occurring at black institutions and in African American communities across the US South" (9). The production of the exhibit

was highly collaborative and included "an eclectic set of objects, images, and texts" (9). One year after the publication of Du Bois's groundbreaking sociological study, *The Philadelphia Negro* ([1899] 2014), the organizer of the exhibit, Thomas Junius Calloway, asked Du Bois to "contribute a social study about African American Life" (9).

It is hard to overstate the meaning and goals of the American Negro Exhibit, or of Du Bois's data visualizations. Overall, the Paris *Exposition* marked the turn of the century and a world in the midst of the industrial revolution. As Aldon Morris writes in his essay "American Negro at Paris, 1900," the "fair presented a global stage for nations to strut their sense of national pride" (23). It was also a unique opportunity for Du Bois and his collaborators to directly challenge the myth of Western progress and black inferiority. Morris finds in Du Bois's data visualizations "an attempt to give, in as systematic and compact a form as possible, the history and present condition of a large group of human beings" (28). This is echoed by Mabel O. Wilson in the third essay: "The Cartography of W.E.B. Du Bois's Color Line", when she states that the "data visualizations, and the American Negro Exhibit as a whole, rebuked beliefs that were foundational to the modern ethos of social progress . . ." (42).

Aldon Morris states that "the compilation of data displayed at the exhibit stressed one message: black progress since slavery," and that it was a "masterpiece of sociology, celebrating black humanity on a world stage" (35–36). This directly contradicted prevalent Western beliefs of black inferiority, beliefs based on social Darwinism and scientific racism.

The exhibit had to be strong, as Morris points out, because of the physical constraints imposed by the disadvantageous location of the Negro Exhibit "in the right corner of a room." This meant that in order "to garner attention from this unenviable location, this exhibit would need to radiate its own sparkle and originality" (27). This drove Du Bois and his team to avoid "unmoving prose and dry presentations of charts," for "hand-drawn graphs, charts, and maps arrayed in lively, vibrant colors" (33–34).

Economic constraints, linked to the general lack of funding for African American scholarship, also complicated the preparation and installation of the exhibition's data portraits. Du Bois himself had to travel "across the Atlantic in steerage," (17) which highlights the importance of the American Negro Exhibit to Du Bois and his collaborators, and underlines their accomplishment in bringing the exhibit together despite the lack of funding. It also aligns with the narrative told in the data portraits themselves, that:

> the gains that had been made by African Americans *in spite of* the machinery of white supremacist culture, policy, and law that surrounded them. In this way, the data portraits actually challenged the dominant framework of liberal freedom and progress that characterized both the American Negro Exhibit and the Paris Exposition." (22)

After the thorough contextualization of the Exhibit, and the role the data portraits played within it, come the sixty-three data portraits, each reproduced in full color, one to a page. The portraits include innovative and striking charts, maps, tables, and diagrams. Silas Munro provides a caption for each, analyzing the aesthetic logic employed and describing how the design accomplishes Du Bois's goal of communicating black progress.

The portraits are split into two distinct, but related, series to tell this story: *The Georgia Negro: A Social Study* (Plates 1–36), and *A Series of Statistical Charts Illuminating the Condition of the Descendants of Former African Slaves Now in Residence in the United States of America* (Plates 37–63). While the "first set . . . used Georgia's diverse and growing black population as a case study to demonstrate the progress made by African Americans since the Civil War . . . establishing the Black South's place within and claim to global modernity," the "second set . . . was more national and global in scope" (11).

Cartography plays a central role in framing Du Bois's narrative. The first Plate of the series is a map of the Black Atlantic world, which Munro says "visually represent[s] hundreds of years and thousands of miles of oppression" (*caption* Plate 1). Progressing through the set, Du Bois's employment of various thematic mapping techniques becomes increasingly more detailed, and the maps are used to frame the information on the intervening charts and diagrams. The first group—*The Georgia Negro: A Social Study*—finishes with three detailed dot maps of selected Georgia counties, showing the distribution of African Americans' residences based on socio-economic class (Plates 34–36).

Munro comments that "Du Bois and his team used information design as a rhetorical device," (45–46) and this can be seen clearly in the maps on Plates 41 and 42. The first of these maps in the second group—*A Series of Statistical Charts Illuminating the Condition of the Descendants of Former African Slaves Now in Residence in the United States of America*—shows the outlines of various counties, sized proportionately by total population, in comparison to the United States sized by its African American population alone. The second map makes a similar comparison of the total and African American populations of the United States between 1800 and 1890, in four 30-year steps. In both of the maps, as Morris states, "organizers of the exhibit bestowed nationhood on the recently freed slaves, referring to them as a small 'nation within a nation,'" (24), and by representing the United States based on African American population alone, Du Bois asserts a corporate existence for that African American 'nation within a nation' on equal footing with that of other nation states. Plate 41 also subverts the white social darwinist narrative of black erasure in the United States—by not including white population on the map, it appropriates the patriotic symbolism attached to the country's outline.

This example illustrates a key lesson about visual communication for social change that can be learned from the Du Bois's data portraits— beyond the direct cognitive effects of perception, visual variables can encode cultural meanings that can evoke emotion to help tell a story and connect with an audience. Munro suggests that the recurring "color palette of red, green, and black is likely an allusion to the Pan-African flag," (*caption* Plate 42), a good example of the politics of color. In all the diagrams, "Du Bois and his design team used clean lines, bright color, and a sparse style to visually convey the American color line to a European audience" (16), and by leveraging this visual language, Du Bois was able to both immediately and subtly convey the message of "the Black South as an integral part of modernity" (16).

The visual variable of shape, too, can hold cultural meaning. On Plate 1, "The Georgia Negro: A Social Study by W. E. Burghardt Du Bois," Georgia is symbolized with a star. Prior to abolition, the north star represented liberation for enslaved people—both literally and in Frederick Douglass's 1847–1851 abolitionist newspaper *North Star*. In Du Bois's narrative of independent racial uplift, the symbol of Georgia as a star could be interpreted as symbolizing liberation in an independent "small nation within a nation" (24).

Much of Du Bois and his team's visual innovation comes from the understanding that emotion is central to storytelling. Wilson places this work within the context of a "cartographic gaze that cultivated a way of seeing the world through evolving cartographic technologies and new modes of representing a world no longer ruled by God and monsters but guided by reason and science" (41). Du Bois and his team, however, understood that while "unmoving prose and dry presentations of charts and graphs might catch attention from specialists, this approach would not garner notice beyond narrow circles of specialists" (33). Morris finds that "breaking from tradition, Du Bois was among the first great American public intellectuals whose reach extended beyond the academy to the masses," by "using a variety of writing styles . . . that deeply touched readers' emotions" (33).

Reading *W.E.B. Du Bois's Data Portraits* prompted me to re-examine my education in cartography and information design, and to ask some critical questions about pedagogy and representation. I found Du Bois's absence from the indices of *Thematic Cartography and Geographic Visualization* (Slocum et. al 2005), *Envisioning Information (*Tufte 1990), and *The Visual Display of Quantitative Information* (Tufte 2001)—texts widely considered foundational for cartographic or information design study, and regularly assigned reading in introductory classes—to be a loud omission. In particular, Slocum et al.'s, claim that "the notion of social and ethical issues in cartography was first developed in the context of postmodernism" seems to ignore Du Bois's important work (Slocum et al. 2005, 15).

In his "Introduction to the Plates," Munro concludes that the "visualizations offer a prototype of design practices that were not widely utilized until more than a century later, anticipating new trends . . . of design for social innovation, data visualization in service to social justice, and the decolonization of pedagogy" (50). Considering the ways that these groundbreaking data visualizations were rooted in the social and material conditions of their creators made me reflect on the importance of representation of cartographers from oppressed groups in today's professional and social spaces—in meetups, conferences, online spaces, and in pedagogy. How has cartography been—and how is it still being—held back by the marginalization and erasure of the contributions made by oppressed people,

and who and what else is missing from traditional cartographic history?

The design theorist Tony Fry observed that "design is profoundly political . . . it either serves or subverts the status quo" (Fry 2007, 88). In the American Negro Exhibit in 1900, "Du Bois and his team redeployed the Western methods of cartography that had been used to marginalize and exploit black life by inscribing the black world back into history and geography" (42). How is modern mapmaking serving or subverting the status quo?

I cannot count the times I've heard the story of how the power of mapping was shown by John Snow's 1854 cholera map, but this was the first time I have ever heard of how W.E.B. Du Bois used mapping to address racism—a social disease that continues to affect millions across continents and generations. Why has the Snow story been constantly repeated, while Du Bois goes unmentioned? I am grateful for the way *W.E.B. Du Bois's Data Portraits*: *Visualizing Black America, The Color Line at the Turn of the Twentieth Century* challenges existing pedagogy and shows the power of visual communication toward social justice, and I think that this book is a major contribution to cartography and data visualization. I was drawn to mapping because I experienced the way maps can shape how one sees and understands the world, and I recognize that power in Du Bois's work. How can this power be used toward liberation today?

The editors, Battle-Baptiste and Rusert, along with their collaborators, give us a clear vision of the historical moment behind the groundbreaking data portraits in the American Negro Exhibit, and leave the reader to envision, in our own historical moment, "how data might be reimagined as a form of accountability and even protest in the age of Black Lives Matter" (22).

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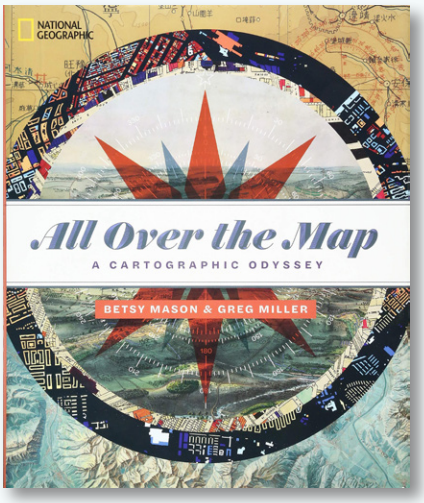
DOI: 10.14714/CP93.1559



ALL OVER THE MAP: A CARTOGRAPHIC ODYSSEY

By Betsy Mason and Greg Miller

National Geographic, 2018

318 pages, about 300 maps and photographs

Hardcover: $50.00, ISBN 978-1-4262-1972-6

Review by: Daniel "daan" Strebe, Mapthematics, LLC

One might expect a book entitled *All Over the Map* to hop back and forth over time and thematic space, and this book does indeed do that. This lavishly illustrated, journalistic ramble bounces from topic to topic, dipping in here, tasting there, and spinning tales about the diverse selection of maps it visits. Do not expect depth or focus, but be prepared for entertaining surprises.

At twelve inches tall and ten wide, you are probably not going to be reading this book in bed, or on the bus. This large quarto volume justifies its size, however, with its many illustrations that are large, clear, and readable, despite frequently being much reduced from their original sizes. Where needed, which is often, the authors give detail excerpts with captions.

Like most National Geographic books, this one would be right at home on a sitting room coffee table—a collection of gorgeous maps to be thumbed through and admired. But there is no shortage of books filled with gorgeous maps, and *All Over the Map* is not distinguished by its eye candy alone. Tossing it on the table to look at now and then would be to squander its value. Yes, the maps are magnificent, but the texts are well written and informative, too. The authors are journalists, and it shows; they spent many years developing the content, and that shows, too. It shows even if you choose only to browse, sample, and taste your way through the book. You don't have to follow any particular order, but simply looking isn't enough.

Mason and Miller carve their tour up into nine chapters, each some thirty-odd pages long: "Waterways," "Cities," "Conflict and Crisis," "Landscapes," "Economies," "Science," "Human Experiences," "Worlds," and "Art and Imagination." Many, or most, of the maps might have been included under more than one of the categories, but for the most part their scheme works well enough.

Chapters open with a short thematic introduction, and then launch straight into the storytelling. Each chapter consists, on average, of nine sections relating to some topical aspect of the chapter theme. Many sections describe a single map, while others deal with collections of related maps. A few are about several maps from a single mapmaker. The heading for each section includes a statement about the maps it contains: the Creator (or the Source) and the year(s) the map(s) were Created—a span sometimes ranging to a century or more. The authors make good use of map comparisons to get their story across—for example, in the section on the maps portraying Boston's centuries-long land-building enterprise (70–73).

It would be impossible to give an overall flavor for *All Over the Map*—it consists of eighty-one independent, very different tales that simply cannot be characterized generally. At best I can confirm that they are, indeed, all over the map: from Jerry Gretzinger's giant, abstract, algorithmically evolving, fictional map thingy (282–285); to eighteenth-century Tōkaidō pilgrimage maps (218–221); to Henry Acland's exacting, but tragically wrong, 1856 maps

of choleric miasma (180–183); to Jim Nieuhues's cartographic ski-slope artistry (139–141); and, yes, to a fly-over map of Westeros. (290–293)

Most of these stories describe, above all else, labors of love. It took decades of hard work to produce some of the maps you will read about, by people who refused be satisfied with the maps that had hitherto existed and how they had been done. You will read about Ferdinand Hassler—the man entrusted by the US government with mapping the young country's coasts—and how he spent 36 years obsessively building and perfecting the US Coast Survey's mapping and surveying skills, only to die a year before it finally published its first map (42–43). You will read about the decades Marie Tharp spent methodically accruing evidence for plate tectonics, recognizing the emerging patterns in seafloor features long before her colleagues could bear to, culminating in a world bathymetric map so strikingly beautiful and startlingly persuasive that it is still widely used forty years later (184–189).

This book's design is dominated by the maps—there isn't a full page of text anywhere in the body of the volume—but that text is constantly engaging and laced with delightful facts. At least I found it delightful to learn that, for example, San Francisco's underground street car tracks pass through the buried hull of a nineteenth-century ship. Most of the delightful facts were new to me, even when the maps were not. If you don't delight in such facts, then perhaps this is not the book for you.

The physical quality of the book is high but not outstanding. Signatures of eight leaves are sewn and glued to a good quality binding. The paper is medium bright, medium weight, and fairly opaque with only a little showthrough. The illustrations are medium-glossy and in color unless the original image was not. The print quality is serviceable, but not the best, and the print smudges on pages 289 and 304 of my copy were a bit disappointing. The dust jacket is expensively produced with spot varnish overprinting, and is commensurately attractive.

I'm not sure what to make of the font choices in *All Over the Map*. The body text is a large x-height sans serif—as are the image captions, albeit in a smaller size. The initial paragraph of each chapter, by contrast, uses a high-contrast serifed face that is close to, but not quite, Century Schoolbook—the same font used in italic form for the chapter and section titles. Maybe I'm just old-fashioned, but I find *serifed* body text more readable, and would have reversed the choices for lead and body—leaving the captions as they are. Print size is about typical for an illustrated book of this sort, but the book-weight typeface's lack of serifs leaves the "color" of the page a bit light. I did not find the typeface choices an impediment, but then again I was not reading for speed—your mileage may vary. In any case, there is no arguing with the overall pleasing aesthetics.

You are probably familiar with the National Geographic editing style—crisp, meticulous, approachable, and largely uncontroversial while listing toward environmental advocacy—and that is just what you will find here. The upper limit to cheeky prose seemed to be the remark that "Those seemingly random facts, in other words, may have had everything to do with the price of tea in China," (174) explaining why tea-drenched China had gotten such short shrift on an elaborate map of tea commerce and culture. The fact checking seems quite good; I only spotted two errors—one that had Mariner 4 arriving at Mars twenty years late to the party (251), and another I discuss below.

The authors, who also write the National Geographic *All Over the Map* blog (**nationalgeographic.com/culture/all-over-the-map**), want you to know that they are not cartographers, but rather, journalists who like and write about maps. Be that as it may, whatever you want to call them and what they do—and however they see themselves and their own activities—they show a fair knack for nosing out and retelling interesting map-related facts, and display an obvious love for the maps, the stories, and the telling. Mason and Miller's love for maps shines through their work. By some measures, the authors have made their task easy—this book is not about any particular kind of map; it doesn't need, or care about, scholarly precision; it doesn't advance any particular thesis. They don't claim their showcased maps fairly sample space, or time, or culture, or their authors' gender identities, or political proclivities, or genre or, really, anything at all. Their criteria for inclusion was simply, "Is there a good story behind this map?" Without a doubt, each of the maps comes with a good story—but that's only part of the story, isn't it? It is obvious that the duo invested an immense amount of time and effort researching these stories, but I also infer that they lived and breathed maps for years. They would have had to, in order to find themselves in the right places at the right times to recognize that there was a story to research, and that the story could be compelling.

The authors have a clear fondness for the underdog, as you can see in the stories about Arnold Colom (32–35), Pierre Charles L'Enfant (51–55), or even, again, Marie Tharp (184–189). Social justice in various forms crops up many times, for example in discussions of San Francisco's maps of moral corruption in Chinatown (214–217), James Cowles Prichard's progressive ethnographic maps of Africa (224–227), or Ebenezer Howard's utopian city designs (289–299). You will also find a good dose of present bias—a surprising number of the maps were produced in just the past few years. National Geographic has long understood that finding the broadest audience means telling *topical* stories. That is particularly important in a periodical, but it applies to books as well—most of a book's earnings come in the first year of sales. In the same vein, maps of the United States or by American authors are strongly represented. Anyone in the publishing business will tell you that it is just good business to reflect your audiences' interests, and your audience is usually most interested in themselves.

The book might be guilty, too, of a little National Geographic puffery. On the one hand, National Geographic has been on the scene for so long, and with such high standards, that they definitely deserve more than one inclusion, but do they deserve the five maps they have here? That is hard to say, but it doesn't much bother me. Still, in a text where most opinions are given cautiously, it's curious that the caption on the trophy map in the Introduction so matter-of-factly claims that "the artistry of the hand-drawn relief on this map of Mt. Everest, published as a supplement to the November, 1988 issue of *National Geographic,* has yet to be rivaled" (8). Is the claim defensible? Absolutely. Is it a fact? Unanswerable.

Even before this, the Introduction had staked out its ground, stating that "Our brains are built for maps," an assertion even more debatable than the unrivaled artistry claim. Fortunately, this sort of grandiloquence occurs infrequently—and I point it out because it is so surprising.

Any map geek might easily finish *All Over the Map* disappointed that some or other pet map of their own did not make it into its pages, and scratching their head about some of the ones that did. Consider, though: if you already know about the map and its story, does it really need to be included? I felt that some of the topical asides may not age gracefully, and I would also have preferred less skew toward present-day maps. In particular, the "Landscapes" chapter would have benefited from some older stories. The earliest concerns Frederick Law Olmsted's 1871 design for Brooklyn's Prospect Park (137–137)—I should think there would be several even older candidates. Are there better stories in the past? Perhaps, or perhaps the objection is a bit petty. The stories that are included live up to their promise, and the book does, after all, need to sell.

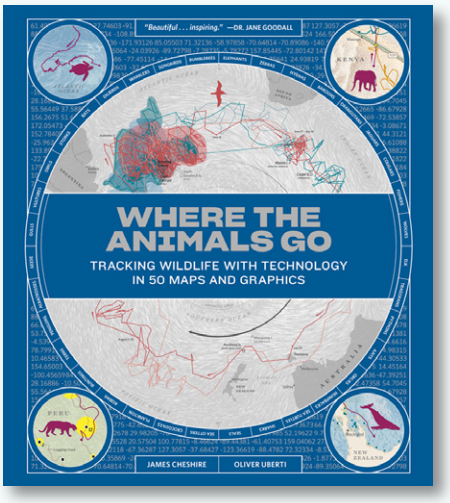
The section entitled "Flattening the World"—in the "Worlds" chapter—is a reasonable discussion of the topic, but it has a problem or two. For one thing, it is not surprising that the authors give an ad hoc list of distortion types: "Projections can distort five aspects of geography: area, shape, distance, angle, and direction" (265); indeed, variants of this list crop up throughout the general-audience cartographic literature—much of it written by cartographers. The problem is that this ad hoc list tends to muddle rather than clarify the issue. The reality is that there are only three independent metrics—area, angle, and proximity—and that, depending on how these three are handled by the projection, no end of other geographical metrics can be distorted. Proximity is especially notable as the metric that somehow never makes it onto these lists—even though every map is interrupted, some of them repeatedly. For example, the Fuller Dymaxion and Cahill Butterfly, both illustrated right there on the next page, are both easily recognized by their interruptions. Also on page 265, in both the text body and in a caption, there is a description of the Peters projection that tells us that "the continents are stretched vertically near the equator"—which is correct—"and compressed horizontally near the poles"—which is not correct, and quite obviously so. I'm also disgruntled about the way the Peters hogs the stage as the only equal-area projection mentioned—precisely as Arno Peters schemed, and despite a long and storied history of equal-area maps. But, these noted exceptions aside—and I'm really not sure I've ever read a popular account of map projections that I did not find unnecessarily misleading—this chapter is, as I mentioned above, otherwise reasonable.

Stepping back to assess my entire tour through *All Over the Map*, I found the stories informative and enjoyable, and their selection sensible. The authors' choice to home in on lesser-known tales even for famous mapmakers—such as Olmstead's Prospect Park instead of his Central Park—meant that most of what I read was new to me. The selection prioritized interesting stories over pretty maps, and is a policy I thoroughly endorse. Don't get me wrong;

you will feast on plenty of fine and beautiful and striking cartography—just don't suppose that pretty maps are the whole meal. Overall, I found that the prose was engaging, and that the journalistic bent offered an uncommon perspective. I daresay that the selection and presentation benefited by having originated outside academic circles. This is commendable work.

Does this odyssey all over the map add up to anything? It might if you let it. It definitely won't if you don't. Even if you never read the entire book, there is plenty of satisfaction and knowledge to be had by reading individual stories scattershot. The more of these compelling stories you read, though, the more profoundly and poignantly you will apprehend the meanings behind the singularly human impulse to map our knowledge, our experiences, and our yearnings.

DOI: 10.14714/CP93.1571



WHERE THE ANIMALS GO: TRACKING WILDLIFE WITH TECHNOLOGY IN 50 MAPS AND GRAPHICS

By James Cheshire and Oliver Uberti

W. W. Norton & Company, 2017

192 pages

Hardcover: $39.95, ISBN: 978-0-393-63402-0

Review by: Harrison Cole, The Pennsylvania State University

Over the past thirty years or so, GPS receivers, remote-sensing satellites, drones, mobile phone telemetry, and other spatial technologies have had profound impacts on fields ranging from behavioral sciences to military operations to transportation planning. While they have often been developed to better locate people, these technologies have also been applied to tracking and analyzing animal movement and behavior, resulting in the emergence of the interdisciplinary fields of animal biotelemetry and movement ecology. The latter term encompasses a broader range of lifeforms—including plants and microorganisms—and so will be the primary term used for this review. A movement ecology study typically entails tracking organisms, as individuals or as groups, over a period of time that could last anywhere from minutes to years, ultimately yielding a highly detailed geospatial dataset. James Cheshire and Oliver Uberti—a geographer and graphic designer, respectively—have curated a selection of these datasets and mapped them in *Where the Animals Go*.

The two parts of the book's subtitle outline its thematic hierarchy: *Tracking Wildlife with Technology* foregrounds the data science that forms the topical core of the book, while *50 Maps and Graphics* points to the supporting role of the illustrations. *Where the Animals Go* is targeted at a broad audience and is supported with maps that are both expertly designed and backed with expansive data. The authors, their book, and their maps have won a number of awards, including: the London Book Fair Innovation in Travel Publishing Award (2016); the British Cartographic Society Award (Best Overall, 2017); and the North American Cartographic Information Society (NACIS) Corlis Benefideo Award for Imaginative Cartography (2017–2018).

At ten and a quarter by eleven and three-eighths inches, and with only one hundred and ninety-two pages, the book allows for appropriately large spreads without being unwieldy. The maps and visualizations frequently take up double-page spreads, and a handful of the graphics extend to foldout pages. The book comprises thirty-six chapters, each focused on a particular species and each sorted into one of three major sections: terrestrial, aquatic, and aerial creatures. A typical chapter is two to four pages long, with one to three graphics and around 200 to 500 words of description. The first chapters of each section, at around six pages and more than 1000 words, are longer than the following chapters and thus serve as introductions to each section. Each features a collection of graphics and a short narrative about how data science and tracking technology have impacted animal conservation efforts; these themes are carried through the chapters that follow. It may be worth noting that, as implied by the title, the topical content of *Where the Animals Go* is focused almost entirely on technology, data, and animal conservation efforts, and as a result features little to no discussion about the design of the maps themselves. In other words, it is a book *of* cartography rather than a book *about* cartography. This is not out of line with the book's mission, but cartographers interested in the authors' creative process should consult other

resources such as their keynote speech at the 2018 NACIS Annual Meeting (**youtu.be/3hrcziwEyPo**), which is reframed as an article elsewhere in this issue of *CP*.

The maps are designed in a style that I personally refer to as *high data journalism*, examples of which can be regularly encountered in periodicals such as the *New York Times*, *Washington Post*, and *National Geographic*—hardly surprising considering co-author Oliver Uberti's former life as a senior design editor for *National Geographic*. The style is often characterized by desaturated base maps (often incorporating satellite imagery or shaded relief), uncomplicated symbolization, elegant serifed typefaces, a muted color palette, and ample whitespace. The resulting design gently focuses a reader's attention on the thematic elements, in this case the tracings of animal movement. Most of the studies featured in *Where the Animals Go* involve thousands, and sometimes millions, of points that trace out intricate and often serpentine paths across the surface of the planet. While in most of the maps the individual locations are serialized into line features, sometimes the nature of the data—or of the generalization—dictates the use of outlined areas instead.

While the maps in *Where the Animals Go* are stylistically consistent, they vary substantially in content and scale. For instance, the relatively small extent of bee movement is shown, as one might expect, at a relatively large scale (1:10,000), while the truly remarkable 80,000-mile migration of the Arctic tern requires a map of the entire world. The other forty-eight maps fall between these extremes. Inset maps occasionally augment the larger ones by depicting particular aspects of the study data or other pertinent information. A map of elephant perambulations, for example, is accompanied by a smaller map color-coding each elephant's range in the dry and rainy seasons. Similarly, a map depicting pheasant tracks also features an elevation graph showing the climbs and glides—of sometimes hundreds of feet— that each pheasant makes along its journey. The longer chapters at the beginning of each section also contain a wider variety of illustrations, including historical maps, a diagram of the mechanics of whale echolocation, and a map of global wind patterns.

As Uberti explains in the Preface, *Where the Animals Go* was intended to illustrate and celebrate the collaborative research facilitated by advances in technology and data science in general—not just in movement ecology, Together the authors call for continued collaboration amongst scientists, as well as between scientists and other specialists such as "engineers, coders, statisticians, geographers, and designers" (16). Furthermore, the authors implore laypeople—citizen scientists—to become involved as well, citing the Great Backyard Bird Count (**gbbc.birdcount.org**) as a good example of how technology—in this case, the internet—can facilitate large-scale citizen science research. Of course, given that neither of the authors are themselves movement ecologists, the book itself serves as another example of what can be produced through this new model of interdisciplinary research.

In some ways, flipping through *Where the Animals Go* is like watching a trailer for a big budget nature documentary; the complexity, scale, diversity, and sheer number of maps in the book do a superb job of expressing the magnitude of the phenomena that they represent. One of the most striking maps in the book depicts the flight paths of albatrosses as they circumnavigate Antarctica (132). While lines trace out the movements of the albatrosses, the map also includes white slashes representing wind patterns and small arrows showing the direction of the birds' movement. Together, these symbols engender a sensation that you yourself are aloft with the birds as they conduct their journeys. Elsewhere, a pair of maps depicting elk movements during their summer migration around Yellowstone National Park (66–69) differs from many others in the book in that it depicts the general movements of a herd over the course of a typical year, rather than showing specific paths of individual animals. The color scheme and symbolization together result in a highly organic design, as if the location symbols are patches of lichen on a tree branch. In fact, these maps and others appear to be very nearly animated—occasionally reminiscent of Futurist or op art, and a testament to the dynamism that good design can give rise to, even in static documents.

In a strict sense, none of these maps are really visualizing movement itself, but, rather, they string together sampled locations and interpolate connections between each location, thus *implying* movement. Certainly, the ink on the paper does not itself move, nor do the coordinate points collected in the field. But within that constraint, I wonder if some of these maps could more effectively or creatively represent the phenomenon of movement. For example, the uniform weight and color of the track lines employed throughout the book could be read as implying that the animals travel at a more or less consistent rate of speed. As an alternative, variations in line weights, lightnesses,

or even transparencies could be used to represent changes in speed, or perhaps in the number of animals traveling in a group. Many of the tracking devices employed in the studies are able to record speeds as well as locations, but there does not seem to have been any attempt to incorporate this data. It could be argued that in many cases the animal's speed was irrelevant, or that including it would have overcomplicated the maps, but it is nevertheless reasonable to ask why the map symbols express only the locational component of the field data.

In other cases, though, the authors do a masterful job of conveying the true dynamic feeling of movement. The Yellowstone elk map, for example, depicts herd movements not as *here to there* or *point A to point B* phenomena, but rather more like water flows—pouring between, across, and around spaces. The map of goose flight paths over the Himalayas (134–135), though, represents another missed opportunity. Although a key finding of the study concerns the dramatic variations in flight altitude, that data is relegated to a small graph at the bottom of the map. These are more than simple quibbles about technicalities. Cartographers who work with dynamic phenomena have the simultaneous blessing and burden of reckoning with a range of options for visualizing data in order to express or suggest actual movement. These issues have been well studied and discussed in the cartographic literature, notably by Andrienko and Andrienko (2013); Buchin, Speckmann, and Verbeek (2011); and Jenny et al. (2018).

The final chapter discusses how the methods and technologies featured in the book might also be applied to research on human movement and behavior—described as having such practical applications as finding violent criminals, allocating municipal services, or optimizing marketing campaigns. Interestingly, the discussion does not touch on the ways these same methods and technologies are currently being used by governments and corporations in a variety of encroachments upon civil liberties (Crampton 2015; Leszczynski 2015). While the absence of acknowledgment of these concerns does not necessarily detract from the book's overall narrative, it is a major shortcoming of the closing chapter.

This is not an academic text, so it is light on argument and there is little critical reflection on the implications for how data was gathered or how it was mapped, but, nevertheless, *Where the Animals Go* does a good job of fulfilling its mission of providing a showcase for interdisciplinary, technology-driven ecological research. The fact that *Where the Animals Go* is a collection of original thematic maps—in a world where non-academic cartography books typically focus on historical or reference maps—makes this an exciting volume. That the maps are expertly designed and backed with expansive and authoritative datasets just makes it more so. It doesn't hurt that the book breaks significant new ground in both cartography and movement ecology as a synthesis of studies from several different fields, many of them relatively nascent, or that the writing will appeal to a broad audience of cartographers and non-cartographers alike. *Where the Animals Go* is a book well worth adding to one's collection.

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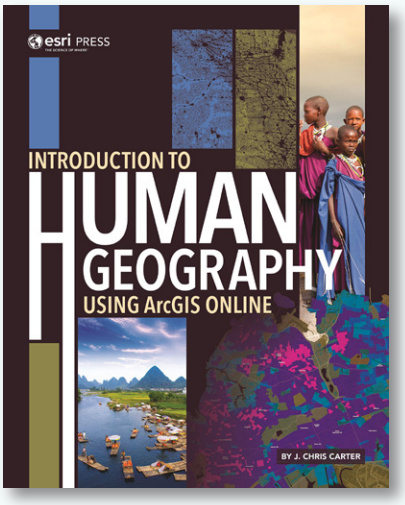
DOI: 10.14714/CP93.1573



INTRODUCTION TO HUMAN GEOGRAPHY USING ARCGIS ONLINE

By J. Chris Carter

Esri Press, 2019

427 pages

Softcover: $74.99, ISBN 978-1-58948-518-1

Review by: John T. Bauer, University of Nebraska at Kearney

Esri Press has been publishing educational books about Esri products for many decades. I remember being assigned *Understanding GIS: The ArcINFO Method* over twenty years ago in college, and more recently Esri Press has expanded its catalog to include textbooks for cartography, remote sensing, and other GIScience areas. *Introduction to Human Geography Using ArcGIS Online*, authored by J. Chris Carter, is its first textbook for an introductory non-GIScience geography course. The blurb on the book's back cover describes it as "a one-of-a-kind introductory textbook aimed at college undergraduates and high school advanced-placement students"—one that "bridges classroom lecture with live, current, interactive data for reinforced learning and a hybridized teaching approach." "With this book," they tell us, "instructors can tailor classroom examples and homework assignments to local geography." Carter is a professor of geography at Long Beach City College in California, where he teaches human geography and geographic information systems. His training and experience in both human geography and GIS make him ideally suited for writing this text.

Like other introductory human geography textbooks, this book is organized into topical chapters, each between thirty and forty pages long. Chapter 1 provides readers with an introduction to both the discipline of human geography and important concepts of GIS online mapping. Topics covered include space, place, region, spatial diffusion, human-environment interaction, geographic data sources, map scale and accuracy, map types, and coordinate systems.

Chapters 2, 3, and 4 are titled "Population," "Migration," and "Race and ethnicity," respectively. Chapter 2 explains such basic demographic indicators as crude birth rate, total fertility rate, and rates of natural increase. It also covers population pyramids, dependency ratios, and the concept of demographic dividend. Some population theory is also included, with discussions of the demographic transition model and of Malthusian theory. Chapter 3 expands upon the basic demography concepts from Chapter 2 with a thorough overview of migration, and it clearly explains topics such as a migrant stock and flow, push and pull forces, government immigration policies, the impacts of migration, and migration gravity modeling. The concepts of race and ethnicity are carefully explored in Chapter 4, as is the spatial distribution of racial and ethnic minorities in the United States. The author explains how geographers have studied racial and ethnic discrimination using methods such as hot spot analysis, the location quotient, the index of dissimilarity, market segmentation analysis, and tapestry segmentation.

"Urban geography" is the title of Chapter 5. After a definition of urbanization and a short historical discussion of the origin and growth of the city, Carter launches into an extensive explanation of the distribution of cities, both at the global and regional scales. The rank-size rule (Zipf's law), central place theory, and the concepts of site and situation are all introduced as theories geographers have used to explain and model urban population distributions. Next, the author turns to the models used to describe the spatial organization of cities, such as sector, multiple-nuclei, and

concentric rings. Related topics such as urban and suburban growth and decline, zoning, smart growth, and urbanization in developing regions are also briefly touched upon.

Concepts in economic geography form the subjects of Chapters 6, 7, and 8. Food and agricultural production—the primary sector of the global economy—is covered in Chapter 6. The chapter begins with an historical overview of the first (or Neolithic) agricultural revolution, plant domestication, the fifteenth- and sixteenth-century Columbian exchange, and the second agricultural revolution of the mid-seventeenth to late nineteenth centuries. As has been his pattern in earlier chapters, Carter follows this introduction with a detailed analysis of the spatial distribution of agricultural activity, including commercial, subsistence, and plantation farming. Hunger and food security, food deserts, and food loss and waste conclude the chapter. The geography of manufacturing, representing the secondary sector of the economy, is covered in Chapter 7. Beginning at the Industrial Revolution, the chapter explains the spatial distribution of manufacturing along with the various factors that drive industrial location—including the theories of Alfred Weber: for example, that firms seek out factory sites that minimize transport and labor costs—and segues into the contemporary changes in industrial production in the United States, Europe, and the developing world. The service, or tertiary, sector of the economy is the subject of Chapter 8. As in Chapters 6 and 7, Carter begins with a bit of history before turning to spatial distributions, utilizing location theory and central place theory where applicable. The chapter ends with a discussion of service employment through the topics of automation, inequality, universal basic income, and labor unions.

In Chapter 9, Carter examines the geography of human development, starting with a definition of development and an overview of the basic development indicators such as gross national income, life expectancy, a gender inequality index, and the human development index. Well-known theories of development are explained, including exploitation-based theories such as dependency theory, and market-based theories such as modernization theory and neoliberalism.

Chapter 10, "Cultural geography—folk and popular culture, language, religion," begins with a discussion of cultural regions in the United States and demonstrates how tapestry segmentation analysis can be used to determine their extents. The discussion of folk and popular culture focuses on music, food, and housing. An analysis of linguistic and religious geographies, using both American and international examples, forms the bulk of the chapter. Topics include language development and language families, dialects, lingua francas, endangered languages, ethnic and universalizing religions, intolerance, and religious persecution.

The wide-ranging subfield of political geography is the subject of Chapter 11. Electoral geography (including gerrymandering), the concepts of nation and state, state border issues, the size and shape of countries, unitary and federal states, authoritarianism and democracy, centripetal and centrifugal forces, balkanization, terrorism, and supranational organizations are just a sample of the plethora of topics covered in this long chapter.

The final chapter of the book, Chapter 12, is about human-environment interaction, focusing on pollution and climate change. After introducing the concept of the Anthropocene (or the human-recent) epoch, Carter examines air, water, and solid waste pollution and discusses sources, temporal trends, spatial patterns, and solutions for each. The chapter concludes with a discussion of the causes and consequences of global climate change, and its impacts on human geographies.

A unique feature of this textbook—one that sets it apart from other human geography texts—is the inclusion of sixty-two hands-on ArcGIS Online exercises that span topics in all twelve chapters. The exercises are available as PDF files (almost 400 pages total) on the Esri Press website and contain step-by-step instructions along with gradeable questions to assess progress. I could not find an answer key for these questions, so I assume that the instructor has to complete the exercises themselves before grading. Purchase of the textbook provides students with a 180-day free trial of ArcGIS Online, access to the ArcGIS Living Atlas of the World, and 200 ArcGIS Online service credits.

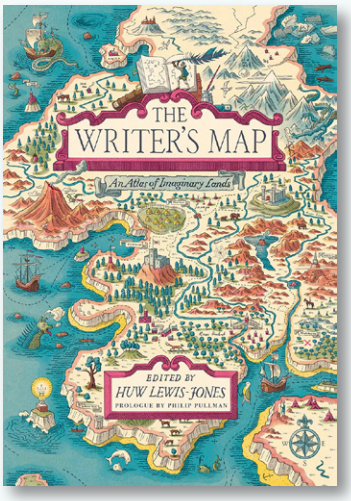
At over 425 pages, the book is thicker than most introductory human geography textbooks, but at least some of that bulk is because its text is set in 11-point type and because it contains hundreds of large, full-color charts, tables, diagrams, photographs, and historic maps, as well as many custom ArcGIS Online maps. All of these are available

as projection-quality downloads from the Esri Press website, a resource facilitating high-quality classroom lecture presentations. The custom ArcGIS maps are a particular strength of the book. Each has a URL that connects to the live map resource on ArcGIS Online, where the student can manipulate the map and interactively explore the data behind it. Each chapter includes a list of about thirty to fifty references for further reading. These references are relevant, current, and easily accessed via URL or DOI number. Curiously, the review copy that was provided did not include a table of contents or a preface, but I was able to download the table of contents from the book's webpage at the Esri Press website (**esripress.esri.com**). The preface was not available for download, so I could not include it in this review.

Not surprisingly, because of its integration with ArcGIS Online, the textbook provides a very numerical, spatial, and model-driven approach to human geography. Many of the theories presented in the chapters are commonly used in GIS analysis and originated decades ago during geography's Quantitative Revolution. This is not a social theory text with introductions to the many French theorists that have influenced some contemporary geography circles, and Marxists, feminists, postcolonialists, and other critical human geographers will probably find the text unattractive.

Overall, *Introduction to Human Geography using ArcGIS Online* is an excellent textbook. The writing is clear and concise, and the examples and issues given in the book are current and relevant. Although the majority of the examples and topics are of North American human geography, Professor Carter does add some international subjects with geographies from Europe, Asia, Latin America, and Africa. Thus, this is not a book about the human geography of the United States, or even of the World, but one about human geography in general. Although introduction to human geography is not a current teaching assignment of mine, I will seriously consider adopting this book if my assignments change in the near future.

DOI: 10.14714/CP93.1577



THE WRITER'S MAP: AN ATLAS OF IMAGINARY LANDS

Edited by Huw Lewis-Jones

University of Chicago Press, 2018

256 pages

Hardcover: $45.00, ISBN 978-0-226-59663-1

Review by: Nat Case, INCase, LLC

It deserves saying up front: *this is a beautiful book*. If you run a map library, you should have it in your collection; if you read fiction and are interested in maps, you will find a lot in it to explore. That said, many *Cartographic Perspectives* readers used to reading and thinking about factual maps—maps which describe our real world and which often carry serious consequences in their use—may find this book odd and even slightly disturbing. I often found myself feeling like something was missing, and although in the end I think that the feeling was misguided, I did find the experience interesting in ways I don't believe the editor and authors intended.

This volume consists of twenty-five lavishly illustrated essays written by a variety of hands: the editor, notable fiction writers, creators of maps based on fictional worlds, and readers of maps. Originally published in Great Britain by Thames and Hudson, *The Writer's Map* has a strong Anglo-centric bias: while it does include examples of maps for fiction from outside of the United Kingdom, it keeps returning to its point of origin. The focus is on well-known writers, the likes of J.R.R. Tolkien, J.K. Rowling, Arthur Ransome, Phillip Pullman and A.A. Milne; the often excellent maps that illustrate second-tier (or third-tier) fantasy novels are not discussed, and neither are maps for computer or tabletop roleplaying games.

There are three essays written or co-written by the editor, Huw Lewis-Jones. The first two, which open the volume ("The Little Things: Mapping Memories" and "In Fabled Lands: Literary Geographies"), provide overviews of the experience of maps, and of the history of authors using maps in their work, while the third ("Exploring Unknowns: Terra Incognita") surveys the power of imprecision and incompletion—exploring the role these elements play in imaginative mapping where, unlike in our modern factual maps, they are not always considered a defect. All three essays suffer from the same problem as the book overall: they have a subject—maps—but struggle to say anything really interesting about them. In tackling an over-broad subject, these essays don't cohere into an argument and so offer little of use.

By contrast, the remainder of the essays gain a great deal by being unapologetically, and often eccentrically, personal. In "Foreign Fantasy," Lev Grossman, author of *The Magicians* (2009) and its sequels, explores how in his youthful, imaginative play of Dungeons and Dragons, mapmaking became part of his storytelling. Daniel Reeve, the artist who produced calligraphy and maps for Peter Jackson's Tolkien-based movies, describes in "Uncharted Territory: A Middle-Earth Mapmaker" how his pen-and-ink career and fascination with Tolkien got him that job. "Mischief Managed" is graphic designer Miraphora Mina's dive into her translation of Harry Potter's Marauder's Map from text on a page (Rowling 1999) into a three-dimensional movie prop (Curaón 2004). Cressida Cowell's "First Steps: Our Neverlands" essay tells about how the germ for her series of novels that began with *How to Train Your Dragon* (2003) was a sketched map of the

islands where the stories take place. In the essay "No Boy Scout: With Swallows and Amazons," Roland Chambers narrates his step-by-step metamorphosis into someone who thinks "more and more carefully about what maps are" (190). From a beginning of not liking maps at all, he began to see something of their power in writing about the work of Arthur Ransome (who knew a thing or two about maps), and learned even more when he was persuaded (twice) to himself make some maps for his friend (and fellow *Writer's Map* contributor) Lev Grossman (2009; 2011). Brian Selznick, author of *The Marvels* (2015), discusses the visual relationship between anatomy and geography ("Landscape of the Body: Interior Journeys"). The graphic novelist Isabel Greenberg writes about how incompleteness and error are central to how she approaches maps as an opening to invention. Her essay, "The Cycle of Stories: Early Earth and Faerie," makes an interesting counterpoint to the editor's similarly themed "Exploring Unknowns: Terra Incognita."

The Grossman-Chambers connection is not the only one in the book. Writers and the maps in their books influence other writers and their maps in complex ways, and several books and authors (Tolkien most notably) appear in multiple essays. The resulting tangle might be annoying—especially if one wanted to use this book as a reference—but there's an index to keep one from getting completely lost. In the end, it's fascinating to see how the whole world of fictional maps is itself a kind of interconnected ecosystem—one full of admiring imitation and borrowing. I note how similar this is to my experience in factual cartography, where we often look to both historic and contemporary maps for general inspiration and specific style points. Many of my favorite recent maps—both fictional and factual—are explicitly exercises in reproducing old map styles using modern technologies.

As a group, the essays are uneven in tone, execution, and interest, but all have a common underlying theme: *I love maps*. This may seem like a commonplace starting point, but it's rare to see a book about maps that so effectively sticks to that theme of love. So often, moral responsibility and the weight of the things mapping has enabled—war, mineral extraction, colonial domination, vast transportation networks, and the power of the nation state—creeps into and dominates any discussion of maps, however celebratory the author may want to make it. This is because so many maps, being fact-centered in design and attitude, are tightly interwoven with our world and physical acts within it. Thus, power exerted by and through maps has been a central pillar of cartographic critique for at least the last quarter century.

This book, however, does not have that issue—it is a lovefest straight through, although the individual results are, as I said, variable. Some essays feel indulgent, and others wander, but many of them are profoundly revealing of the ways that maps can enlighten and encourage the work of writing fiction, and particularly of fantasy fiction. Each illuminates a corner of the craft of creating a believable fictional world, but because the authors use and interact with maps in such a wide range of ways, the book fails to gel except on the one common theme that *maps are fun*.

By turning back, as many of the authors do, to childhoods spent exploring maps, this basic fact that *it's fun to look at maps* comes up over and over. It's a kind of play to let oneself wander into exotic places, to follow the route of explorers and adventurers, and just to see the world in miniature. Maps are like dollhouses or model railroads or the paintings of Pieter Breughel: we can play *let's imagine* games of all kinds as we wander with our eyes and trace shapes with our fingers. This imaginative play reflects back on the way that the serious work of the cartographer's craft is also, in part, a guilty pleasure. To divide up the world, to sort it into categories and regions, is also a kind of play. It's all consequential and all very serious—as cartographic criticism has tried to tell us for decades—but maps are not just tools but also toys. While the projection of power is an important part of why maps are important, the reason we *like* them has as much to do with the simple fact that it's fun to play with the world on a piece of paper or on a screen.

What's a little odd for a factual cartographer to see, though, is that many of what are widely considered the essential tools and ideas of our trade—projection, accuracy, comprehensiveness, currency, and so on—become peripheral stylistic points to most of the works here. Odd, perhaps, and yet the maps here work; they are effective and informative illustrations to the texts they accompany. How then can a map be both a good map and disregard those qualities by which we judge our own work? The book leaves me wondering how many of the criteria by which we critique our maps and those of others have to do with the world we live in, and how many truly have to do with the practical craft of making map graphics.

As an amusement park full of different rides and riders, *The Writer's Map*: *An Atlas of Imaginary Lands* offers a great variety of experiences, but ultimately, and despite the editor's best efforts, it fails to explicitly provide the kind of convincing thread one might expect from a book about maps and literature. When one comes down to brass tacks, it is the illustrations that carry at least half of the weight of the book: reproductions of published maps with which many readers will be familiar, shown alongside manuscript and draft versions, and historical maps that the authors and creators recall working from as inspiration. The selection is—as is the whole book—drawn more from love than from any didactic plan, and can thus seem bewilderingly scattered. To those used to viewing cartography through a historical structure, or to discussing it according to theory and plan, *The Writer's Map* can be disorienting—but there is another important message in its personally-oriented structure: *come in*, *play*, and *have fun*!

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Danzer, Gerald. 1990. "Bird's-Eye Views of Towns and Cities." In *From Sea Charts to Satellite Images: Interpreting North American History through Maps*, edited by David Buisseret, 143–163. Chicago: University of Chicago Press.

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Cartography Associates. 2009. "David Rumsey Donates 150,000 Maps to Stanford University." *David Rumsey Map Collection*. Accessed January 3, 2011. **http://www.davidrumsey.com/blog/2009/8/29/david-rumsey-donates-150-000-maps-to-stanford**.

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Cartographic Perspectives

The Journal of **Nagis**

Number 93, 2019