(Un)bounded: Rethinking "The Border" with New Visualization Technologies
By
Ellen Currin

Senior Honors Thesis
Department of Geography
University of North Carolina at Chapel Hill

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Approved:

John Pickles, Thesis Advisor

Elizabeth Olson, Reader

Altha Cravey, Reader

Abstract

Western state cartography has produced the common understanding of "the border" as the line between two sovereign areas, but this simplistic view is now being challenged by practices of critical cartography and geography. Academics, activists, artists, and government institutions are developing new understandings of the border as multifaceted phenomena of performance, experience, movement, and conflict. These modern understandings require more complex methods of representation. This thesis investigates how new cartographic and visualization technologies can contribute to a new, more complex understanding of "the border."

IMPORTANT NOTE: This thesis contains many dynamic and interactive figures and should be viewed in digital format. Please read and explore this thesis project at http://ellencurrin.github.io/unbounded/. Thanks!

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Digital Version -- http://ellencurrin.github.io/unbounded/

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Preface

This thesis came about as a means to two separate ends. First, I wanted a chance to explore a deeply rooted interest in borders. This interest began in fifth grade, where our social studies curriculum included world geography. I remember thinking that the division of countries was so arbitrary and I wondered if we couldn't simply redraw them or abolish them all together. This led to several arguments with my classmates who were much more willing to accept the natural existence of borders than I was, but my skepticism persisted. While I never quite accepted that borders *needed* to exist, I never thought to question what exactly "the border" was until my second semester as a Geography major.

In the Fall of 2012, I attended a presentation about the political enclaves and exclaves along the Indian-Bangladeshi border. The existence of these small land-locked islands made me question everything I *thought* I knew about sovereignty, territory, and borders. Regardless of their necessity or natural existence, I had always assumed these sorts of geographic entities were clear-cut. Sovereignties suddenly became blurry, and the lines that once divided them ceased to exist. At least, they ceased to exist in the way I had always assumed. I undertook this thesis with the hope of using my theoretical education in geography to answer a few of my personal questions about borders.

I also undertook this thesis with the hope of researching and applying new digital mapping practices. My interest in interactive mapping developed out of frustration with the limits of traditional and often outdated GIS practices, and a desire to expand my spatial analysis and data communication toolsets. For the past year I have immersed myself in the world of web design, coding, and open source data in order to gain the skills I need to begin making the sort of digital cartographies that I imagine. Practicing and perfecting new my own technological skills

became an important part of this project, thus while I could have relied solely on the (more advanced) work of others to conduct my analyses, I chose to build own examples. While my visualization examples might not be technically perfect, my understanding of the technologies I discuss is much deeper now that I have tried them out myself.

In addition to borders and visualization technology, my fascination with and coursework in linguistics has been an influencing factor in the direction of this paper. Linguistics has impacted the way I think about discrete categorization and meaning, both of which are relevant not only to language but also to the discussion of mapping and borders. Not only do maps use language, but they are a sort of language of their own. Denis Wood, a cartographer and scholar whose ideas have greatly influenced my work, also uses linguistic theories as a way to understand how maps make meaning and myth. As Wood explains, "Every map is at once a synthesis of signs and a sign in itself," (Wood and Fels, 1986:54).

Looking back on the process of this thesis, I have accomplished both the theoretical and technological goals I set out to achieve, but in ways I had never predicted. I learned that all borders, not just the borders of political enclaves, are complex and contradictory. I also learned that technology is not necessarily as important as perspective when trying to generate and communicate new understandings.

Introduction

MAPPING IT ALL OUT

For centuries, borders have been thought of, and represented, as static, linear, and black-and-white, but recent studies and practices of critical cartography and geography are complicating this simplistic view. Just as cartography has been key in constructing this prevailing understanding of "the border", it can also challenge, disrupt, and supplant "the border." This thesis investigates how digital cartographic and visualization technologies can contribute to a new, more complex understanding of "the border."

Before directly addressing this central question, it is important to explore what exactly the prevailing understanding of "the border" is and where this understanding came from. Chapter One identifies and problematizes the traditional explanation of the border as the line between two sovereign areas, and it traces the practice of bounding land back to the rise of the nation-state and the coterminous rise of Western state cartography. Chapter One also addresses why maps, by their propositional nature, are well positioned to create and enforce borders.

Chapter Two then asks: Who/what is challenging the traditional understanding of the border, and where/how are these challenges being developed? It looks at a broad sample of cartographies that each approach and/or expose the border in different ways. The examples, which come from academics, activists, artists, and government institutions, serve as a survey of diverse border perspectives. Additionally, they provide glimpses into the different techniques and technologies that are being used to explore and expand the border. I do not argue that any particular understanding is better than the rest, but rather suggest that the border is made up of the culmination and co-occurrence of many understandings and the simultaneous spectacles that

they produce.

Chapter Three investigates how new cartographic and visualization technologies can help represent, produce, and explore a complex and multi-spectacled understanding of the border. Using my own work as examples, I present and evaluate the use of several digital technologies in border-related cartographies. Chapter three finds that interactivity, animation, customization, and multimedia integration make digital maps better suited than paper maps for the representation of multifaceted, multidimensional data. Additionally, the chapter confronts the assumption that spatial attributes necessarily have Cartesian locations, and it concludes that digital and paper cartographies alike should critically consider and accordingly represent the relationship between "the border" and Cartesian space.

Borders are increasingly being understood as a complex phenomenon of performance, experience, movement, and conflict. While technology is not necessary for creating new understandings of "the border," it does support the sort of advanced and complex representations of space that new understandings of "the border" demand. While this thesis does draw from many theoretical and conceptual sources, it is first and foremost a practical exploration and demonstration of the role of visualization, especially digital visualization, in constructing and understanding borders. I hope that this thesis can convince others to incorporate new visualization technologies into their attempts to overturn historical cartographic convention and redefine "the border" in meaningful ways.

Chapter 1

CARTOGRAPHY AND THE CREATION OF "THE BORDER"

What is "The Border"?

In 1976, Raymond Williams wrote "Keywords: A Vocabulary of Culture and Society" in order to describe and discuss words which, he says, "are significant, binding words in certain activities and their interpretation" and "significant, indicative words in certain forms of thought." The word "border" was excluded from his work, but modern geography scholars, arguing that this term now demands a critically deconstructive analysis just as much as William's keywords, have remedied this in a new piece of work titled "New Keywords: Migration and Borders," (Casas-Cortes, et al. 2014). According to the authors, "the discursive currency of these terms, and much of what has come to be commonplace in popular understandings about borders and migration, is the product of a rather short (global) history," (1-2).

Consider the definition below from the Oxford English Dictionary:

> bor·der ˈbôrdər/ *noun* **1**. a line separating two political or geographical areas, especially countries. "the German **border with** Denmark" **2**. the edge or boundary of something, or the part near it. "the northern border of their distribution area"

This definition seems to capture the popular understanding about borders, but it is far from adequate. As Raymond Williams explains in the beginning of "Keywords", "When we come to say 'we just don't speak the same language' we mean [...] that we have different immediate values or different kinds of valuation, or that we are aware, often intangibly, of different formations and distributions of energy and interest," (11). In other words, "particular terms and

phrases acquire quite discrepant and even contrary meanings over time and across space, such that the same words – and the conceptual categories that they index – can be so variously deployed, from one idiomatic usage to the next, as to appear to no longer refer to the same things,"(Casas-Cortes, et al. 2014: 2). The O.E.D. definition tells us that a border is "a line separating two political or geographical areas," but what is a "geographical area" except a piece of the earth demarcated by a border? This definition tells us that a border is the edge of *something*. But *what* thing?

Sovereignty: Not As Simple As You Think

Modern sovereignty-related research generally relies on the basic assumption that the world's territory exists in "non-overlapping, juridical autonomous spaces" (Murphy, 2005: 281) and that the only question is how authority in those spaces is exercised (R. Jones, 2009: 376). But, as Reece Jones reminds us, "the traditional definition of sovereignty as the unambiguous connection between a single sovereign entity and a clearly defined territory is, of course, increasingly contested," (376).
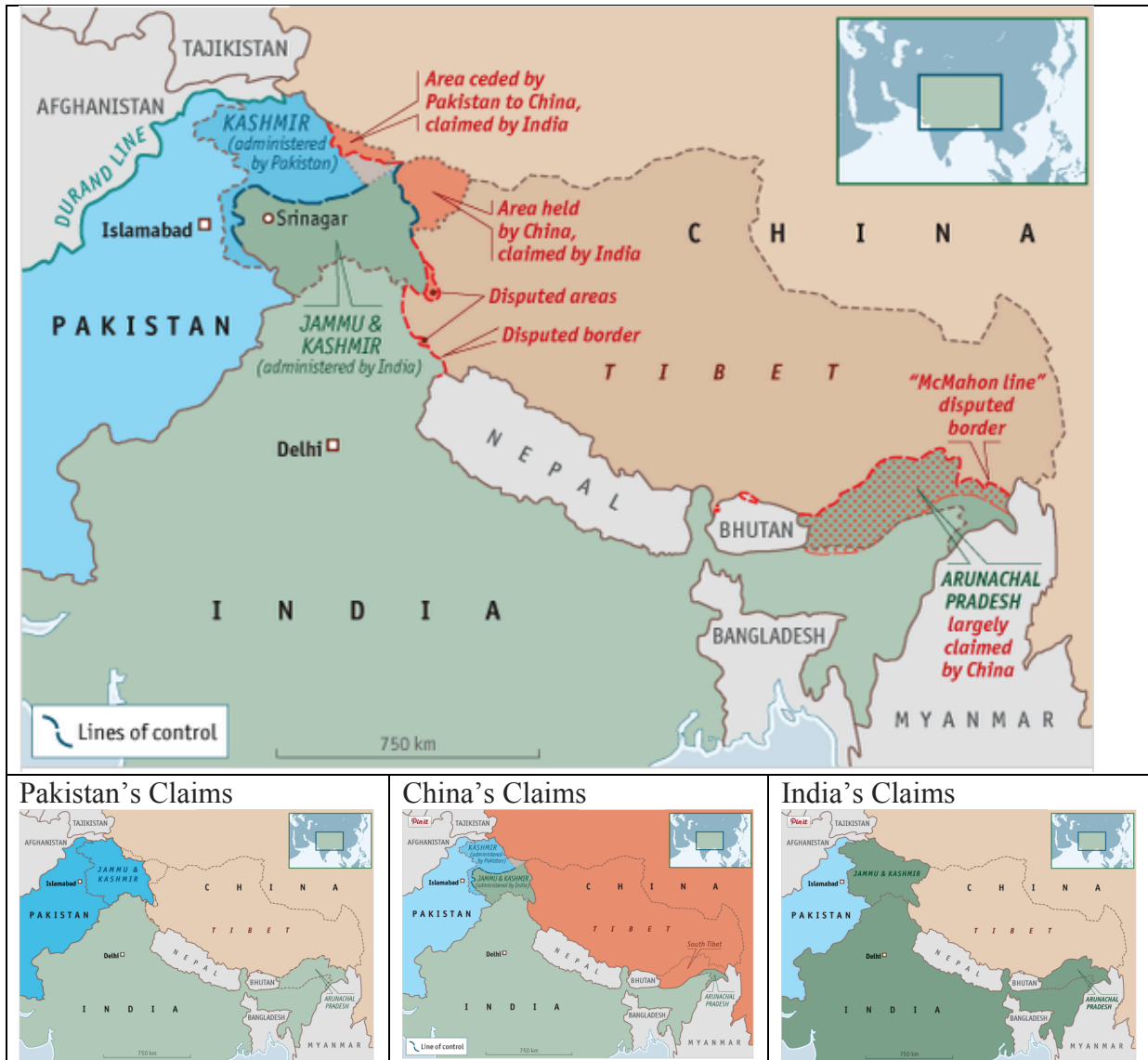
Figure 1-1. "South Asian Territorial Claims," *The Economist*.

For one, territory is not always so "clearly defined," as Figure 1-1 illustrates. A Pakistani man and an Indian woman might have very different ideas about the "line" which separates their "two political or geographical areas." A Kashmiri insurgent would likely disagree with them both, siting the "edge or boundary" of a space that neither the Pakistani man nor the Indian woman recognizes as legitimate.

A border dispute happens when two (or more) powers claim the same land. Sometimes, however, two powers really do have ownership over the same land. According to West's Encyclopedia of International Law, a condominium is "*a non-self-governing territory over which two states share administrative control.*" Other times, a single sovereign territory contains "exclaves"- pieces of land that are politically attached to a larger piece but not physically conterminous with it because of surrounding foreign territory (*Webster's Encyclopedic Unabridged Dictionary of the English Language,* 1989).
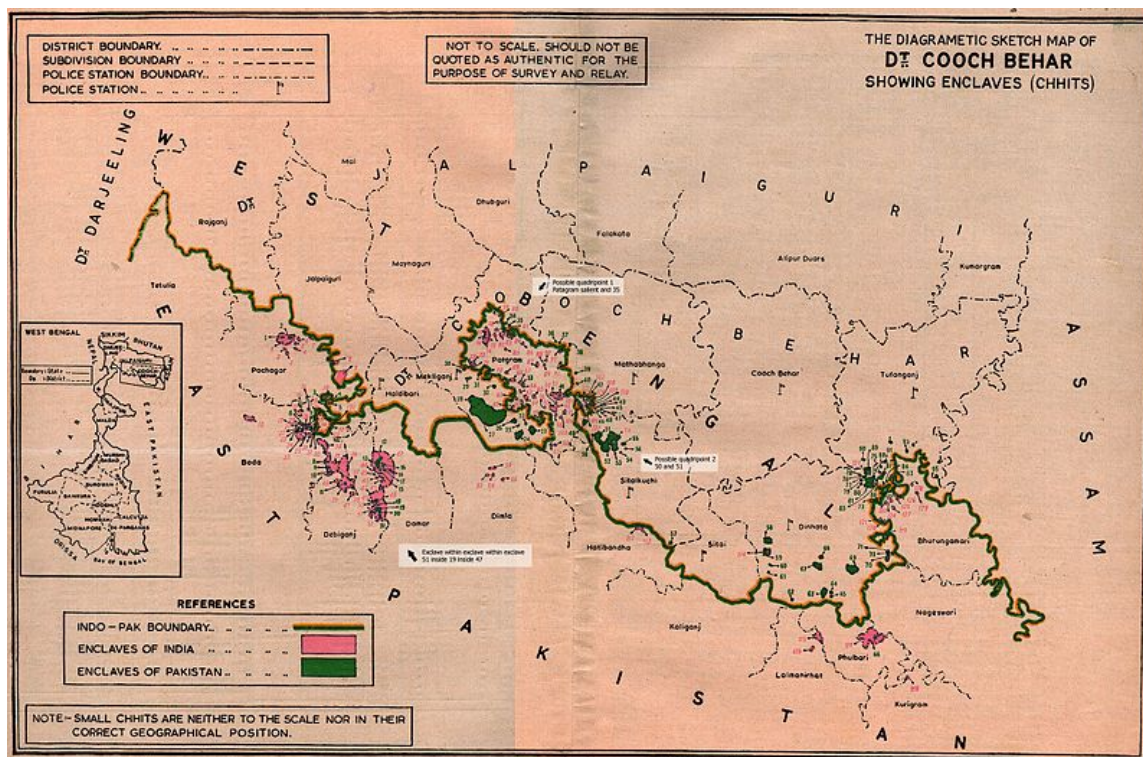
Figure 1-2. "Coochbehar map" by Cyberpunk7282, Wikimedia Commons.

Along the India-Bangladeshi border, there are 198 enclaves/exclaves. 92 are Indian exclaves, surrounded by Bangladesh, and 106 are Bangladeshi exclaves, surrounded by Indian territory (see Figure 1-2). There are 24 "second-order" exclaves, which sit within an enclave, and within the particularly complicated region of Cooch Behar, there is a third-order enclave: an

enclave within an exclave within an enclave (Whyte, 2002). In many of the Indian exclaves, residents are dependent on Bangladeshi infrastructure, and the Bangladeshi Taka is used as the sole currency (R. Jones, 2009: 377). As Jones points out, "the existence of the enclaves undermines the claim of an unambiguous connection between a sovereign authority, a particular territory, and a single people," (377). There are hundreds more of these political exclaves/enclaves around the world.

Harder to define yet similar in nature to the existence of exclaves are embassies, military bases, special economic zones, even international airports. The legal and political regulations that govern sovereignty and rights in these spaces are often quite different from those in the surrounding area. If you ask someone to draw "The United States," you would most likely receive an image of the 48 contiguous states. But if we take into account the reality of overseas territories (as Bill Rankin has done in his map titled "The Territory of the United States: a patchwork of jurisdictions and rights", Figure 1-3), "The United States" looks quite a bit messier.

Figure 1-3. Excerpts from "The Territory of the United States: a patchwork of jurisdictions and rights," by Bill Rankin, from radicalcartography.net.

Sometimes the "line" between two geographical areas is neither cleaved (as it is with enclaves) nor contested (as it is with disputed borders). Sometimes the line is just plain shifty. Tides move in and out on coastlines, changing the continental shapes our desk globes suggest. Polar ice caps are receding and expanding by the season despite their static white presence sandwiching our world maps. It is convenient to consider sovereignty in black-and-white terms, because then we can define "border" as the crisp line between one jurisdiction and another. But the truth is, sovereignty is a gray area, and "border" is a gray area, too. As Denis Wood preaches, "land isn't divided except in our heads and on our maps," (Wood, Fels, and Krygier, 2010:49)

The Power of Maps

W=F*d

Work= Force*distance

Maps work. They help us get where we are going, they tell us what school district we are assigned to, they declare international boundaries that (most) people accept and respect. If you know the shape of Texas, you probably know it because of a map. Cartographer and scholar Timothy Stallmann explains that the question "How do maps work?" can be answered in two ways (2012: 11). The first way is psychological, concerning itself with how readers perceive and interpret maps. The second and perhaps more important way is concerned with the power of maps and their role in society. As Denis Wood reminds us, "work is the application of a force through a distance, and force is an action that one body exerts on another to change the state of motion of that body," (Wood, Fels, and Krygier, 2010:1). Indeed, maps don't only work, they *do*

work. Maps have a powerful ability to persuade and propose. They are "engines that convert social energy into social space, social order, knowledge," (Wood, Fels, and Krygier, 2010:6).

Until the work of J.B. Harley in the 1980s, maps tended to be understood as records of geographic fact (Stallman, 2012). Harley was one of the first people to bring critical theory to the study and deconstruction of maps, encouraging others to think of maps not as mirror representations of 'the world', but as representations of the context and environment in which maps are produced. By reading "between the lines", Harley argued that the context of the map could be discovered, providing clues to what was included on the map as well as what was omitted (2001: 45). Building off of Harley's work, Denis Wood argues that maps are not only *not representations* of the world, but that they are in fact *propositions*. Wood explains that maps make their propositions through "postings," which are visual and linguistic claims that 'this is here,' (Wood, Fels, and Krygier, 2010).

In the introduction to the *Rethinking the Power of Maps*, Wood uses a Wake County school district map to illustrate power of maps. First, a map is needed to create- to propose- the existence of school districts. Before they are drawn, the districts literally don't exist! But who requires residents of Wake County to abide by the proposition of the districts? The map is backed up by the force of the school board, which is backed up by the law, which is backed up by the police and the military. While this logic might seem a bit extreme, Wood reminds us of when the National Guard had to enforce the rights of black students to attend integrated schools in the south.

Usually, however, the use of force to defend what is drawn on a map is not needed. This is because we tend to accept the communications of a map as fact, and arguing with reality doesn't seem worthwhile. To quote Wood, "The most fundamental cartographic claim is *to be a*

system of facts, and its history has most often been written as the story of its ability to present those facts with ever increasing accuracy," (Wood and Fels, 1986: 63). In the past century, cartographers and scholars have constructed this fundamental cartographic claim through the professionalization of cartography (Wood, Fels, and Krygier, 2010:132). Ultimately, the attempt to separate Cartography (as an academic science) from the "handicraft" of map-making has been quite successful, thus further masking the indexical (or context-dependent) nature of maps (Turnbull and Watson, 1993). "Naturalizing" the map (i.e. defining it as a mere representation of the earth's surface) has universalized it and helped "obscure the map's origin in the rise of the state," (Wood, Fels, and Krygier, 2010:19).

The Rise of Nation-States and The Rise of Cartography

Another source of the map's power, hardly separable from it's propositional logic, is its ability to "give us a reality beyond our reach," (Wood, Fels, and Krygier, 2010:15). "Ultimately," says Wood, "the map presents us with the reality we *know* as differentiated from the reality we *see* and *hear* and *feel*," (Wood, Fels, and Krygier, 2010:16*).* Maps tell us what our country looks like and where we are within it. Maps are what tell us that a physical country exists at all!

Maps are so common in our daily lives that it is hard to imagine a time without them. Wood reminds us, however, that Genghis Khan, Charlemagne, the Roman emperors, and the pharaohs all ruled without maps, and that the Bible was written without ever referring to one (Wood, Fels, and Krygier, 2010:18). Wood's extensive research on the history of map making has shown that maps have really only been around since the sixteenth century. "People create maps only when their social relations call for them," says Wood, "and the social relations that

most insistently call for maps are those of the modern state," (Wood, Fels, and Krygier, 2010: 19). Modern states require a territory to rule over, and maps provide them exactly that.

The common understanding of maps is that they simply abstract and represent things that already objectively exist, but Thongchai Winichakul's study of Siam (now Thailand) revealed a relationship that was entirely reversed. According to Thongchai, the map "was a model for, rather than a model of, what it purported to represent," (1994:310). Ultimately, Thongchai argues that the formation of Thailand as a modern nation-state would have been impossible without the map. Richard Helgerson claims a similar thing about Elizabethan England: that the cartographic representation of England had an ideological effect that strengthened national identity and loyalty (1992:144). The map's ability to construct the spaces that it eventually seems to merely represent is what Matt Sparke calls "the recursive proleptic effects of mapping," (1998:466).

Thongchai Winichakul (1994) has coined the term "geo-body" to describe the bounded spaces that maps construct. Geobodies, with their concrete edges, are controllable and ownable. They present themselves as "visually and territorially unified constructs," creating national unity between people who might otherwise be disjointed by geographic, political, or ideological distances, (Wood, Fels, and Krygier, 2010:31).

In sum, maps are not mirror representations of reality. Rather, as Wood eloquently puts it, "maps are an argument about existence," (Wood, Fels, and Krygier, 2010:34). Geobodies, and by extension borders, are created through mapping, which means that borders are nothing more than arguments about a particular space. Anyone can use a map to make an argument, but the arguments that become 'naturalized' as common sense in our society are the ones that come from those with the loudest voices, those with the most power.

Counter Cartography

In this thesis, I borrow Tim Stallman's use of the term "Western state cartography," to describe a type of cartography which purports to be objective and 'expert'; contains a state-ist and capitalist viewpoint which sees the Earth as a patchwork of bounded and ownable territorial units; and presents cartography as an empirical science (2012: 141).

Counter mapping (also called "counter cartography" or "critical cartography") has been questioning the hegemonic effects of Western state cartography for decades. In 1979 McArthur published his "Universal Corrective Map of the World" (Figure 1-4) to protest the prejudice for North-as-up orientation. His purpose is written plainly on the map: "Never again to suffer the perpetual onslaught of "downunder" jokes -- implications from Northern nations that the height of a country's prestige is determined by its equivalent spatial location on a conventional map of the world."
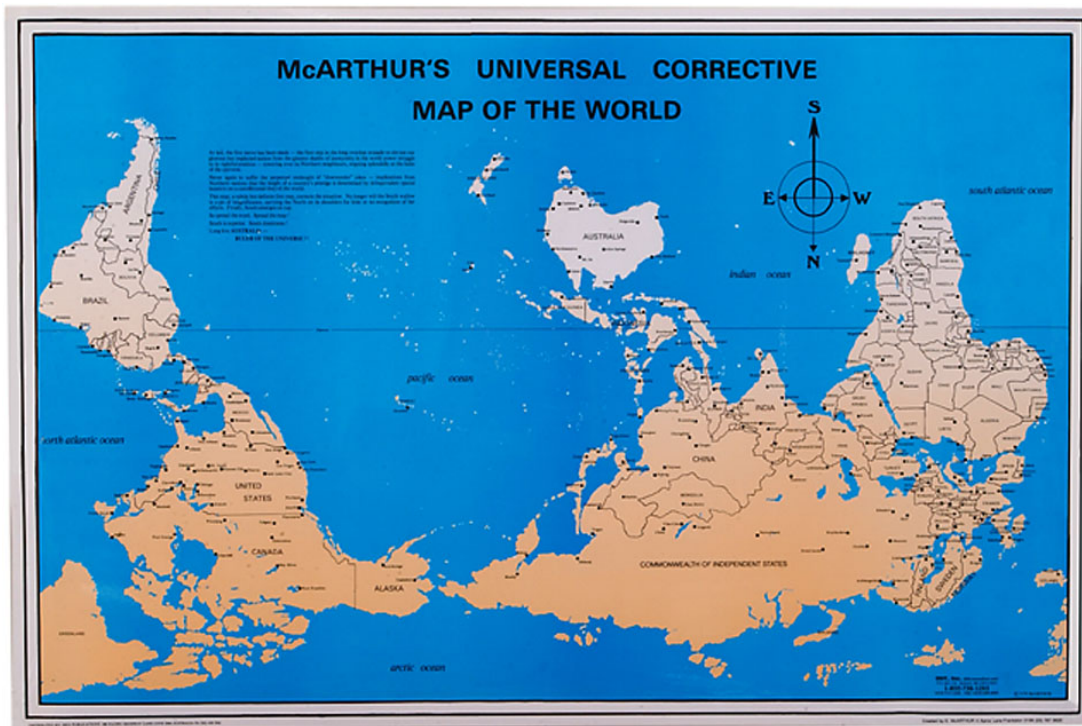

Figure 1-4. "McArthur's Universal Corrective Map of the World" by Stuart McArthur, copyright ODT.

While McArthur literally turned cartographic convention on its head, others have employed strict cartographic norms to gain recognition for their counter-hegemonic causes. For example, since the early 1970s, indigenous mapping movements have questioned the control of the state and reclaimed titles to tribal lands using the same cartographic weapon that was used against them in the first place (Wood, Fels, and Krygier, 2010:147). As Bernard Nietschmann has said, "More indigenous territory has been claimed by maps than by guns. And more Indigenous territory can be reclaimed and defended by maps than by guns," (1995: 34). Indigenous counter-maps, for example, played a fundamental role in the creation of Nunavut out of Inuit land formerly considered part of British Colombia (Wood, Fels, and Krygier, 2010). In a map-obsessed society like our own, bounding historically unbounded territories is a precursor to them being recognized by the State.

Other counter cartographies are more concerned with exploring space and finding new ways to orient ourselves within it. As the Cartac collective writes, "Even though the map is not the territory, to make maps is to organize oneself, to generate new connections and to be able to transform the material and immaterial conditions in which we find ourselves immersed. It isn't the territory but it definitely produces territory," (,qtd. in Mendez de Andes et al. 157). Cobarrubias and Cortes point out that this idea resonates with Fredric Jameson's (1991) suggestion that we need a new sort of "global cognitive mapping" to reorient ourselves in a postmodern world (qtd. in Casas-Cortes and Cobarrubias 2007: 63). Other groups, such as Hakitectura (which I discuss later), have taken this idea even further, using cartography as a tool to actually create and enforce new physical spaces.

Counter cartography is a tool used by many different groups for vastly different causes, but intentionally or not, nearly all of them argue against the objectiveness of maps by demonstrating their subjectiveness.

Conclusion: Drawing and Interpreting Lines

Swedish Geographer Gunnar Olson once asked, "What is a geography if it is not the drawing and interpreting of a line?" In the introduction to *A History of Spaces,* John Pickles builds off of this question by asking, "What is the drawing of a line if it is not also the creating of new objects?" (Pickles, 2004: 3).[1]

Western state cartography, both influencing and influenced by the rise of nation-states, has drawn many lines and created many objects. Ultimately, it is responsible for our common understanding of "the border" as the line between two discrete sovereignties. This understanding is wrapped up in state-ist and capitalist viewpoint that sees the Earth as a patchwork of bounded and ownable territorial units (Stallman, 2012: 142). But maps and borders are contestable, and new ideas about the border are now being created and explored. A central part of this creation and exploration is redrawing the border on the map or even erasing it all together. Building off of the knowledge that maps have the power to define "the border", Chapter Two will investigate a diverse array of cartographies and the equally diverse stories that they tell about where and what "the border" is.

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[1] Gunnar Olsson, cited in Pickles, A history of spaces, p. 3. The quotation is from a presentation entitled 'On persuasion and power', to the Committee on Social Theory, University of Kentucky, 29 March 1991.

Chapter 2

UNDERSTANDING "THE BORDER"

"Land isn't divided except in our heads and on our maps." -Denis Wood

Wood's quote intends to show that the division of land is artificial, but it also admits that the division is *real*. The power of maps is that they can *create* divisions- districts, territories, even borders- through their propositions. Borders, as manufactured as they may be, do exist, and they have real impact on politics, economics, societies, and individual lives. And if the map creates the border, then understanding the border is simply a matter of deciding what the map says about it.

Border as Wall

The rise of the nation-state required that land (as well as the people living on the land) be discretely bound, organized, and controlled. This produced a modern capitalist space that, Lefebvre (1991) explains, is "abstracted and organized as decorporealized, bureaucratized, and commodified," (Sparke, 1998: 464). The international political and economic climate at the turn of the century, emphasized by World War I, further necessitated the participation of discrete nation-states.[2] State cartography (and the militant enforcement of that cartography) produced these bounded bodies and thus produced their borders. Rather, it could be said that it produced a *spectacle* of their borders. According to Casas-Cortes, et al., a border spectacle is a social relationship between people that is mediated by images (2014:12). Western state cartography

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[2] According to Benedict Anderson (1991), nations and nationalism are a response to modern political and economic situations.

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has produced a spectacle of the border as a wall, whose primary social function is to divide, contain, and distinguish. Deeply intertwined with this border spectacle is the "us" versus "them" mentality.

For example, on Aschmann's Map of North American English Dialects (Figure 2-1), dialect isoglosses curve throughout the North American continent, paying no heed to state boundaries. But the region labeled as "Spanish speaking area" distinctly follows the US-Mexico border, as though the border was a sound- and culture-proof wall. This map, produced by a linguist with a relatively progressive agenda, is not an active attempt to shape the border as a wall, but it is an example of how this understanding of the border has influenced modern thought. It is also an example of how maps can, even inadvertently, enforce this understanding by unquestioningly bounding fluid social and cultural phenomenon within discrete political borders.
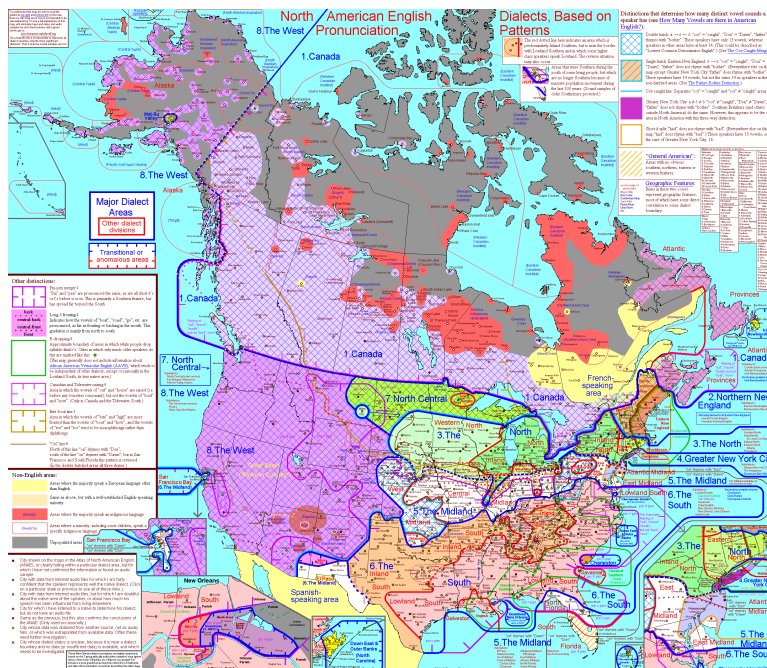
Figure 2-1. Aschmann, Rick. North American English Dialects, Based on Pronunciation Patterns. Last updated 2013.

While many critical geographers will push back on the idea of the border as a wall (citing things such as the trans-border flow of capital, people, culture, etc.), the fact that it is so frequently drawn as such is evidence that many people really do understand it that way. And this understanding influences more than just thought: it can actually change the physical landscape of a place. Along the US-Mexico border, for instance, the physical construction of barriers has turned an imaginary line into a physical reality. As part of their "Borderland" project, National Public Radio partnered with the Center for Investigative Reporting to generate a map of all the fences along the US-Mexico border (Figure 2-2). This graphic uses an abstraction of space (a map) to illustrate the on-the-ground impact of the border, determined by user-contributed data from OpenStreetMap.org. The invisible border, made visible by the physical fence, determines where people can travel, the goods and services they have access to, the schools they can attend, and the legal rights that they hold.

Figure 2-2. http://apps.npr.org/borderland/#_/23
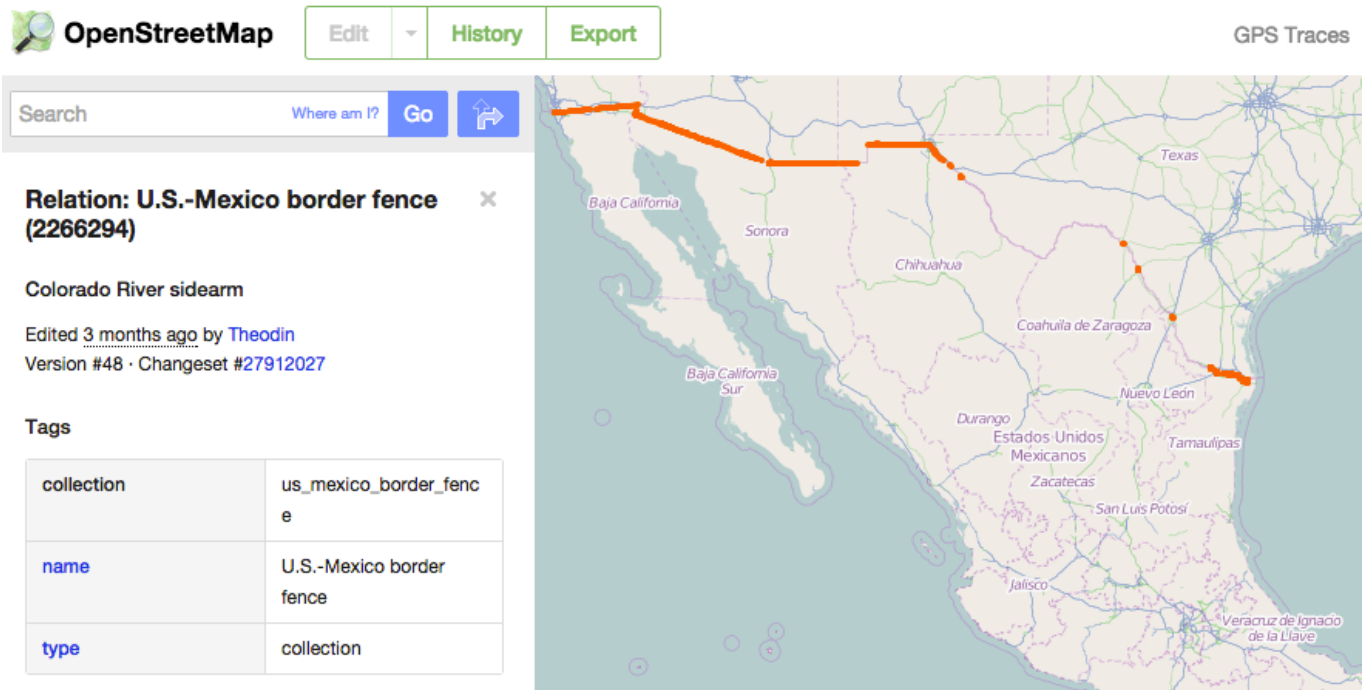
Figure 2-3. OpenStreetMap data on the US-Mexico border fence.

Bill Rankin has also mapped the physical impact of the US border, though his approach is less direct. His cartography titled "Thin White Line" (Figure 2-3) maps all of the roads on either side of the 49th parallel, which is the border between the US and Canada. At first glance, the image seems to be a chaotic cluster of thin gray lines. However on closer inspection, an absence of the tightly clustered gray lines creates a thin white line down the center of map. At exactly 49 degrees North, the white line is where the local roads on each side come to an end. Only a few major roads bridge the white gap, and even fewer are identified as legal border crossing stations. The illustration, though simple, effectively communicates one of the many tangible impacts of the border: the end of one local government's facilities and the beginning of another's. It also speaks to the control of movement across the border: geometry teaches us that a line is made up of infinite points, but only 54 of the points on this line are considered "legal" for intersecting.
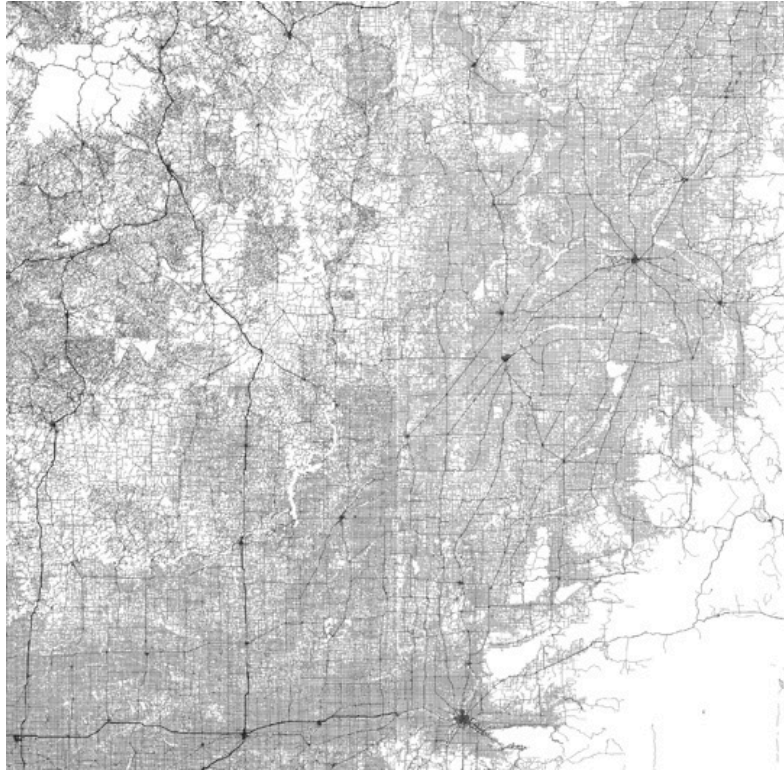
Figure 2-4. "Thin White Line" by Bill Rankin,
http://www.radicalcartography.net/index.html?49th

The idea of the border as a wall creates an image of the border, and thus the region it

bounds, as established and unquestionable. The previous two examples illustrate this point by

drawing attention to the physical, on-the-ground manifestations of the border: a gap in one case,

a fence in the other. But while the impacts of borders are real and undisputable, exact location of

borders are often disputed. International disputes such as that between India and Pakistan over

Kashmir are easy to point to, but other disputes are much subtler. In another of Bill Rankin's

projects called "The Midwests" (Figure 2-5), Rankin overlays 100 arguments about the boundary

of the Midwestern region of the United States. We speak of "the Midwest" as though it is a

discrete and obvious unit, but the cartography reveals that it is not as established or

unquestionable as we often assume regions to be. In the map's caption, Rankin concludes that

"The American Midwest has no obvious boundaries; it is, at best, a collection of ill-defined

ideals about landscape, labor, and culture that vaguely invoke the westward march of U.S. expansion in the nineteenth century." The historopolitical context of the region's boundary(ies) and it's sloppy sociocultural associations are two characteristics relevant to not only this border, but nearly all borders.
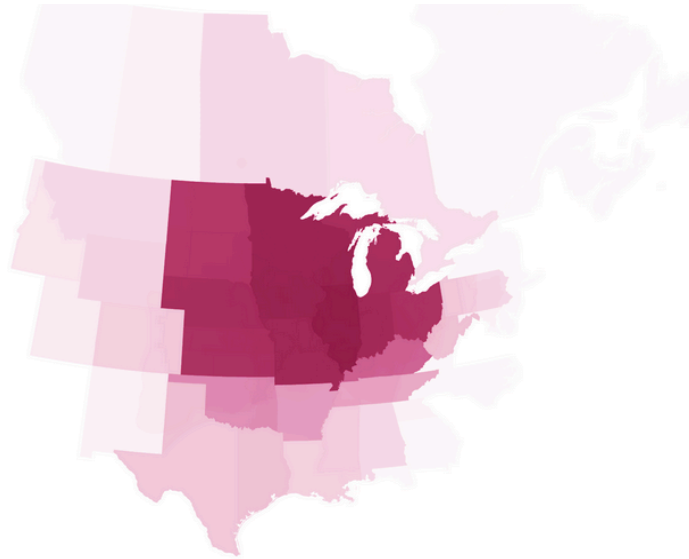
Figure 2-5. "The Midwests" by Bill Rankin, radicalcartography.net.

Border Regime

The border as a "wall" is an idea created by Western state cartography, but it is enforced by a variety of actors, processes, and discourses. As Casas-Cortes, et al. point out, state agencies and policies "seek to invoke the border as a stable, controllable and manageable tool of selective or differential inclusion," (2014:15). Of course, these agencies would not have this job to do if it weren't for the "forces and movements of migration that challenge, cross, and reshape the border," (15). The *New Keywords* authors have used the term "border regime" to describe the multiple actors and movements which construct the border as a "site of constant encounter, tension, conflict, and contestation," (15).

A regime is much harder to visualize than a wall, but that has not stopped some groups from trying. MigMap (short for Migration Map) is an online, interactive visualization produced

by an organization called Labor k3000 in collaboration with the Transit Migration project. It is a multilayered look at the complex processes, places, and actors involved in migration and the construction of the European border regime. According to transitmigration.org, MigMap does not "(re)produce territorial borders", but rather it "visualizes social space." This "social space" is where the conflict and negotiation of the border regime happen.

The MigMap project (Figure 2-6) includes four different visualizations: one maps out actors in migration, one maps out migration discourses, one maps out the phenomenon of Europeanization, and one maps out the places and processes of migration. The visualizations are not geographic maps of physical spaces, but rather each one maps out a component of the border regime which has constructed and enforced a divisive European border. The map of Europeanization, for example, looks like a subway transit map, but it is actually an interactive, multidimensional timeline of the meetings, conferences, papers, and processes that have constructed continental Europe as a discrete body. The map of Discourses looks like a topographic map, but it plots actors, campaigns, and terms and maps out migration discourses relative to non-Cartesian spaces (like neoliberal spaces and counter-hegemonic spaces). The map of Places and Practices quantifies spaces and institutions according to the things that they provide or require of migrants. The map contains personal stories embedded within it, introducing a hyperlocal component to the otherwise quantitative visualization.
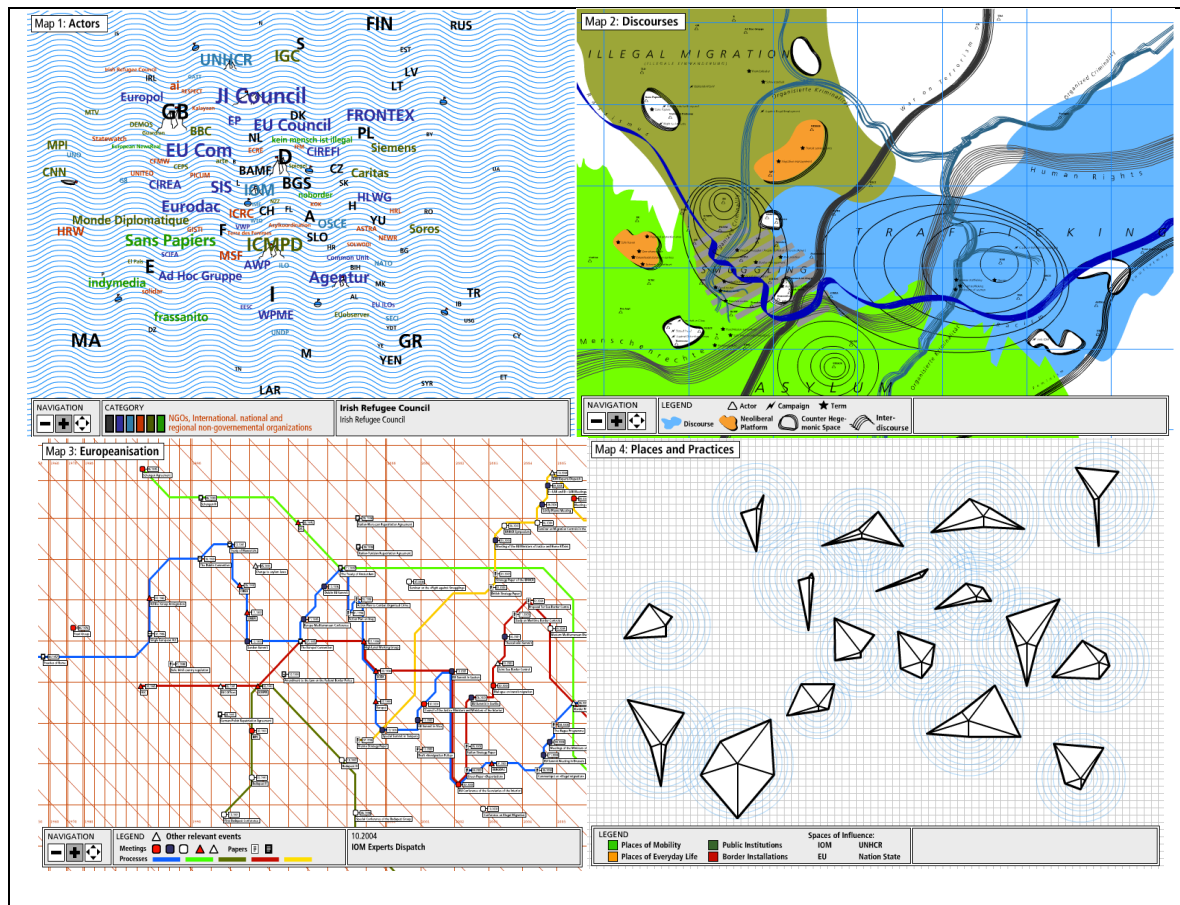
Figure 2-6. Screenshots from each of the 4 MigMap visualizations.

While MigMap visualizes the actors and processes *constructing* the European border, Transborder Map 2012 (Figure 2-7) maps out the people and forces working to *resist* this border. The map, produced by the noborder network, is a result of a transborder conference that took place in Istanbul in 2012. It aims to "document the multitude of actions against the European Border regime and includes key-incidents of struggles," (No Border Network, 2012). The map plots sites and actors of border resistance such as noborder camps, campaigns, local and international pro-migrant organizations, and migration routes. It also plots sites and actors of the border regime like detention centers, FRONTEX operations, and refoulements-expulsions of persons who have the right to be recognized as refugees. In resisting the border as a stable and

exclusionary force, Transborder Map 2012 actually creates a new image of the border (or lack of border). In fact, the pro-migration and anti-border forces displayed on the map should be considered a border regime of their own.
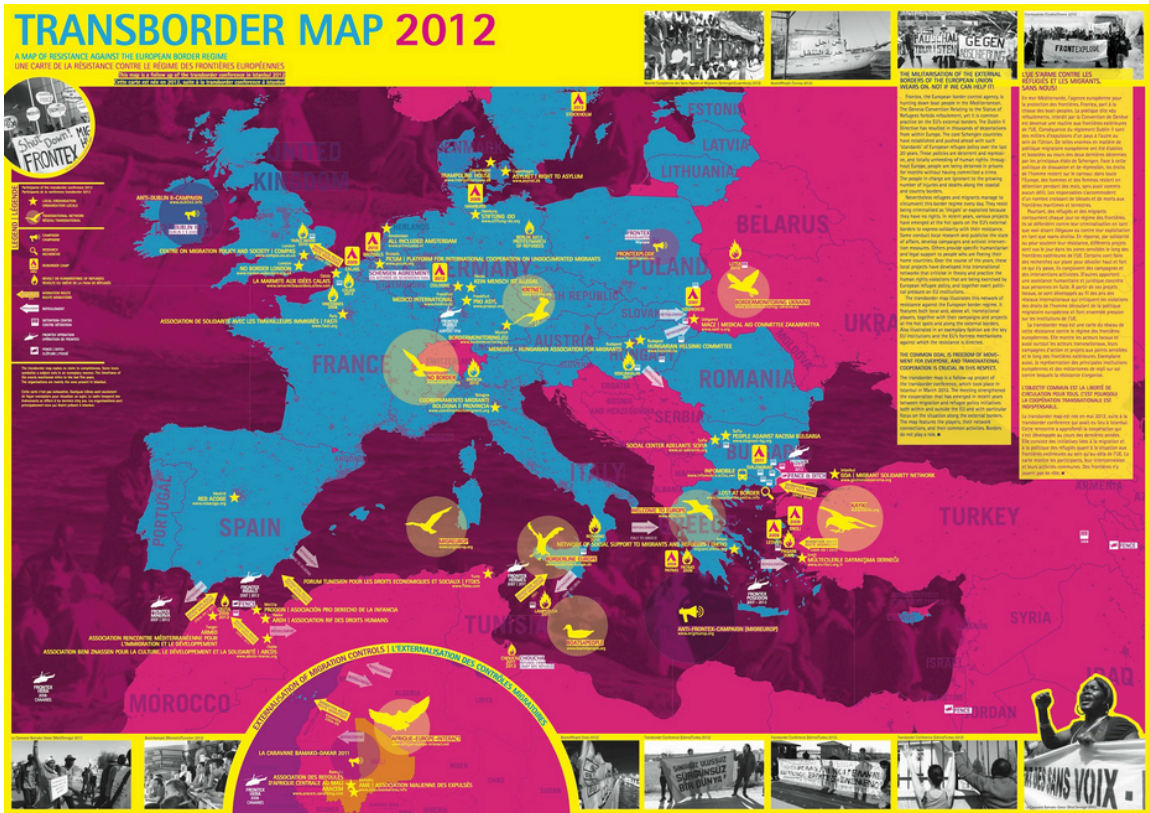
Figure 2-7. "Transborder Map 2012" by the noborder network, noborder.org.

No Border

Of course, while the "wall" might be a truth from some angles, it is a wild misunderstanding from other angles. Legally and illegally, people, cars, goods, capital, telecommunications, and music all traverse the border. Culture, language, and ideas mix and spread organically and abstractly, not according to any vector image on a political map.

Hakitectura is a group of critical architects, artists, and computer scientists who use cartography to create and redraw connected spaces. While the group engages with political issues across the globe, the majority of their work focuses on the militarized border between North Africa and Southern Europe. In a cartography called "Cartografía Crítica Del Estrecho De Gibraltar" (Figure 2-8), Hackitectura refutes the 'border as wall' philosophy and constructs a counter understanding of the border as a complicated, contested, and connected space.
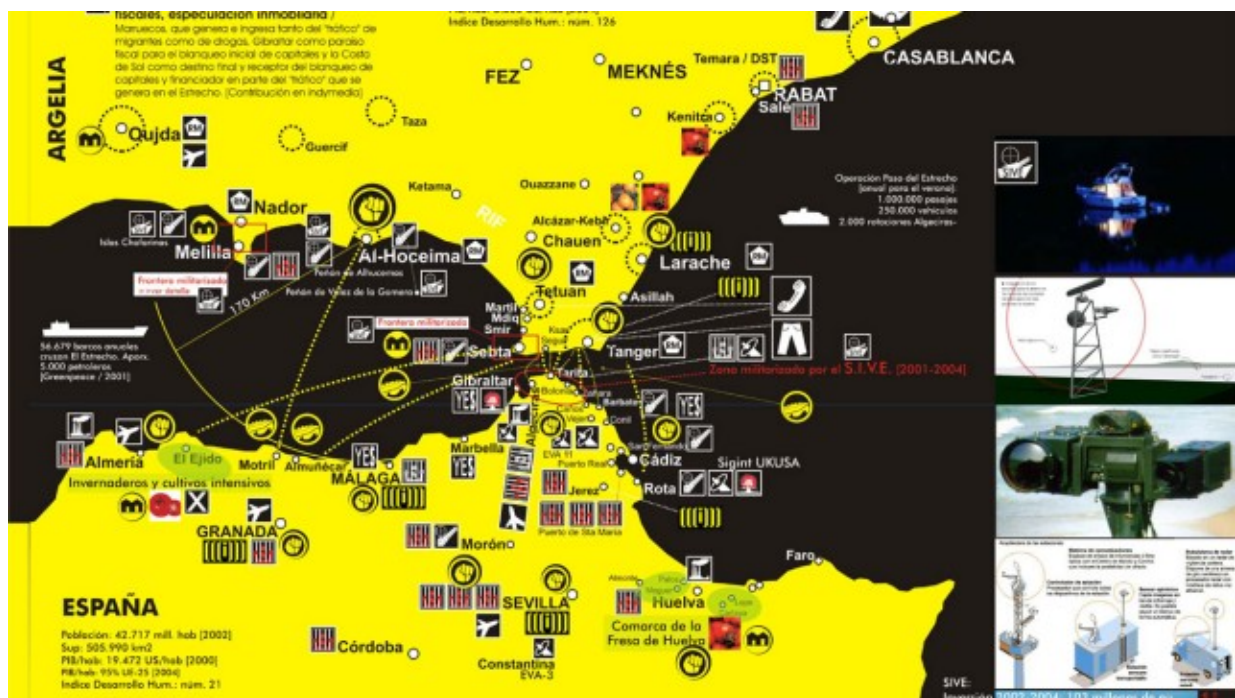
Figure 2-8. "Cartografía Crítica Del Estrecho De Gibraltar", hakitectura, hakitectura.net

Along the Straits of Gibraltar, the Spanish government draws the border as an impenetrable line on maps. But Hakitectura questions this impenetrability by mapping the paths of transborder communication and the globalization of capital and goods such as textiles. And just as the Spanish government enforces their interpretation of the border on-the-ground by controlling communication and flows across the border, Hakitectura enforces their own

conception of the border space with a project called "Indymedia Estrecho." Borrowing methods used by hacker community, the project used free technology to subvert the power structures that regulate communication (Hakitectura, 2003). This action opened new links and lines of cross-border communication and constructed a temporary space of connections.

Border Externalization

Accepting that migration and migration management are key factors in a border-producing regime helps provide an answer to the question of *what* a border is, but it complicates the question of *where* the border is. While the US image of migration management often looks like walls and guards patrolling a line in the desert sand, the European image is quite different. As Casas, et al. point out, European migration management has recently shifted its focus from borderlines to migratory routes: programs such as EU Neighborhood Policies and the Migration Routes Initiative (under the framework of Global Approach to Migration) have essentially externalized migration management practices (2011:71-90). The *New Keywords* authors have included "border externalization" as an important term for modern border studies and have defined it as "the process of territorial and administrative expansion of a given state's migration and border policy to third countries," (19).

The Interactive Map on Migration (Figure 2-9), or "i-Map", is an online interactive map produced by European border management agencies ICMPD, Europol, and Frontex. According to it's website, i-Map supports intergovernmental dialogues on migration by facilitating access to and exchange of information through visualizations and news. The project was developed as a way to educate policy makers and enforcement agencies about transit routes and points (Casas-Cortes, Cobarrubias, and Pickles, "Riding Routes and Itinerant Borders"). The map recognizes

migration routes that span thousands of miles across multiple countries, and the project has

refocused migration management efforts on these flows and networks rather than static lines.

Figure 2-9. Screenshot from "The Interactive Map on Migration" by ICMPD, imap-migration.org.

As Casas-Cortes, Cobarrubias, and Pickles point out, "border externalization refers to a

fundamental change in the scales and operations of border institutions," ("Riding Routes and

Itinerant Borders": 1). The state practice of externalization, which claims the right to exert

influence and control along migratory routes regardless of sovereign territorial limits, is actually

extending and *altering* sovereignties (27). The externalization of migration management forces

us to confront a type of sovereignty that is "not limited to the control of a closed territory (the

Westphalian state model), but rather is concerned with the flows happening beyond territorial

boundaries," (Casas-Cortes, Cobarrubias, and Pickles, "Good Neighbours Make Good Fences": 2).

Just as the control of migration (and thus the enforcement of borders) is not exclusive to the thin line of the political map's borders, neither is the effect of this control and enforcement. "Dying at the Gates of Europe" (Figure 2-10), though basic in design, shows the geographic expanse of the precarious impact of transborder migration. Drawn in 2003 by Olivier Clochard of the Migrinter Insititute at the University of Poitiers, the map has been updated and published for a segment about Europe's war on immigration by Le Monde Diplomatique, an independent international paper known for its critical vision (Rekacewicz, 2013). The hand-drawn map outlines the Schengen Area border in dark red, while the dots representing internment camps and migrant camps are scattered both within and outside of the delineated area. Graduated circles representing border-related deaths are located both on the Schengen border as well as within the region. The death and detainment depicted on the map is found across the entire continent, not just along the dark red line.
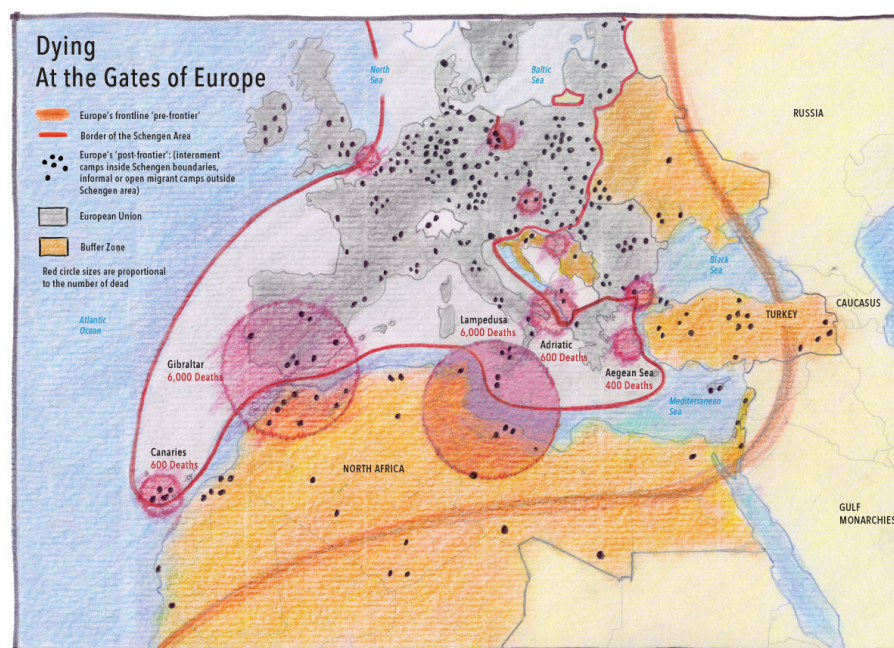

Figure 2-10. "Dying At the Gates of Europe" from *Le Monde Diplomatique*.

Border externalization "changes the understanding of borders by reworking who, where, and how the border is practiced," (Casas-Cortes, et al. *New Keywords* 19). I would add that it also changes how it is *experienced*. While the border of "Fortress Europe" is socially and culturally understood as a wall, border management practices reveal that the border is increasingly being treated as a complex network of routes, and that the impact of the border extends far beyond territorial boundaries.

Border as Experienced/Performed

While counter mapping tends to replace or supplement the authority of the map, map art attempts to dissolve the authority of the map all together. As Denis Wood explains, map art "takes the statements, the assertions, the this-is-heres and the that-is-theres of the maps and says…really? Are you sure?" (Wood, Fels, and Krygier, 2010: 270).

The Institute for Infinitely Small Things is an interdisciplinary group of artists and activists that "conducts creative, participatory research that aims to temporarily transform public spaces and instigate dialogue about democracy, spatial justice and everyday life," (Institute for Infinitely Small Things). They implement projects ranging from performance art to counter cartography. One project called "Erase the Border" (Figure 2-11) is particularly relevant to this study, as it questions the legitimacy of the US-Mexico border as it divides historic Tohono O'odham tribal lands. Through a digital platform, the project unifies each side of the border with videos, photos, maps, and the voices of the Tohono O'odham people. "The Border Crossed Us" (Figure 2-12) is an extension of this project in the form of a public art installation at the UMass Amherst campus. The project installed a to-scale photographic replica of the fence that cuts

through Tohono O'odham land along the North-South boundary of the campus. Present for two weeks, the divider separated the two sides of campus and allowed passerbys to experience what it is like to have your community divided.
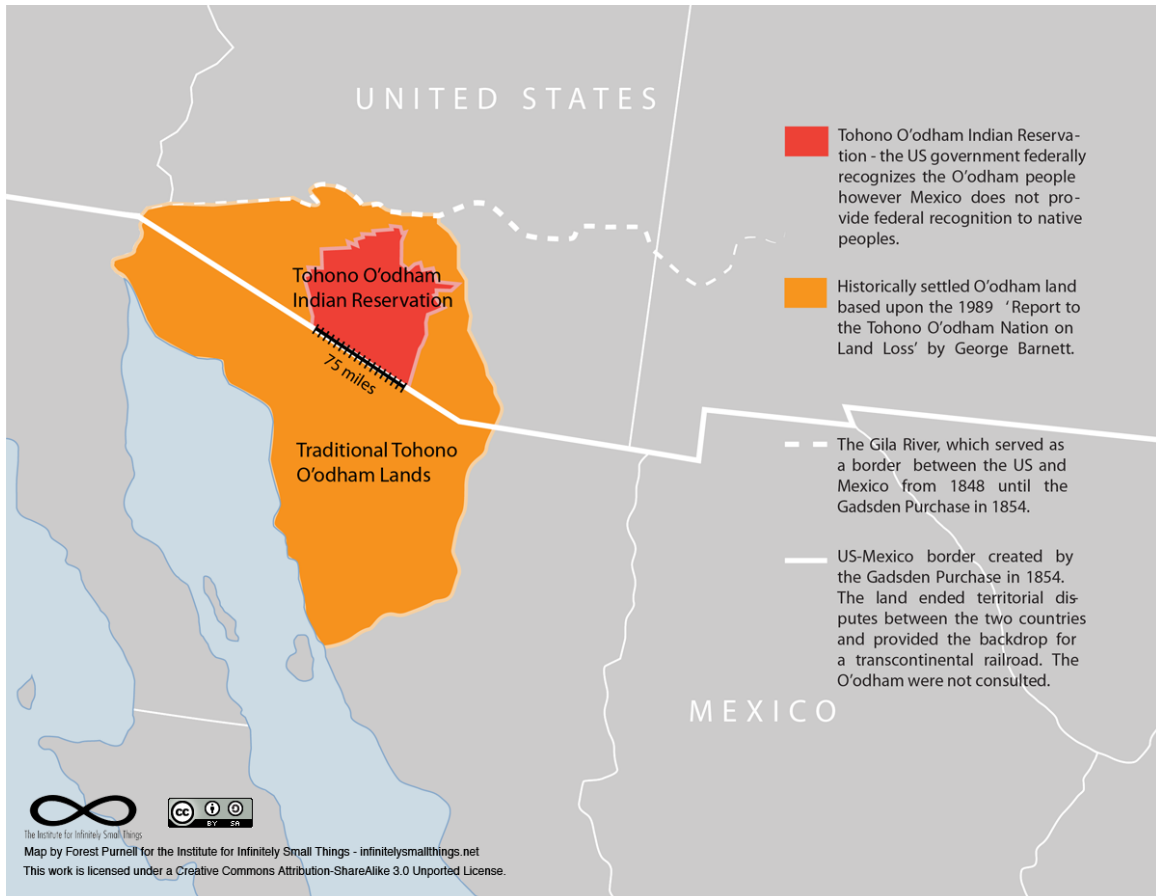
Figure 2-11. Map component of "Erase the Border" by The Institute for Infinitely Small Things, from erasetheborder.com.

Figure 2-12. Photo of "The Border Crossed Us" art installation at UMass Amherst by The Institute for Infinitely Small Things. For a timelapse of the whole project, see The Border Crossed Us on vimeo.

Susan Page is an independent artist working on a project about the spaces and objects associated with migration across the US-Mexico border. "The US-Mexico Border Project" (see Figure 2-13) is a collection of photographs that document the mundane (yet personal and important) objects that are left behind as humans cross the border. The objects- which include toothbrushes, toys, socks, and water jugs- are photographed exactly as they are found, and they tell a story about the border as it relates to the act of migration and the people who attempt it. For Page, the border ceases to be a line or even a region, but rather it is a *site* of action and experience.

Figure 2-13. Image by Susan Page as part of "The US-Mexico Border Project."

Pedro Lasch is an artist who also works to tell a story about the border through migration experiences, but he takes a different approach than Page. For his project, "Latino/a America" (see Figure 2-14), Lasch provided prints of North and South America to people as they moved and traveled across the US-Mexico border. The prints were returned with rips, folds, dirt, and water stains, and are displayed as physical memoirs of the voyage between the two countries. The project does not attempt to draw or define the border; it focuses on the movement experiences of those who cross it. In some ways, "crossing" the border creates a line by acknowledging that it was traversed. On the other hand, the movement of people from place to place shows the openness and connections between the places, thus denying the border.

Vicencio Marquez (México) cruzó 7 veces...nos escondimos en una como laguna de aguas negras...llegaron los helicópteros, nos apuntaron con las armas y nos sentaron bajo la lluvia...el rico puede ser rico porque se cansó de ser pobre...

Vicencio Marquez (Mexico) crossed 7 times...we hid in something like a lagoon of sewage...the helicopters arrived and they pointed their weapons at us...the rich can be rich because they got tired of being poor...

Figure 2-14. *Route Guide - Mexico/NY - Vicencio Marquez (Guia de Ruta - México/NY - Vicencio Marquez), 2003-2006.* Part of a gallery showing of "Latino/a America" by Pedro Lasch.

Conclusion

At the beginning of this chapter, I oversimplified by claiming, "understanding the border is simply a matter of deciding what the map says about it." While it is true that the way we understand borders is influenced by the way borders are visualized, it is also true that the way we visualize borders is influenced by the way we understand them. Maps create borders, but humans create maps and humans are products of their contexts.

For nearly two centuries, we have let "conventional cartography" define borders for us. But "conventional cartography" was created at a particular time with a particular purpose: to bound and organize territory for control by rising nation-states. Nowadays, our politics, economies, and societies are globalized, demanding that modern discourses be filled with diversities, multiplicities, movement, and evolution. This also demands a new type of mapping!

Casas-Cortes and Cobarrubias illustrate that mapping is not simply a tool for explaining borders, but that is actually a useful and necessary tool for "understanding and navigating" them (2007: 65). Many border-minded groups and organizations are doing exactly that. Car-Tac Collective, for example, explains that their purpose is "to organize oneself, to generate new connections and to be able to transform the material and immaterial conditions in which we find ourselves immersed," (qtd. in Casas-Cortes and Cobarrubias 2007:64). In other words, this movement (like many others) recognizes that a border is more than a line, and they try to map it to make sense of it.

Hakitectura, too, views cartography in a similar exploratory way: "as not knowing, as permanent research, as a survey of the composition of the social and the interstices of reality […], a survey of social processes in conflict," (Monsell and Perez de Lama 2006). The Interactive Map on Migration is another example of this cartographic exploration being done. By

mapping international migration routes, i-Map revealed fluid and networked challenges to Fortress Europe, impacting the EU's approach to migration management and, therefore, impacting the border.

The border is not a stable, static line, and this, Transit Migration explains, "necessitates the development of a new, adequate, dynamic method of description and representation," (Transit Migration, 2004). MigMap tackles this challenge using technology to represent the dynamic and multi-layered components of the border regime. NPR's Borderland project also attempts to use technology as a way to synthesize several border perspectives into a single multi-media composition.

The attempt to synthesize multiple border spectacles is a significant one. As the *New Keywords* authors emphasize, it is the various forms of the border, their spectacles, and their unique representations which give rise to the public image of the border (14). Each of the visualizations mentioned above produces a new understanding of the border, how it functions, and what its effects are. Yet I am less interested in what each story is and more interested in the fact that multiple interpretations can, and do, exist. Rather than posing different understandings of the border as contradictory, a lot can be gained by placing them in conversation with one another. While each representation has faults and limitations, taken together they can provide a fuller and deeper understanding of the border phenomenon.

Chapter 3

REPRESENTING "THE BORDER" WITH NEW VISUALIZATION TECHNOLOGIES

An Introduction to Digital Geovisualization

In *Rethinking The Power of Maps*, Denis draws on Saussurian semiotics, to argue that mapping is a semiotic practice of meaning-making. In this sense, the map is coded with a wide range of signifiers and meanings. At the heart of this complex array of signifiers is "the border". In early modern cartography, the border often signified the division of two parcels of state or private property, and it's signifier was a well-defined ink line on parchment. In contemporary cartographies this original *signified* concept of "the border" is being challenged and rediscovered as more complex and often contradictory. This new, more complex meaning demands a new, more complex method of representation- a new "signifier."

In parallel with the rise of more fluid mapping practices has been the rise of digital technologies, which provide opportunities to embed complex and dynamic qualities into representations of space. In 2005, the International Cartographic Association (ICA) established a Commission on Geovisualization, to focus on "use of interactive maps and cartographic techniques to support visual analysis of complex, voluminous and heterogeneous information," (ICA 2014). "Geovisualization" is simply a term used for the visualization of geospatial data and information. In particular, the ICA is concerned with the *display* of the "complex structure" of spatial data- which includes space, time, and thematic attributes- as well as the *exploration* of the relationships between these complex components. The ICA believes that geovisualization is important for knowledge building and theory generation as well as decision support, information communication, education, and learning.

The ICA is concerned with all realms of geographic study, but I believe that border studies can especially benefit from exploration and analysis through geovisualization. Drawing from this ICA's priorities of representing and exploring the complex spatial and temporal elements of geographic data, this chapter focuses on some emerging digital visualization practices that help reframe our understanding of "the border." Specifically, this chapter addresses the following questions: How can digital technologies surpass the static map's ability to display temporally and spatially complex borders? How can digital technologies surpass the static map's ability to explore relationships between the spatial and temporal components of borders? This chapter also problematizes the ICA's assumption that the spatial component of geographic data is necessarily Cartesian, and it will explore ways to visualize non-Cartesian understandings of "the border." I address each question with an example of my own implementation of a digital technology, followed by a critical analysis of what each technique offers and lacks.

Mapping Temporally Dynamic Borders

Borders are dynamic, evolving, impermanent, and disputed. But maps, like history, tend to be written by the victors, further ensuring that the border narrative we often read appears static. The historical evolution of borders is frequently ignored or forgotten in our representations of them, because, as Andrienko, et al. (2010) point out, "the methods used in static maps are limited to small amounts of data and few time units." But digital maps, unlike paper maps, have the advantage that they can convey the dynamic history of borders using interactivity and animation.

Figure 3-1. US-Mexico Border History 1 (http://ellencurrin.github.io/us-border-history-1/)

Figure 3-1 is an example I created to show the evolution of the border between the United States and Mexico using map animation. It slides from frame to frame automatically, much like the .gif animations that are popular around the social Internet, to provide a visual timeline of the border. At the moment, the animated map stands alone, but I can conceive it as an informative basemap layered under any variety of demographic or economic data. Doing so might help blur the line between "us" and "them" and challenge national stereotypes by recognizing historical overlap.

While animated maps make the *presence of change* quite clear, research suggests that they may not actually help the user grasp the *individual changes* that are occurring (Slocum et al., 2004). Tests conducted by the Commission on Geovisualization revealed that users tested on static map displays seemed more focused on 'states' and 'spatial patterns' rather than *events* and temporal *processes*,"(Andrienko et al., 2010). Tufte (1997) recommends the implementation of "small multiples"-i.e. multiple static frames side by side- to communicate changes to a user.

With this in mind, I created a new version of the visualization (Figure 3-2). This updated

visualization relies on a manual slider so that users can click through the visualization at her/his

own pace. Like the animated version, this manual slider could be adopted as basemap for other

spatial information, but it would require more effort and interest on the part of the user.

Figure 3-2. US-Mexico Border History 2 (http://ellencurrin.github.io/us-border-history-2/)

Mapping Spatially Concurrent Borders

Mapping the history of a border forces us to recognize that multiple "borders" can and

have existed in a single space at different moments in time. Perhaps a greater challenge is

mapping multiple, interrelated borders in a single space at the same moment in time. Static maps

are forced by their nature to show everything at once or not show it at all, thus the relationship

between concentric and overlapping geographies can easily be overlook or confused on a

crowded static map. On static maps, conflicting and intersecting borders are often omitted or

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differentiated from one another by line width or color.

Interactive digital maps, however, allow us to display more and more complex geographies. One particularly complex border geography is that of the overlapping jurisdictions that make up the various political units of the British Isles. Using the digital tools at my disposal, I attempted to visualize the multiple and interrelated geographies that make up (and are made up by) the United Kingdom (Figure 3-3). This task, of course, assumes that borders *do* concretely exist and they *can* be drawn with relative accuracy, thus I was required to adopt this assumption, at least temporarily.
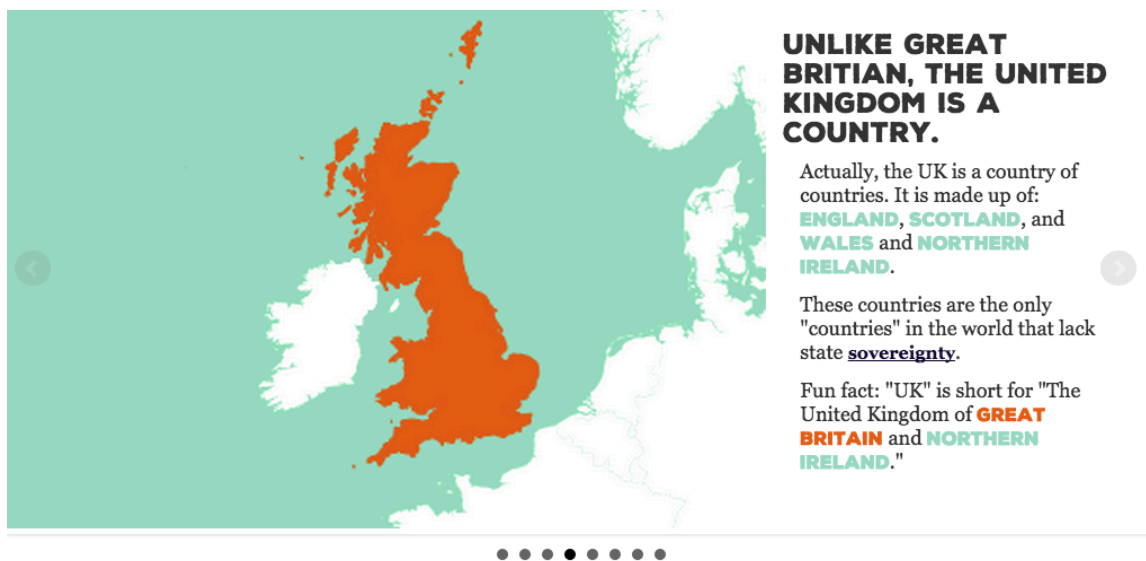

Figure 3-3. British Geographies (http://ellencurrin.github.io/ukgeog)

As a potential solution to this problem, I built an interactive digital slider. As a user clicks through the slider, s/he is consecutively exposed to cartographies of related geobodies such as the United Kingdom, the British Isles, Great Britain, and England. The user can interact with each slide by hovering over maps and text to reveal more information or additional images for comparison. Unlike a static map, the slider allows users to view each geobody individually, consecutively, and concurrently. This establishes an understanding of each geobody as a separate

entity as well as establish an understanding of its relationship to the other sovereign bodies in question. The goal is to show the user how multiple geobodies (each with different sovereignty claims) can and do exist in the same place.

This visualization, like the historical border visualization, assumes that we know enough about what and where a border is to draw it on a map. This assumption, of course, is a particular border perspective in itself. But I believe that the interactive slider visualization method can be used to represent multiple different perspectives, not just multiple borders derived from the same perspective.

Exploring and Creating New Border Landscapes

Interactive digital maps allow cartographers to communicate more, and more complex, stories than static maps, but ultimately the map (and thus the user of the map) is subject to the same constraints. Digital technology, however, provides an opportunity for users to tailor maps to their own values and perspectives. As the ICA points out, the exploration of data is an important objective of geovisualization (ICA 2014).
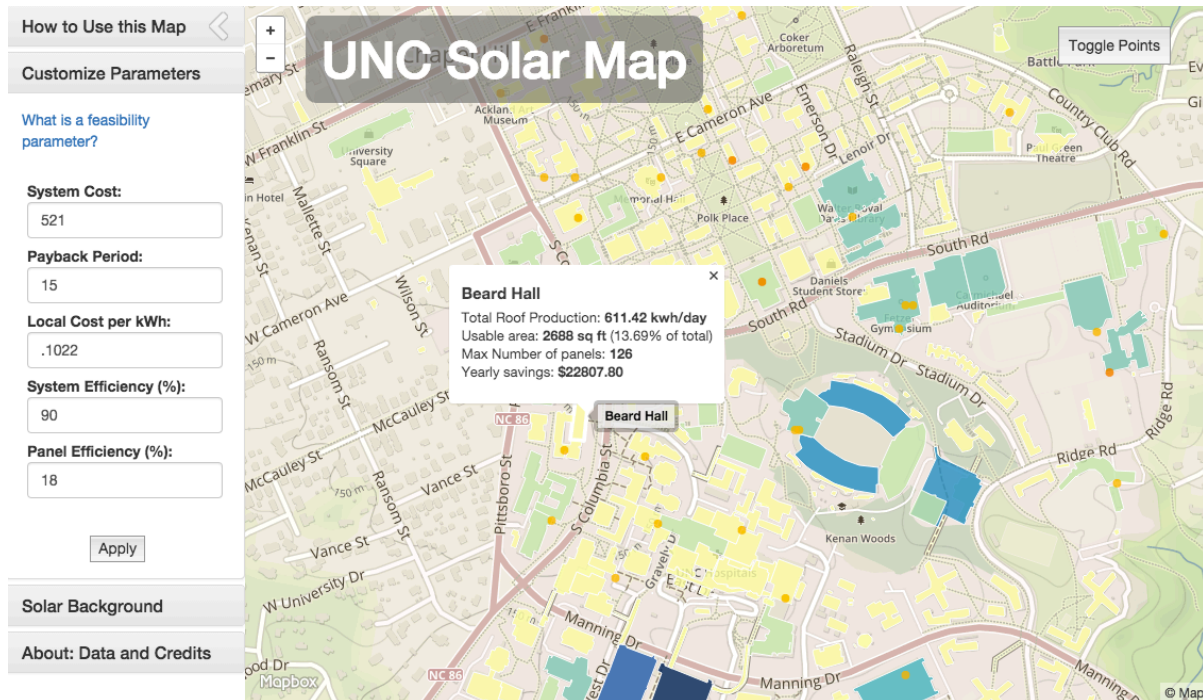
Figure 3-4. UNC Solar Dashboard (http://ellencurrin.github.io/UNCsolarMap/)

My project "UNC Solar Map" (Figure 3-4) is an example of a user-customizable map. The map, created with the purpose of helping decision-makers identify feasible sites for PV solar panel installation, lets users customize the cost and budget details that factor into the suitability calculation. Suitable solar panel installation sites then appear and disappear on the map based on the user's custom feasibility parameters. While the UNC Solar Map project itself is not directly related to borders, the project's customizable technology could be adopted in a new border project. This project would allow users to define their own "border requirements" to create their own political maps. Users could draw and dissolve conventionally accepted international political borders based on custom criteria such as flow quantities of capital or people, or political or economic influence.

This project does not entirely circumvent the perspective of the cartographer, as the parameter options s/he provides could never encompass the every desire of every user.

Additionally, this project would be dependent on the conventional cartography that it would be built upon. Finally, while the project recognizes that what constitutes a border can vary by perspective, it provides no room for non-linear, non-Cartesian understandings of the border.

Open sourced mapping platforms such as Open Street Maps take the 'customizable map' one step further by letting users not just customize, but actually create their own maps. Open Street Maps, for example, shifts power to the people by letting them define and describe their own surroundings instead of letting The State dictate what is/isn't, exists/doesn't exist. Yet even crowd sourced maps like Open Street Maps cannot evade the influence of Western state cartography. In fact, assuming that the majority of the users have grown up saturated with Western cartographic conventions, it is likely that these conventions will simply be replicated in users' own cartographies.

Mapping the Performed Border

On their website, the ICA Commission on Geovisualization proclaims that "the visualization of spatial data requires the use of maps or 3D displays where at least two display dimensions are utilized to represent the physical space." But this statement reveals the critical assumption that the spatial attributes of geographic data necessarily exist within a Cartesian coordinate system. This assumption is unsurprising because GIS conventionally conceptualizes space as 'absolute', Euclidean, or Cartesian space wherein objects are clearly defined and exist at precise locations and scales. (Pavlovskaya, 2009:25). Yet while it is unsurprising, this assumption is limiting. In critical geography, understanding social processes requires an understanding of 'relational' space (Harvey, 2006; Massey, 1985), because aspects like experience, power, and certain properties of place lack Euclidean measurements. According to

Marianna Pavlovskaya, Understanding these aspects of space requires qualitative modes of explanation prominent in Marxian, feminist, post-structural, and postcolonial approaches," (25).

Artists Susan Page and Pedro Lash, recognizing the importance of relational space and human experience, take a performative approach to understanding the border. Both artists use smaller-scale and personalized methods of collecting and documenting the lived experiences of "the border" which make up "the border" itself. With this in mind, I asked whether it might be possible to scale-up this performative border mapping by integrating data from social media. The rise and spread of social media allows us to collect massive amounts of similar data, but in digital form. Using social media data gathered through Twitter and Instagram, I built a digital project to explore the US-Mexico border through people's publicly and digitally documented experiences (Figures 3-5 and 3-6).
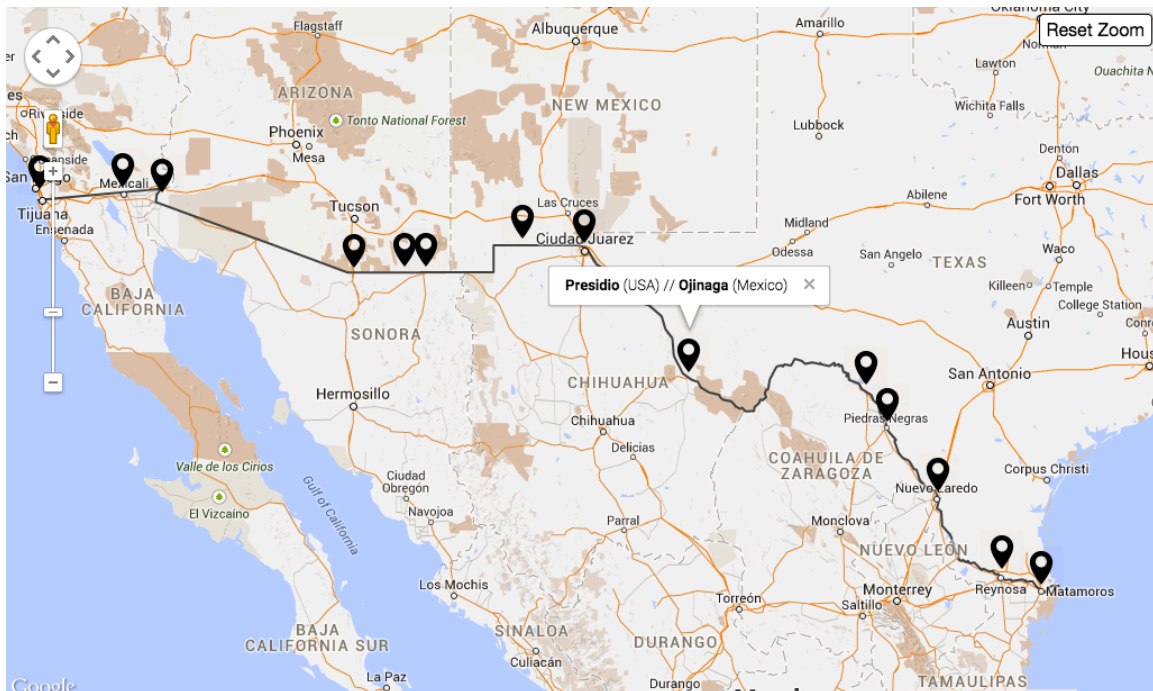

Figure 3-5. Twin Cities Border Exploration (map at full extent)
(http://ellencurrin.github.io/twincities)

Specifically, the project aims to explore the effect of the border on the lives of people in the "twin cities"- the 14 cities that are split into 28 municipalities by the international border between the United States and Mexico. The project gathers free and public Twitter and Instagram data using something called an Application Programming Interface (API), which allow independent programmers to capture, process, and display real-time social data from users. The project includes a map (built with the Google Maps API) where users can click on any one of the 14 twin cities to compare Instagram and Twitter content from both sides of the border. The project offers a dynamic picture of the lived border as a way to understand the border's impact on *space* as well as the people that inhabit and pass through that space: Is each twin city really a singular place, two separate places, or a singular place viewed through two separate lenses?
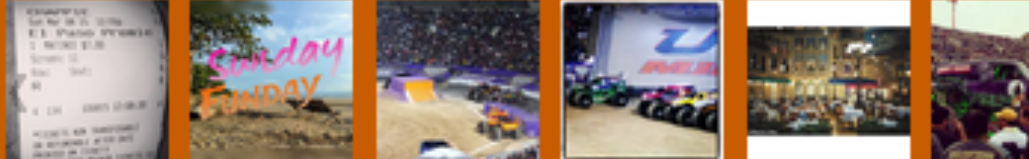
The Google Maps API allows me to present the users with two perspectives of the region. First, at it's most zoomed-out extent (Figure 3-5), the map consists graphically abstracted base map with a thickly drawn international border. I made the choice of presenting a familiar, border-inclusive image of the region to help users orient themselves within it. But as the user selects a twin city to explore, the map zooms into a satellite image of the area and the thick, graphical indicator of the border disappears (Figure 3-6). Rather, the satellite image displays what often appears to be a singular urban center. The direct opposition of these two images of the region- one divided, one unified-forces the user to confront what they assume to be true about "the border."
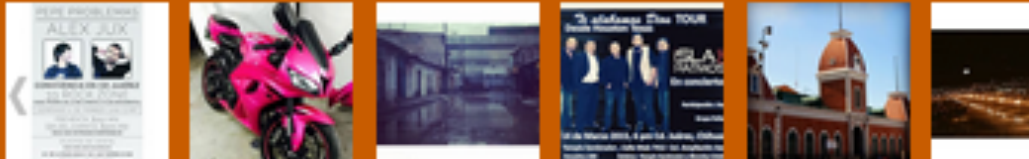
Figure 3-6. Twin Cities Border Exploration (snapshot of page after map is clicked)
(http://ellencurrin.com/twincities/)

Though the Twin Cities project aims to blur a clearly-defined political border using social data, it is limited by its dependence on a conventional political map to navigate the data. Even the satellite image of the region, offered as an alternative to the graphical maps that draw borders as natural and obvious landmarks, has its own perspective and bias. Satellite images, like all photographs, are taken from an allocentric point of view. As McKinnon (2011) points out in her essay on recent cartographic practices in the social sciences, this is linked to Haraway's critique of "the god-trick of seeing everything from nowhere," (Haraway, 1988: 678). Furthermore, the project differentiates the two "sides" of each twin city by the location of the political border, rather than letting the social data determine if/where the border exists.

By incorporating qualitative, ethnographic data into a Cartesian display, the Twin Cities project takes a "mixed method" approach common in the field of critical human cartography. According to Pavolvskaya, mixing methods makes relational spaces of experience and power visible, and thus "theoretically and politically" significant (28). It also reveals inconsistences in partial knowledges and opens up research opportunities about "social power configurations," (29). The mixed method approach enjoys some success by bringing much-needed qualitative consideration to the overwhelming quantitative field of GIS, but it does very little to challenge and change the Cartesian notions of space which have been shaped by Cartography for centuries. Rather, when relational geographies are mapped with Cartesian coordinates, Euclidean distances dominate our visual interpretations of the phenomenon and we are forced to (re)think of relations in Cartesian terms.

Mapping Non-Cartesian Borders

I was first introduced to the rapidly changing role of technology in shaping how we

understand Geography through the Digital Humanities, a discipline that borrows methods from the humanities to analyze digital and digitized materials using computing tools. My specific experience with Digital Humanities involved digitizing, coding, and archiving oral histories about the intersection of religion and place. The digital component of the project made the oral histories easier to search, sort, and compare, and it also allowed us to plot the oral histories using a "mixed method" approach.

While our attempts to visualize the relationships between religion and space within and across the oral histories provided an extra dimension of analysis, it also posed many challenges. First, as the ICA explains, when two dimensions are utilized to represent physical space, this "restricts the possibilities for the representation of the temporal and thematic components of the data," (ICA 2014). Secondly, and most importantly, the resulting mixed method visualization did very little to enhance the data. The map we produced illustrated where in *Cartesian* space each recorded event occurred, but drawing on feminist and performative theories of space, the geolocation of each event turned out to be far less important than the relational spaces wherein they occurred. Additionally, our visualization suffered from the same dominance of Euclidean relationships that most all mixed method maps suffer from. With a budding interest in information visualization, I was inspired to take on the challenge of visualizing the project's non-Cartesian geographies.

My endeavor resulted in a responsive network map that aimed to synthesize the prevalence of each space within the oral histories as well as the relative relations between each space (Figure 3-7). Built using Google Fusion Tables- a free technology available to anyone with a Google account- the network map was an easy feat to accomplish and one replicable by most any interested person.
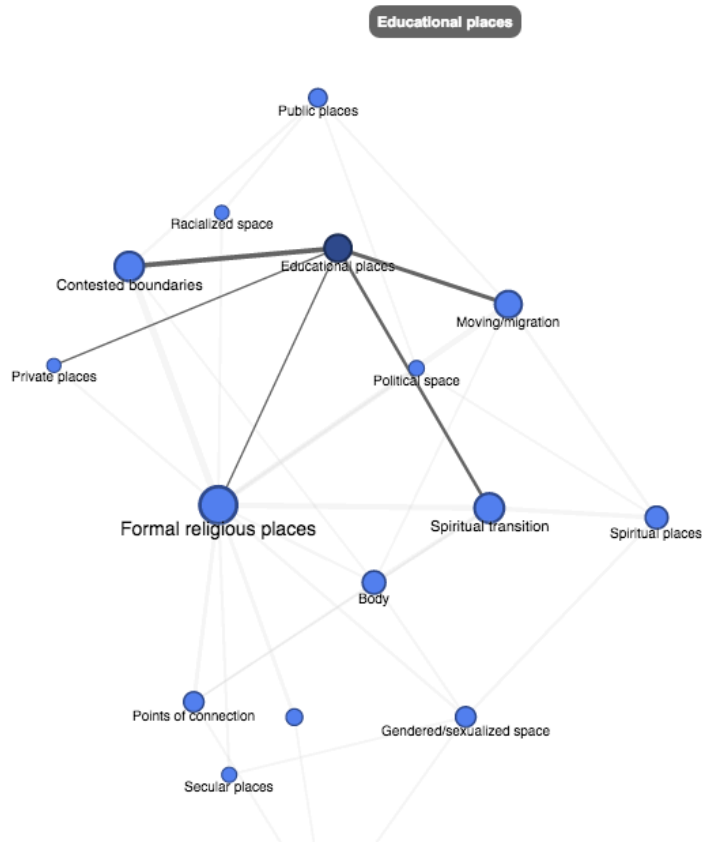
Figure 3-7. Non-Cartesian Geographies of Religion (https://inls541.web.unc.edu/network-map/)

Mapping oral histories about religion might seem unrelated to the present question of borders, but it is not. Borders, like people's experiences with religion, are not necessarily *primarily* Cartesian. In other words, borders aren't as solid as we once thought they were. The ability to organize information and data in new configurations- unbounded by Cartesian conventions- opens up opportunities to find new patterns. Additionally, unlike Cartesian maps, non-Cartesian maps never pretend to be mirror representations of the real physical world. Non-Cartesian maps can be a way of breaking the habit of assuming that borders exist on the ground exactly the way they exist on paper.

Of course, we are socially conditioned to expect maps to look a certain way (i.e. Cartesian), thus it might be difficult for many people to accept a non-Cartesian representation of

a border as an "accurate" representation. Non-Cartesian maps might rather be accepted as supplements to, but not replacements for, Cartesian representations. Non-Cartesian maps still require us to categorize and theoretically bound phenomenon and ideas, even if they do not require us to bound them spatially. Thus they do not entirely free our representations of borders from and subjective decisions, assumptions, and exclusions.

Conclusion

Technology is not required to visualize non-Cartesian representations of space. In fact, a static network map of actors and institutions might be much more informative of a border regime than a complex, interactive Cartesian cartography. But technology allows us to communicate more, and more complex data more simply, and non-Cartesian data is no exception to this. The digital inclusion of multi-media evidence of experience and performance can help us generate new understandings of "the border," and technology can help us collect large amounts of this evidence using social media. Technology also makes the exploration of information more widely available to interested persons. Democratizing geospatial data and analysis is not only right, but it is important because we, the people, are ultimately the ones both creating and being impacted by the "geo-spaces" in question.

Conclusion

SO THEN, WHAT *IS* "THE BORDER"?

The conventional understanding of "the border" has been shaped by Western state cartography over the past several centuries. The rise of modern cartography and the development of the bounded nation-state are so closely intertwined, it is hard to say which phenomenon is more responsible for the other. Maps are powerful because they posture themselves as "representative" even though they are actually "productive." Using nothing but a thin ink line on paper, maps can, and have, invented borders that change lives and landscapes. Historically, maps have used their power to create and enforce a certain capitalist and state-ist perspective of the border as something that bounds land into fixed and ownable parcels. But cartography can also be used to present and produce new configurations of space and power, including the spaces and power of borders.

New critical geographic studies of borders and migration are rethinking the dominant understanding of "the border" and what it means for flows of capital, ideas, and human lives. Western state cartography has framed "the border" as a wall, and although many critical geographers reject this interpretation, this understanding has produced a border spectacle with real physical impact on a place. Sometimes this impact is quite obvious, such as the installation of a fence, and other times it is less noticeable, such as the dead-end of a local road. Understanding "the border" as a "border regime" recognizes the actors, processes, and discourses that construct what looks like and acts as a "wall." These regime components include human migration, institutions of migration management, and sites and actors of conflict and resistance.

An understanding of "the border" as a product of migration and migration management opens up new possibilities for the geographic location of the border.

The externalization of border management practices and the decentralized impacts of those practices further modifies where we can claim "the border" physically exists. While the border can act as a wall of regulation and exclusion, some groups such as Hakitectura focus on the flows of capital, ideas, and culture that connect the spaces that others consider "divided" by "the border." The most progressive understanding of "the border" addressed in this paper accepts the border as a phenomenon composed of performance and experience.

All of these new, multifaceted understandings of the border demand a new method of representation, and digital technology provides a modern and growing toolset with which to explore and visualize "the border." Interactive maps support the visualization of complex spatial and temporal components such as movement through space and time. Meanwhile dynamic maps allow users to explore and define landscapes via customization. But geographic visualizations in the digital age tend to look a lot like interactive versions of a static paper map, and they are equally as dependent on a Cartesian representation of space. Progressive understandings of "the border" as places of process and performance are not concerned with synthesizing a multitude of complex factors within a Cartesian space, but rather are concerned with transcending the Cartesian space all together. Limiting the visualization of these progressive viewpoints to a Cartesian map ultimately limits the viewpoints all together. These perspectives, therefore, demand methods of visualization that facilitate the exploration of space without tying it down to a Cartesian grid. While non-Cartesian spaces do not require digital visualization technologies, they can benefit from them. Most notably, interactive technology allows us to both gather and communicate more information at once.

As a cartographer, my experimentation with new digital cartographic and visualization technologies has been radically informative. While I used to begin a project by determining on the best way to represent my subject in space, I now first question: *What is the real relationship between my subject and space?* I cannot help but imagine the academic and personal impact this relational understanding would have had on me if I had learned it in fifth grade instead of the state-ist and 'absolute' perspective that I was taught. I believe that unconventional and multifaceted representations of the border, which can be greatly aided by flexible and powerful digital toolsets, are the first step in overturning the simplistic and state-ist understanding of the border that has dominated for centuries.

Our societal obsession with Scientific Truth makes us resistant to accept anything but a Cartesian coordinate pair as an answer to the question, *Where is the border*? This is an obstacle to unconventional- and in particular non-Cartesian- understandings of the border, but it is not an impossible hurdle. From Autism to sexuality to gender, things that were once considered discrete categories are increasingly considered spectrums. This progressive momentum gives me hope that borders, too, might someday be understood not simply as lines but as something with more dimensions. These dimensions might include history, performance, experience, power, conflict, as well as space. There are many dimensions to borders that I have left out, and even more that have not yet been discovered. From desert fences to global economies, borders have impact. The better we understand borders, the better we can understand the world around us.

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