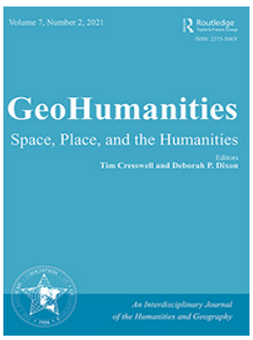

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Mapping Bodies, Designing Feminist Icons

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Bodies are nuanced, fluid, and political—often combining forms of intersecting and experiential identities. Nevertheless, bodies are frequently missing from maps altogether or, when they are included on maps, they are reduced to points, lines, and polygons. Focusing on iconography, I explore the depiction of bodies in map symbolization through a feminist lens. I apply a feminist semiotic analysis to thirty-eight Maki icons to problematize the ways in which bodies are depicted, abstracted, or erased. I analyze icon symbolization, particularly the presence/absence of bodily forms, the presence/absence of an embodied object, and the icons' iconicity. My feminist analysis reveals the underlying silences, defaults, and power dynamics within the Maki icon set. I call mapmakers to rethink the depictions of bodies in icons—and the role of "universal" icon sets, more broadly—through a feminist lens. I offer design opportunities as a starting point for such an endeavor. **Key Words: cartography, embodiment, feminist mapping, iconography, semiotics.**

A swimmer braving razor-sharp waves.
A police officer tapping someone on the shoulder.
A misplaced stethoscope.
A square, a city, or maybe a cartographer?

Bodies are nuanced, fluid, and political, combining intersecting and experiential identities that may or may not be visible. Feminists have brought bodies into academic, social, and political conversations that emphasize the body's entanglement with the mind, the sovereignty of bodies and choices, and the importance of embodiment and situated engagement with our worlds (Haraway 1988; Rose 1993; Sovereign Bodies Institute n.d.; Sprunk 2010). Black feminist writing illuminates the complexities of bodies and experiences, marginalization from intersecting systems of oppression, and structural tensions between missing and hyper-visible bodies (Benjamin 2019; Collins 2009; Combahee River Collective 1977; Crenshaw 1989). Nevertheless, mapped bodies are frequently reduced to points, lines, and polygons, are used to depict activities or are missing from maps altogether (Kelly 2015; Rose 1993). Simply stated, bodies matter and need to matter more in map design.

Bodies and map icons are at the center of the descriptions above (Figure 1). They are Maki map icons designed to locate people, places, and activities in interactive maps (Mapbox n.d. a). Maki is a prominent, open-source mapping icon set curated by Mapbox. Icons from the set are easily downloaded and then loaded into interactive maps around the world. "Swimming," "police," "doctor," and "square"—Mapbox's designations for these icons—form part of the

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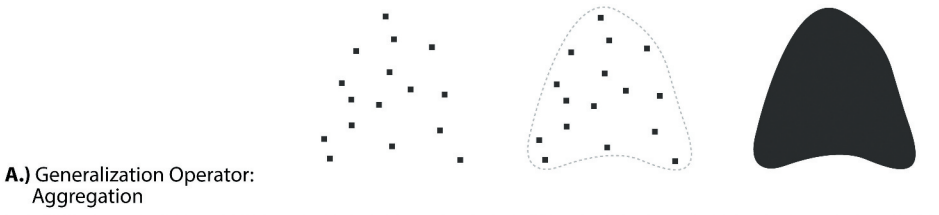
FIGURE 1 "Swimming," "police," "doctor," and "square" are four icons included in the Maki icon set. Icons were reproduced here following "CC0 1.0 Universal" status (Mapbox n.d. a).

larger icon set meant to be universally applied across contexts. A feminist lens, however, asks us to question this notion and view these icons in new ways. The swimmer within "swimming," for example, appears athletic and non-disabled with prescribed and perfected form. Who is missing, and why? If we want to swim, do we have to swim laps, or can we just cool off in the water? The police officer faces us directly with a hand raised in authoritative attire. How does the icon make us feel? Do we feel welcomed or uncomfortable? Can we assume the police and swimming figures are white men? If so, why are white men default assumptions? Who is the stethoscope portraying, and how do we know it is depicting a doctor without a body present? Would everyone share our perspectives? The square could be anything as it removes recognizable bodies altogether. Does abstraction make this icon more inclusive? Is the square happy or powerful? What changes if we put a label on the square? These questions are feminist at their core. Map icons vividly illustrate these points and generate possibilities between feminist theory and cartographic symbolization.

In this paper, I draw on feminist perspectives in mapping and design as well as a feminist semiotic analysis to explore the depiction of bodies in map symbolization. I argue that cartographers and designers need to rethink the depictions of bodies in map symbolization and the role of icon sets, more broadly, through a feminist lens. I use the Maki icon set as a case study to question conventional approaches to universal icon sets, and I argue for a feminist approach to icon design.

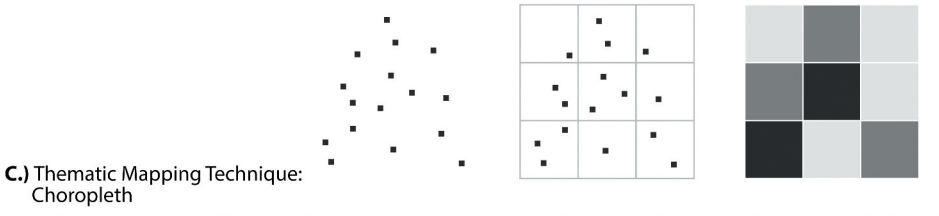
MAPPED BODIES

The concept, mapped bodies, feeds the imagination and produces an array of Google search results. What do I mean by mapped bodies? Mapped bodies range from artistic, imaginative, and unconventional renderings to more traditional mappings that use conventional cartographic techniques (Figure 2). Scientific illustrators, radiologists, and artists have explored body mapping in literal ways, from anatomical sketches and x-ray images to life-sized mosaicked mixed-media maps (Nestel n.d.). Bodies have also been used in mapping as anthropomorphic metaphors of power, femininity/masculinity, nature/infrastructure, and progress (McKay 1889; Münster 1570). Further, maps that use Chernoff faces quite literally utilize bodies, particularly facial features, to depict multivariate, numeric data. What could go wrong? In short, plenty. Chernoff faces have been critiqued as heavily racist and sexist. In response, the technique has been subverted to include non-normative bodily forms like blue skin, feminine bodies, and even zombie bodies (see Rosenfeld et al. 2017 for a critical overview).

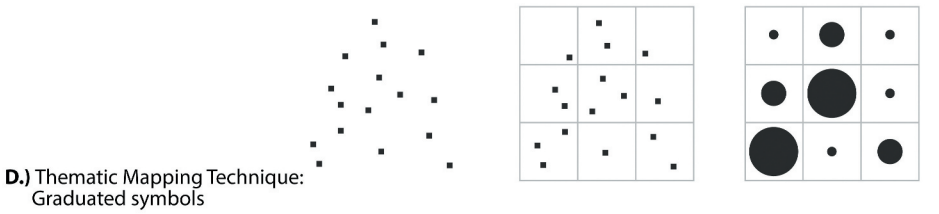


A.) Generalization Operator: Aggregation

B.) Generalization Operator: Collapse



C.) Thematic Mapping Technique: Choropleth



D.) Thematic Mapping Technique: Graduated symbols

E.) Thematic Mapping Technique: Flow map

F.) Visual Variables

FIGURE 2 Cartographic techniques for mapping bodies. a) Aggregation is a generalization operator used to group a sample of points into a polygon that approximates the extent of their distribution. If the sample of points represented individual bodies, the individual bodies would be lost to a shaded, homogenous gray polygon. b) Collapse is a generalization operator where a sample of points or bodies is collapsed into a single point. The "many" individual bodies are erased into "one" point. c) Choropleth maps use aggregation to group a sample of points into predetermined enumeration units or polygons (like counties). The number of points in each unit can then be counted and shaded according to each unit's value. d) Like choropleth maps, graduated symbol maps aggregate or group a sample of points or bodies into predetermined enumeration units or polygons. After the number of points is counted and assigned to each unit, the points are collapsed into a single point before being rescaled according to their numeric value. e) Flow lines are another way of depicting bodies. The single flow line illustrates the movement of one individual body. The second example shows the movement or paths of many bodies collapsed into single flow lines. The last example resizes the flows lines based on the volume of bodies moving along that path. f) Points can also be depicted to show a one-to-one relationship using visual variables or graphic indicators. In this example, each shape could directly illustrate one individual body.

Bodies are also mapped using more conventional cartographic techniques (Figure 2). These techniques stem from the rise of Western academic cartography and scientific cartography in the postwar era—much of which is still valued and taught in academic and professional settings (e.g., Slocum et al. 2009; UCGIS 2019). Cartographic pedagogy, for example, relies on the spatial dimension of a vector dataset to determine visual form as points, lines, and polygons. Bodies in data are then aggregated, constrained to a geographic unit, collapsed into a point or a line, or erased through generalization and selection (Kelly 2015). Figure 2(A-C), respectively, aggregate individual bodies into an amoeba-shaped polygon and geographic units. In these practices, individual points or bodies and clusters of bodies are erased as polygons appear homogeneous. Lines frequently show bodies in motion. A body's movement can be depicted individually as its own line (Figure 2E). Additionally, groups of bodies can be collapsed into flow lines and can then be rescaled to show the number of bodies (Figure 2E). The latter examples similarly remove bodies. It is important to note that these techniques are not overtly incorrect, malicious, or unethical. The takeaway here is that given their dimension, form, and symbolization, bodies become more or less legible when mapped.

Points are the last dimension and technique used to depict bodies in maps. Bodies can be aggregated and then collapsed into individual points in a many-to-one relationship (Figure 2B). Point symbolization can then inflate or deflate based on statistical data like "peopled data" (e.g., the population of a city or a demographic variable) (Figure 2D). Individual bodies can also be mapped as individual points in a one-to-one relationship (Figure 2F). In reference maps, point features are styled using visual variables like shape to locate specific bodies. Points are further used to locate activities, events, and places. The symbolization of bodies varies as point symbols range in their the degree of abstraction from reality. This degree of abstraction is also

known as iconicity. The "police" and "swimming" icons in the introduction, for example, resemble bodily figures more than the "square," making them more iconic.

In what follows, I focus solely on point features and, more specifically, icons. Icons are extremely flexible in design, ranging from iconic or pictorial shapes and abstract geometries to associative depictions. As such, mapmakers can design bodily icons in a variety of ways. Icons, like those embedded within Google Maps, are also reoccurring and low-lying map features that recede into the background, and, accordingly, are often overlooked. The ubiquity of interactive maps further makes individual icons and their broader icon sets increasingly invisible. Additionally, there are various icon sets, like Maki, that are open-source and publicly available for web mapping (Figure 3). Icons are familiar and provide a legible entry point for mapmakers with all levels of expertise. And last, icons are powerful symbols. They are collective undertakings (Noun Project n.d.) and productive sites of subversion (Horsky n.d.), activism (Vision Archive n.d.), and anti-colonialism (Chief Lady Bird 2018).

MAPPED BODIES (AND ICON SETS) IN THEORY

Bodies and Embodiment

Feminists recognize the importance of bodies (Longhurst 1995; Price and Shildrick 1999; Fraser and Greco 2005). Many continually question and disrupt the arbitrary binary distinction between the mind and body, prioritizing the masculinized mind over the feminized body. Haraway (1991), for example, uses the image of the cyborg to disrupt such binaries freeing bodies from structural categorization. Feminists acknowledge the limits of the perceived body or what is visible and celebrate complexity, difference, and the many intersections of identity, including the invisible. Bodies and our corresponding identities are ever-changing, and as transfeminist scholar Joy Ladin (2014) writes, these changes or permutations are "expressions of a single self." Too often, certain types of bodies are marginalized or missing, and feminists call attention to the margins, outliers, and those that are "unsurprisingly" missing in our data-saturated world (Onuoha 2018; Welles 2014).

The depictions of bodies, particularly the representation and simplification of bodies in maps and visualizations, have been scrutinized by feminist writers. Rose (1993, 31) writes that individual bodies are frequently left unspecified, undifferentiated, and "colorless" in many cartographic depictions. As a result, bodies appear homogeneous, silencing the experiences of and interactions between bodies. In response, feminist designers in and beyond cartography prioritize bodies and embodiment in meaningful ways. D'Ignazio and Klein (2018), for example, poignantly state "bring back the bodies" in their digital text on data feminism. The authors emphasize a need to bring bodies that are missing or suppressed back into the visualization process. Feminist cartographers have responded to these critiques by recognizing the bodies, embodied experiences, and everyday spaces that are largely absent from maps (Brown and Larry 2008; Ferzoco 2018; Kelly 2019; Kwan 2002, 2008; Lucchesi 2019a; Onuoha 2018; Pearce 2008; Westerveld and Knowles 2018). Considerations of bodies and embodiment in mapping range from the portrayal of oral histories of Muslim women after September 11, 2001, (Kwan 2008) and experiences of place (both topographical and relational)


aerialway


airfield


airport


alcohol shop


american football


amusement park


aquarium


art gallery


attraction


bakery


bank test


bar


barrier


baseball


basketball


bbq


beer


bicycle


bicycle share


blood bank


buddhism


building


building alt


bus


cafe


campsite


car


castle


cemetery


cinema


circle


circle stroke


city


clothing


college


commercial


cricket


cross


dam TEST


danger

defibrillator

dentist

doctor

dog park

drinking water

embassy

emergency phone

entrance

entrance alt

farm

fast food

fence

ferry TEST

fire station

florist

fuel

gaming

garden

garden center

gift

golf

grocery

hairdresser

harbor

heart

heliport

home

horse riding

hospital

ice cream

industry

information

karaoke

landmark

land use

laundry

library

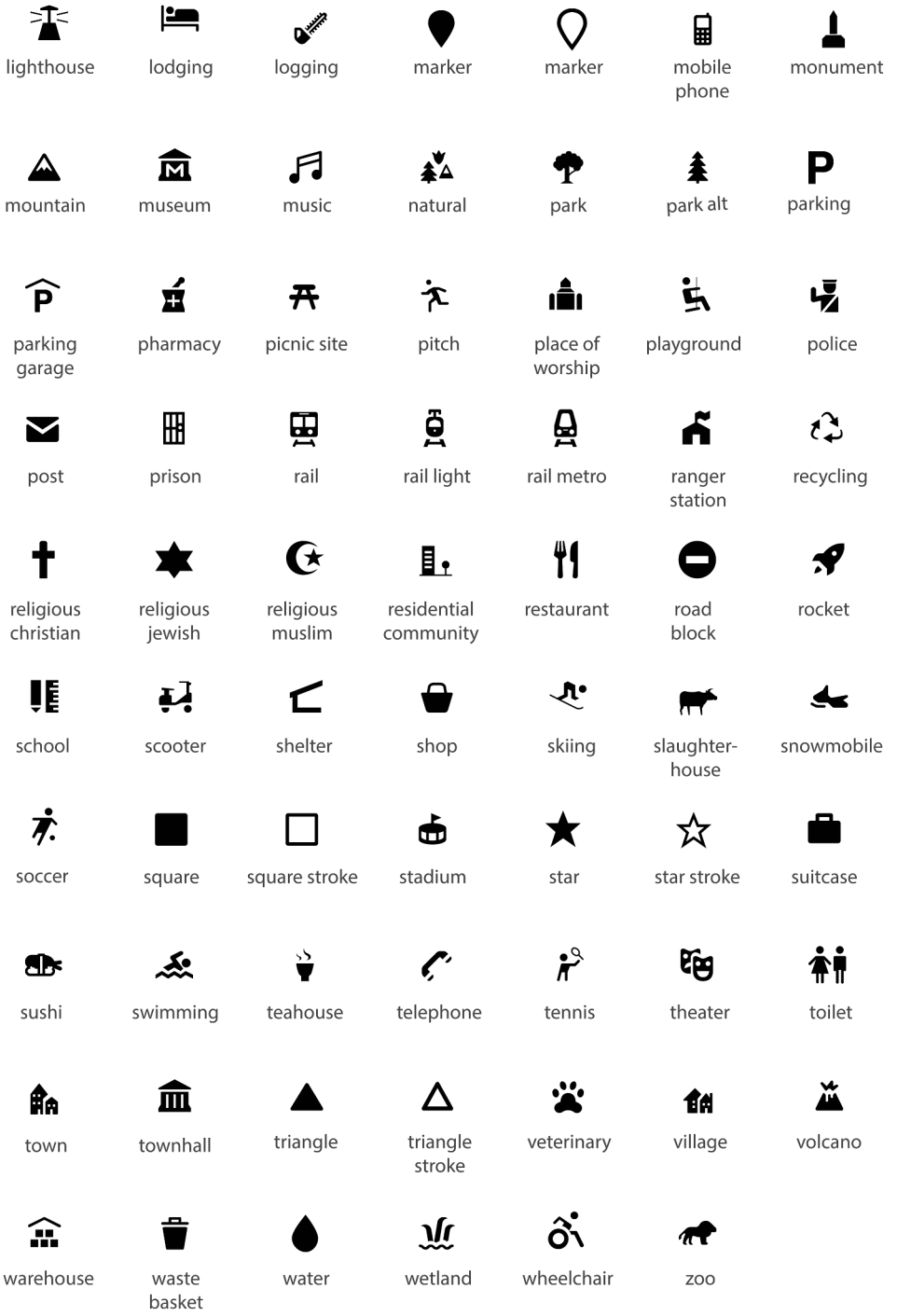


FIGURE 3 Maki is an open-source icon set available for download and use in interactive maps. At the time of this writing, the icon set consisted of 146 icons available at two sizes: 11 × 11 pixels and 15x15pixels. Icons were reproduced here following "CC0 1.0 Universal" status (Mapbox n.d. a).

in testimonies from Holocaust survivors (Westerveld and Knowles 2018) to Indigenous women and two-spirit people challenging structural violence through mapping practices (Lucchesi 2019a) and the everyday stories of queer spaces (Ferzoco 2018; Queering the Map n.d.). Feminist mapmakers (often at the margins of design) continue to expand and create new cartographic vocabularies for bodies and embodiment that embrace individual experiences and lived realities. Explorations of bodies and embodied cartographic language for iconography, however, lags in such conversations.

Embodied Objectivity

Relatedly, feminist thinkers and tinkerers challenge conventional notions of objectivity and universal understandings of the world around us (Harding 1986). This critique includes questions of positivist approaches to Science, technology, and mapping. In geography, such challenges manifested as the "GIS wars" in the early 1990s, where feminist and critical scholars questioned top-down, universalizing approaches to geospatial data and technology (Schuurman 2000). Instead, feminists recognize that all knowledge is situated, and all knowledge is partial (Collins 2009; Haraway 1988). Situated knowledge is thus grounded in bodies and context—our understandings of the world come from our positions within it. Haraway (1988, 581, emphasis in original) calls for "embodied objectivity," noting that "feminist objectivity means quite simply *situated knowledges*." Feminist approaches to objectivity *necessitate* bodies and embodied contexts.

Feminist or embodied objectivity unfolds across spatial data, map design, and cartographic processes. Universal objectivity in data, particularly "big" data, has been problematized in queer feminist work noting the multiscalar, fluid, and situated contexts of data (Gieseking 2018). Further, the very process of data collection, curation, storage, and analysis debunks any semblance of objective data or the possibility of letting the data "speak for themselves" (D'Ignazio and Klein 2020; Loukissas 2019; Ricker 2017). Instead, feminist data scientists illustrate the opportunities, limitations, biases, absences (deliberate and structural), errors, and partiality of any dataset calling for "data biographies" and reflexive praxis (Krause 2017; Ricker 2017). Feminist mappers expand notions of data that move beyond raw numbers to include more nuanced, qualitative data (Knigge and Cope 2006). Scholar-activists with the Anti-Eviction Mapping Project, for example, note that the "objectivist epistemic tradition must be disrupted" by combining datasets that "co-locate personal narratives (oral histories and stories) against the geography of evictions" (Graziani and Shi 2020, 400). Feminist questions of objectivity continue to revolutionize map symbolization. Mapmakers routinely reveal their maps' underbelly by documenting and sharing their design decisions, both significant and minute. Others provide visual cues to demonstrate the presence of a cartographer in seemingly objective and persuasive visualizations. Westerveld and Knowles (2018), for example, use hand-drawn circles in the re-telling of Holocaust survivor stories to remind the viewer that the map is a visual interpretation or, better yet, an expression of an oral history that is produced by an outsider, the mapmaker.

Feminists acknowledge the importance of "pressing pause" throughout mapping processes to recognize their situated perspectives in relationship to power (Kelly and Bosse 2019; Kelly and Bosse Under Review). Embodied objectivity and design justice frameworks center individuals most directly impacted by mapping an issue (Costanza-Chock 2018, 2020). Such approaches

might include collective and participatory mapping frameworks that disrupt the singular answers and linear processes that we are often taught as cartographers, designers, and data scientists. Even efforts toward "user-centered design" or "universal design" processes are being questioned (Costanza-Chock 2020). Universal design, for example, aims to create the most inclusive and accessible designs possible through participatory processes and an emphasis on the margins, folks falling outside of conventional needs who are often erased. Such efforts have been undoubtedly instrumental in making the world more accessible to many. Yet, tension remains. For many universal designs, like the Maki icon set, someone will always be excluded from the design's intentions. Feminist and design justice frameworks demand "highly specific, intentional, custom design that takes multiple standpoints into account," along with an acknowledgment of context, the beneficiaries, and exclusions within design practices (Costanza-Chock 2020, 230). As a result, embodied objectivity and situated knowledge are necessary frames for map design. Context matters and is an imperative disclosure in the design of iconography.

Power, Selection, and Default Bodies

Power is central to discussions of mapped bodies. While feminist perspectives on power vary, I draw on an intersectional approach to power, specifically exploring differential privileges and systems of oppression that play out across gendered, racialized, and "othered" identity landscapes (Collins 2009; Combahee River Collective 1977; Crenshaw 1989). Intersectional power is vividly illustrated in default designs. At the beginning of this article, I posed the question, "Can we assume the police and swimming figures are white men?" D'Ignazio (2016) states that design defaults to "straight, white, rich men." This includes but is not limited to the design of technology like TSA airport scanners or hand dryers and emojis, iconography that we use every day (Benjamin 2019; Costanza-Chock 2020; McGill 2016). Data collection similarly defaults to dominant groups, and artists like Onuoha (2018) reveal missing data that falls outside of default considerations. Likewise, Stephens (2013) and Geochicas (Yang, Jacquin, and González 2019) identify missing perspectives, specifically gendered perspectives, in crowdsourced datasets like OpenStreetMap. Power is also reflected in map iconography through default data selection and design decisions that center dominant perspectives (e.g., "straight, white, rich men").

Power is baked into the very process of design. Small, big, and taken-for-granted design decisions create world views. The selection of features determines what counts or what matters. The amount of generalization or the level of detail maintained in map features prioritizes some and obscures others. Together, selection and generalization reflect as well as reinforce conventional knowledge systems that notable critical (and often default) mappers like Harley (1989), Wood and Fels (1992), and Crampton (2010) have questioned, albeit neglecting feminist works in this area (Elwood and Leszczynski 2018). Today, feminist scholar-activists like Annita Lucchesi (2019b) and groups like The Vision Archive (n.d.) direct us, respectively, to Indigenous knowledge systems and collective visions of just futures. Diverse representation and inclusion are key mechanisms for expressing alternative knowledge systems that subvert default designs and world views. Contemporary design frameworks like data feminism and design justice insist on calling more folks to the table, valuing everyone as an expert and designer (D'Ignazio and Klein 2016, 2020; Costanza-Chock 2020). Caution, however, is

warranted as diversity does not necessarily equate to a more equitable design. Instead, the very notion of universal icon sets must be upended to not only recognize bodies at the margins but demand that designers situate and contextualize *all* icon designs in relation to structural mechanisms of power.

UNDERSTANDING MAPPED BODIES

From representational and artistic approaches that emphasize visual expressions to nonrepresentational, post-representational, and performance approaches that consider relational, emerging, and context-dependent mappings, mapped bodies can be understood from a variety of often debated perspectives (e.g., Caquard 2015; Kanarinka 2006; Kitchin and Dodge 2007; MacEachren 1995). Importantly, each framework offers alternative approaches to the datafication of bodies in our everyday lives, and how bodies become in/visible in mappings. In this paper, I focus on representation as an analytical framework to better understand mapped bodies in iconography. Following a post-representational call by Caquard (2015), I bridge and bend the perceived divide between representational and feminist interventions with a feminist semiotic analysis.

Semiotics is a representational strategy and framework used in a number of disciplines to study signs and sign systems (Nöth 1995). Cartographers have utilized semiotics to better understand sign systems in mapping through symbolization (MacEachren 1995). Maps use cartographic language and visual variables to translate, express, or abstract spatial complexities into graphic symbols, including icons. Semiotics can be understood from varying perspectives and models. In this paper, I rely on the triadic sign model (Chandler 2002; Nöth 1995), a system MacEachren (1995) translated to cartographic contexts. The triadic model differentiates an existing object from the mental conception and graphical depiction assigned to the object itself. As applied to map icons in Figure 4, the triadic model uses referent, interpretant, and sign-vehicle to parse, respectively, the object, the mental conception, and graphical depiction.

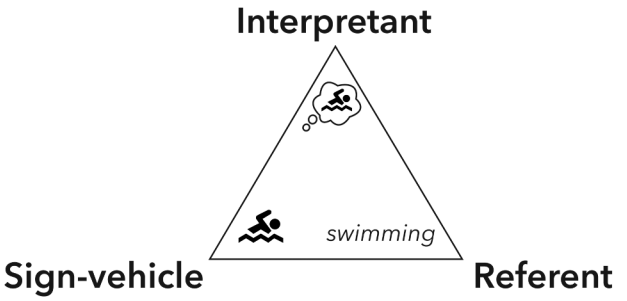


FIGURE 4 Triadic sign model includes a referent, interpretant, and sign-vehicle. In this example, the referent is the object (swimming), the interpretant is the mental conception of the object, and the sign-vehicle is the graphic depiction, in this case, the swimmer's body.

FIGURE 5 This iconicity continuum shows the level of abstraction and detail in given icons. Symbolic icons are heavily abstracted compared to lexical icons that are a 'piece' torn from reality. Indexical icons show very mimetic or iconic shapes. The square and heart icons fall toward the symbolic end of the continuum. A majority of the icons illustrate indexical designs. In this paper, I argue that the police icon is the most detailed and indexical icon within the set. None of the Maki icons show lexical relationships in their designs.

Iconicity refers to the graphic relationship between a sign-vehicle and its referent. In other words, iconicity is the degree to which a sign is abstracted from reality. Peirce identified three sign relationships to describe the relativity of signs: symbolic, iconic, and indexical (Chandler 2002; Figure 5). In symbolic relationships, the sign-vehicle or icon is abstracted enough that it no longer resembles the referent. The icon must then be learned or is perhaps a cultural convention. In iconic relationships, the sign-vehicle or icon resembles the referent. Iconic symbols are culturally recognizable and relatable. When the sign-vehicle or icon mimics the referent exactly, it illustrates an indexical relationship. In other words, a lexical sign is a "piece" directly torn from the referent or object in the real world. Iconicity plays an important role in mapping bodies because it frames how bodies are illustrated in icon designs.

Like other modes of communication, maps, and even more so, icons appear intentionally neutral (Muehlenhaus 2012; Tyner 1982). New digital media, like interactive maps, are being used in Western society at unprecedented levels (Crampton 2009, 91). Although digital map divides continue to persist, society consumes maps more than ever. Further, the general public is naturalized to the medium, the medium's processes, and what is being communicated by the medium. Chandler (2002, 3) writes, "the more frequently and fluently a medium [such as mapping] is used, the more transparent or invisible" it becomes. If the medium itself—the map—is becoming naturalized, what can we say about the map's tiniest pieces, the 11 × 11 pixel icons we place on top?

FEMINIST SEMIOTIC ANALYSIS

A feminist semiotic approach unravels the composition of individual icons and their depiction of bodies as well as the broader Maki icon set to better understand the "social effects of an image's meaning" (Rose 2012, 108). Or, to put another way, how the icon set works in the world. This analysis aims to expose their underlying meanings and the bodily norms prescribed in icon design. Semiotics is an advantageous research approach because of its flexibility across visual phenomenon, especially ubiquitous visuals like map icons. Semiotics moves beyond

description and centers power relations along with the social effects of visualizations. Further, semiotics provides analytical precision by applying "highly refined" concepts and terminology to detailed assessments of visuals, while simultaneously acknowledging the methodology as a subjective and interpretative practice (Rose 2012). Reflexivity and transparency are essential to a feminist semiotic analysis. And while not necessarily replicable, semiotics captures a critical perspective of the visual world we're surrounded by, including our saturation and exposure to maps and map icons. As such, I adapt Rose's (2012, 133) framework on how to visually "do semiology" to conduct my feminist analysis.

Maki Icons

Mapbox is a mapping company that provides a series of products and tools for map design, spatial analysis, navigation, and geocoding. The company aims to change "the way people move around cities and understand our planet" (Mapbox n.d. b). Except for Google Maps and ESRI products, Mapbox is arguably the most prominent platform for online mapping. It is extensively utilized by popular media outlets like the *Washington Post* and social media platforms like *Facebook* (Mapbox n.d. c). Mapbox launched their icon set, Maki, (Figure 3) in 2013 to help cartographers design better web maps with "the most high quality, consistent, and comprehensive point of interest icon set possible" (Mapbox n.d. b). The Maki icon set is continuously updated and documented on Github (Mapbox n.d. d). At the time of my analysis, the icon set (v4.0.0) consisted of 146 map icons at two sizes: 11 × 11 pixels and 15 × 15 pixels. Maki uses specific design principles to provide a "high quality, consistent, and comprehensive" icon set (Mapbox n.d. b). These design principles aim to create bold, all-purpose shapes or silhouettes that are recognizable across cultures. Once downloaded, each icon can be customized with the visual variables—color, texture, size, shape, etc.—and inserted to a web map. Each icon is styled for clarity and easy viewing across web platforms, most notably mobile devices. Icons are built from "geometric building blocks" with solid, block fills and rounded edges (Mapbox n.d. a). Maki attempts generic, yet relatable and understandable icons. Given Maki icons' small size and constrained style guidelines, they operate as frequent and low-level features that appear inconspicuously.

It is important to note that Maki is just one example of a publicly available icon set. This analysis could be easily applied to Google icons or National Park icons, among others. I choose Maki for two reasons. First, Mapbox is a leader in the cartographic community and has an expansive presence in online interactive maps. Second, the Maki designers are open to feedback and encourage cartographers and designers to "push" or upload new designs to the company's Github page. This openness supports a collaborative and community-oriented design approach that I hope to draw on and expand.

Maki Icons as Signs

After selecting the Maki icon set as a case study, I downloaded and previewed all 146 icons. I narrowed the sample to thirty-eight by selecting icons that are used to depict bodies or people directly, utilize bodies in their symbolization (whether or not it is necessary), or could be used to indirectly or abstractly depict bodies (Figure 6). I analyzed the narrowed icon sample by

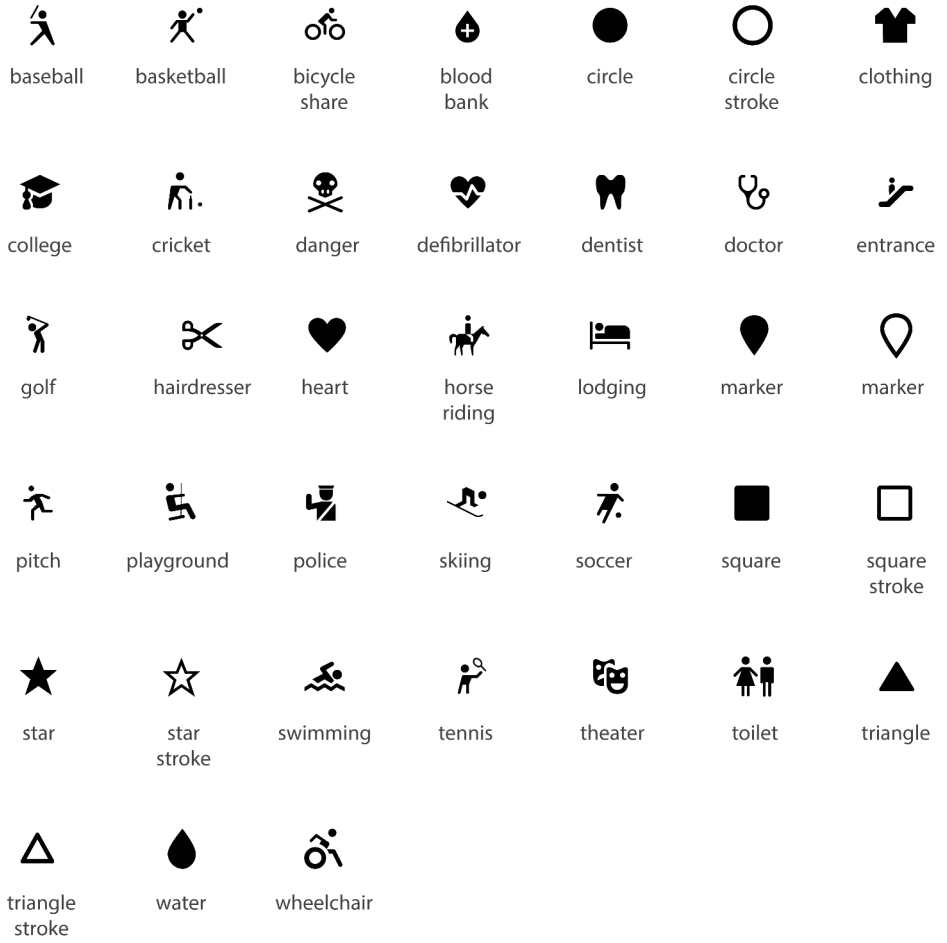


FIGURE 6 Maki icons that depict bodies directly, utilize bodies in their symbolization, or could be used to indirectly or abstractly depict bodies are highlighted in black. These thirty-eight icons were used in my feminist semiotic analysis.

FIGURE 7 The sign-vehicle continuum specifies the degree to which a body is present or absent within the graphic symbol. The police officer is placed on the right side of the sign-vehicle continuum because a body is present within its design. The stethoscope is inversely placed along the continuum because it lacks a body. The tooth and heart icons are placed somewhere in-between.

sign-vehicle, referent, and iconicity. I then used visualization techniques to understand the relationships working within a specific icon as well as broader trends across the icon set.

As I went through the icon set, I noticed surprising relationships and differences between icons and their symbolization of bodies. I created a schematic of these relationships to organize the icons. I deliberately used continuums through the schematic to demonstrate relative, fluid, and subjective relationships as opposed to binary assumptions. Figure 7 places icons along a *sign-vehicle* continuum based on the presence and absence of a bodily form in the icon itself. The "police" icon, for example, includes the bodily form of a policeman within its symbol. The "doctor" icon, in contrast, uses a stethoscope as a non-bodily symbol and appears at the inverse side of the continuum. Similarly, geometric shape icons such as "square," "circle," or "star" would also be placed on the left side of the schematic. If geometric shapes like squares are used to depict bodies, they have been abstracted so that the body is unrecognizable. Whereas, the silhouettes of a tooth and a heart reside somewhere in the middle of this continuum. Although associated with elements of the body, they do not depict the body in its entirety.

Next, I explored the *referent* or the object of reference. As a proxy, I used the name that Mapbox has assigned to each icon as its corresponding referent. I created a referent continuum in Figure 8. Here, bodily referents are located on the right side of the continuum, and referents that do not refer to bodies are on the left. For example, "police," "doctor," "dentist," and "hairdresser" are directly related to specific working bodies (Figure 8). "Lodging," "playground," and "toilet" are locations or objects. "Swimming," along with "skiing," are verbs and show action, not specific bodies. It is important to note that the written form of the referent designations (identified with quotes throughout the paper) are themselves signs and open to interpretation. I rely on Mapbox's designations to maintain consistency across the icon set and avoid assigning referent relationships using yet another interpretative schema that is perhaps even more incomplete. "Police" and "doctor," for example, could be interpreted not as bodies, but as places (i.e., police station and a hospital). As a result, this is not a perfected proxy, and following Rose (2012), I argue that it will never be. Transparency, however, is crucial in the application of the semiotic lexicon.

I combined Figures 8 and 9 to better understand the bodily relationships between sign-vehicles and referents and placed the Maki icons within this Cartesian grid (Figure 9). From this schematic, I identified four types of bodily relationships. Beginning in the bottom right

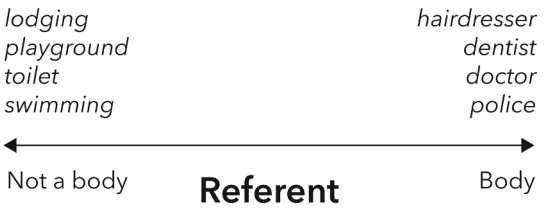


FIGURE 8 The referent continuum notes whether or not a referent (object) relates to bodies. I rely on Maki's designations for each icon's referent. "Lodging," "playground," and "toilet" do not directly refer to specific bodies. In contrast, "hairdresser," "dentist," "doctor," and "police" refers to bodies, specifically working bodies.

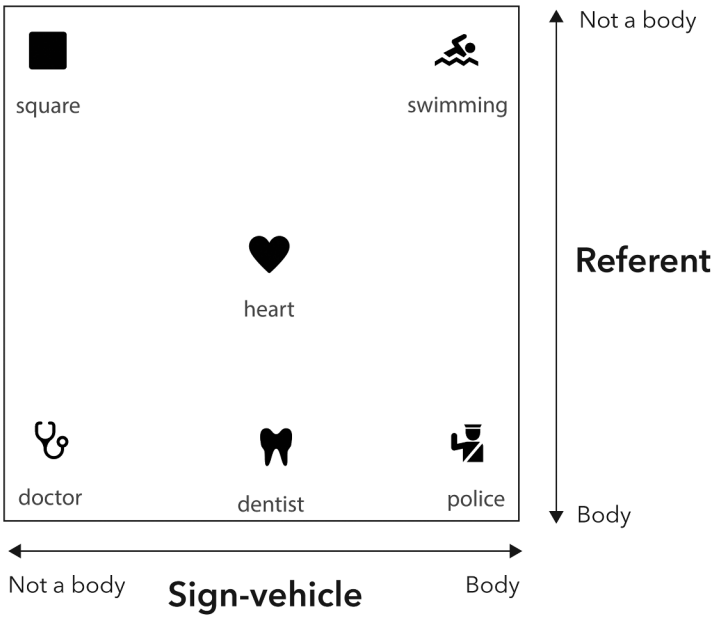


FIGURE 9 The cartesian grid combines the sign-vehicle and referent continuums. The grid's corners present sign-vehicle and referent pairings that I refer to throughout my feminist semiotic analysis: *body–body, body–not a body, not a body–body, not a body–not a body*. Maki icons are placed within the Cartesian grid in this example. Specific icons in the corners illustrate particular sign-vehicle and referent parings like *body–body, body–not a body, not a body–body, not a body–not a body*. The police icon, for example, refers to a body in its referent and incorporates a body as its sign-vehicle. As such, this icon is a *body–body* icon.

corner of Figure 9 and working clockwise, these paired relationships include 1. *body–body*, 2. *not a body–body*, 3. *not a body–not a body*, and 4. *body–not a body*. In each pairing, the first word designates the sign-vehicle, and the second word designates the referent. The "police" icon, for example, is a *body–body* pair. Its sign-vehicle utilizes a bodily figure to depict its referent of a police officer. The stethoscope icon's sign-vehicle does not include the body but does refer to a bodily referent, "doctor." As such, the "doctor" is an example of a *not a body–body* pair. The "square" icon does not refer to a body in its sign-vehicle or its referent, making it a *not a body–not a body* pair. Last, the "baseball" icon is a *body–not a body* pairing as it uses a body in its sign-vehicle even though its referent ("baseball") suggests an activity, not a specific body. Each bodily relationship is discussed in detail in the next section.

To explore the *iconicity* of the Maki icons, I placed the embodied icons along an iconicity continuum. Figure 5 from above graphically depicts the degree a symbol is abstracted from reality on a continuum and places Maki icons along this spectrum. Additionally, I added a third, vertical dimension to the Cartesian organization in Figure 10. By adding this third dimension to

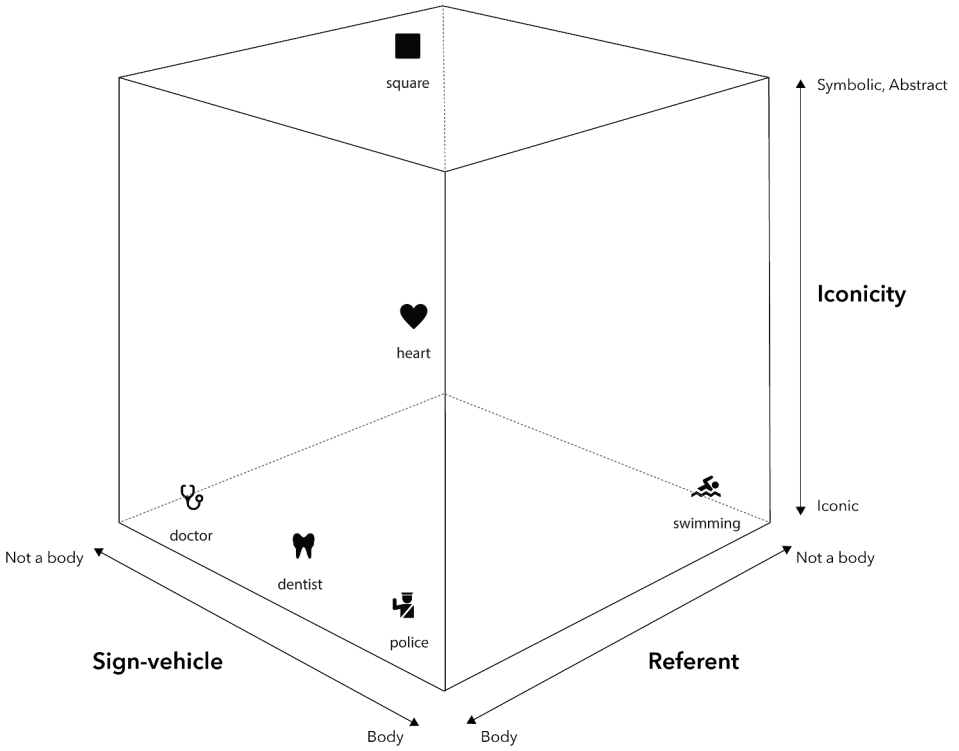


FIGURE 10 This three-dimensional cube presents the conceptual framework for feminist semiotic analysis by combining the cartesian grid in Figures 17 and 18 with the iconicity continuum in Figures 10 and 11. Icons are placed within the conceptual framework for feminist semiotic analysis. I use this framework as an organization tool and visualization method to better understand the relationships between icons, bodies, and feminist theory.

sign-vehicle and referent relationships, I dove deeper into understanding Maki icons and bodily icons as signs.

FEMINIST DISCUSSION

The next step in Rose's guide to semiotic analysis is the exploration of signs in connection to "wider systems of meaning" (Rose 2012, 133). "Systems of meaning" address codes embedded within all signs. Codes are particular sets of conventions that "are specific to particular groups of people" (Rose 2012, 128). No sign goes untouched by societal or cultural codes. Furthermore, codes build ideologies that legitimize unequal distributions of power and systems of oppression (Rose 2012, 106). Due to their vast distribution and consumption, the Maki icon set is intentionally designed to be universal, relevant, and relatable across cultures (Mapbox n.d. a). As such,

I unravel the conventions, codes, and ideologies ingrained in Maki's depictions of the body. I analyze the four sign-vehicle and referent pairings in Figure 10 (*body–body, not a body–body*, etc.). I describe a prototypical icon for each pairing and revisit its placement in the bodily sign cube (Figure 10). I then describe the semiotic relationship within the individual icon and within the Maki icon set. Last, I examine the conventions, codes, and ideologies embedded within each icon using feminist theory as a guide.

Body–Body: Police

Maki's "police" icon illustrates a clear bodily form (Figure 11). The figure's arm is lifted to shoulder height and is bent at the elbow, forming a 90-degree angle upwards. The body is wearing a hat. The hat extends at a sharp angle away from the head and lies flat on top. A sash crosses the body's chest from the upper shoulder to the hip.

The "police" icon constitutes the only *body–body* Maki icon. It uses a body in its sign-vehicle while simultaneously referring to a body, specifically a working police officer, in its referent. The icon does not perfectly depict the referent of a police officer at a lexical or realistic level, nor does the icon abstract into uncertainty at the symbolic level. The "police" icon is an iconic symbol that works on the denotive level. In other words, the icon is not a schoolteacher. It is a police officer. How do I know? The icon fits in my default Western imagination of what a police officer looks like. It is relatively easy to decode as the design's destails are enough to distinguish its body from civilian bodies (Rose 2012).

Power is at the core of the icon's design. First, the "police" icon is the only *body–body* icon in the Maki icon set. It is also the most detailed bodily icon. By designing a sign-vehicle that directly personifies its referent, the "police" icon is privileged above the rest. Given the level of detail in its design, the "police" icon is arguably unmistakable in interpretation. On the iconicity continuum in Figure 5 that ranges from abstract to iconic, the "police" icon marches toward iconic and further distinguishes itself as important and powerful. It is one of two icons with noticeable clothing. (The other is the figure in a dress in the "bathroom" icon.) The bodily figure in the "police" icon is wearing a hat and a decorative diagonal sash. The level of detail or lack of generalization in its bodily form gives this icon priority and power. Its iconic and accessorized body creates unquestioned power. What would happen if we removed details like the body's hat and sash through generalization? What if we abstracted the icon altogether into a triangle or circle? A feminist approach examines generalization and detail as power differentials within icon design, prioritizing some ("police") over others.

The figure's body language appears with an upright and bent arm recognized by many as the "stop" gesture. The icon appears authoritative and dominant. It is almost as if the icon is tapping us on our shoulders. Its body language and posture create emotive responses. My

FIGURE 11 Maki "police" icon reproduced following "CC0 1.0 Universal" status (Mapbox n.d. a).

perspective as a white woman in Western academia, however, presents one specific context. While I feel relatively safe with this depiction, another person in another context might feel uncomfortable, controlled, or threatened. Icon designs like "police" reflect embodied objectivity, partial perspectives. As a result, context is critical in icon design. The singularity of icon design illustrates one context from a presumed universal perspective. A feminist design perspective approaches context and the "police" icon in two ways. First, Mapbox could expand the icon set endlessly to make space for partial designs that fit varying perspectives. As it stands, the icon set presents a selection or curation of a particular world view, data points that "count." An expansive and limitless icon set makes way for additional world views and partialities. Second, the Maki designers could contextualize each icon acknowledging power differentials in their designs and workflows. They could explain their design rationale, as well as the implications of the arm raised at a ninety-degree angle. Reflexive design that examines power and embodied objectivity is imperative for feminist design.

Not a Body–Body: Doctor, Hairdresser, Dentist

A stethoscope is used to symbolize the referent of a "doctor" (Figure 12). The stethoscope is positioned in the upright direction with a slight bend in its tubing. It is drawn in isolation. The stethoscope is not draped across the shoulders of a doctor. There is no bodily form in its sign-vehicle, despite the icon's specific referent, a body trained in medicine. As a result, this icon illustrates a *not a body–body* pair.

The "doctor" is iconic, recognizable, and quickly associated with doctors, but is not denotive like the "police" icon. The "doctor" icon is connotative in that it carries a higher-level meaning. Connotative signs are culturally specific and take more time to understand, but their meanings can be learned over time (Rose 2012). More specifically, the "doctor" icon is a metonymic or associative icon where its sign-vehicle (stethoscope) is related to the body's occupation but is not, in fact, the body itself (Rose 2012, 120). Similarly, the "hairdresser" icon is iconic and is removed from the embodied, physical form of the hairdresser (Figure 12). The scissors are a metonymic cultural convention associated with getting your hair cut. Metonymic icons contrast with synecdochal icons like the tooth depicting "dentist" (Rose 2012, 121). The tooth sign-vehicle symbolizes a bodily referent but is only associated with the part of the body (Rose 2012). Here, I differentiate metonymic icons as tools associated with a specific occupation and synecdochal as a piece of the body that represents the whole. The tooth in the "dentist" icon falls in between the "doctor" and "police" icon on the sign-vehicle continuum (Figure 7).

FIGURE 12 Maki "doctor," "hairdresser," and "dentist" icons reproduced following "CC0 1.0 Universal" status (Mapbox n.d. a).

The "doctor" and "hairdresser" icons (and to some degree the "dentist" icon) disembody their referents by removing the body completely, leaving behind inanimate and associative objects. Feminist perspectives in design emphasize embodiment, and by removing the bodily form, engagement with the body is lost. Borrowing from D'Ignazio and Klein (2018), the bodies are, in fact, missing. The *not a body–body* icons distill the body into inanimate objects, specifically objects related to occupations, and neglect the complexities of embodied experiences. To complicate matters, missing bodies can also be a strategic design choice. Onuoha (2018), for example, recognizes advantages to missing data and missing bodies. Invisibility through lack of collection or, in the case of icons, a lack of design can be a protective shield. This raises the question: bodies or no bodies? Benjamin (2019) finds this same tension in the tech industry where bodies, particularly bodies of color, are either missing altogether or hypervisible. There isn't a "one size fits all" answer to this question.

Feminist theory, however, recognizes situated knowledge and embodied objectivity. The "doctor," "hairdresser," and "dentist" icons embrace the fluidity of subjective bodies by removing the bodily figures altogether. The associative icons push beyond specific bodies and expand the visual imaginary, perhaps making the icon more inclusive. The point here is not to prioritize one feminist principle (embodiment and the presence of bodies) over another (situated knowledge and the absence of universal bodies). Instead, it is critical to weigh context in either scenario. If a bodily figure is added to the icon, who is being portrayed? Is it a default body? Who is missing in our design choices? What power dynamics (often unintentionally) inform our design? Further, if the body is abstracted into an associative icon, how do we recognize the complexity and nuance of the bodies defined by the icon? In choosing associative icons, context completely matters. At the very least, the stethoscope implies Western medicinal practice, the scissors imply a particular type of haircut, and the tooth implies accessibility of healthcare, including dental. Instead, mapmakers must "press pause" to understand and convey the implications of in/visible, missing, or hyper-visible bodies in icon design and mapping, more broadly (Kelly 2019; Kelly and Bosse 2019; Kelly and Bosse Under Review).

Body–Not a Body: Swimming, Soccer, Toilet

The "swimming" icon shows water with a series of jagged angles (Figure 13). Above the water, there is a bodily figure. The figure's head is above water. One arm reaches upward out of the water and bends at the elbow. With this upward motion, the chest and shoulder rotate up and out of the water.

The "swimming" icon is one of fifteen Maki icons that utilizes a body in the sign-vehicle of a non-bodily referent. The referent, "swimming," is an activity and sport that does not refer to

FIGURE 13 Maki "swimming," "soccer," and "toilet" icons reproduced following "CC0 1.0 Universal" status (Mapbox n.d. a).

a specific body. The sign-vehicle is iconic, showing detail in the body's active posture and contextual elements like extremely chopping (and potentially dangerous) waves in the water. The "swimming" icon is also connotative and culturally specific. The icon illustrates specific and prescribed bodily movements. The bodily figure knows how to swim. The body is not drowning. The figure appears athletic, non-disabled, and by default, male.

Icons falling within the *body–not a body* group, particularly the "swimming" icon, sparked my initial inquiry of the Maki icon set. By using body sign-vehicles to symbolize non-body referents such as "swimming," "toilet," "basketball," etc., certain bodies are privileged in relation to the referent. *Body–not a body* icons reflect a default imaginary and expectation of acceptable bodies, bodies that are non-disabled, "straight, white, rich men" (D'Ignazio 2016). Default bodies permeate this icon set. The "soccer" icon, for example, assumes a normative physical capacity in its actions (Figure 13). Additionally, the body's perfected, athletic posture subscribes to conventional notions of health and wellness. The body does not look like a child and does not look like an older individual, fitting an age default. Given the prevalence of whiteness across design, including emoji designs, the Maki icons are presumed to be white. They are also presumed as male based on the gender categorization depicted in the "toilet" icon (more on this below). The icon is recognizable across cultures *because* of its default design. This type of signage limits the scope of inclusion. The mapped bodies become mechanized and disregard bodily differences and various, complex identities in favor of constructed bodies. Outliers and bodies on the margins fall outside of default icon design.

The "toilet" icon performs similarly. Figure 13 depicts bodily figure in a triangular, stiff dress conventionally identified as a woman, and the figure on the right depicts a figure with a broad, rectangular chest typically identified as a man. As a pair, the bodies note and reinforce binary gender and, in turn, prescribes who, in what form, is allowed to use particular toilets. The icons assume a binary and heteronormative relationship between cis-women and cis-men. Non-normative bodies are missing. Together, the bodily figures in the toilet icon define bathroom norms. The "toilet" icon, along with similar renderings, is everywhere, and I am not the first to critique it. The important piece is that while the toilet icon is problematic, similar conventions are applied to all *body–not a body* icons. They all illustrate places or activities (referents) using bodies as their sign-vehicle. Icon design has the power to shape imaginaries and re/enforce action based on default assumptions like gender, race, ability, age, etc. This power requires feminist questions of design. Are bodies needed in the depiction? If so, what options do we have? Can we learn from the *body–not a body* icons like "doctor" that use a stethoscope in their depictions? Could associative techniques like an actual toilet bowl, waves, a basketball hoop, or a soccer ball be used for the "toilet," "swimming," "basketball," and "soccer" icons? By redesigning these icons as associative, binaries and defaults would be disrupted, and the icons would become more flexible and inclusive in their depictions. Associative icons are just one design solution. What other possibilities are there?

Not a Body–Not a Body: Square, Circle, Star

The "square" icon differentiates itself as a geometric icon with a solid black fill (Figure 14). The square is not a bodily sign-vehicle, and its Maki referent is not a body. The "square" is abstracted and inversely related to the "police" icon in terms of iconicity (see Figure 5).

FIGURE 14 Maki's "square," "circle," and "star" icons reproduced following "CC0 1.0 Universal" status (Mapbox n.d. a).

The "square" and other geometric icons like "circle" can represent a range of geographic features, including bodies. They are connotative in that they do not directly depict their referent. They are metonymic and must be learned because they carry a higher-level meaning (Rose 2012). Specificity typically is derived from a legend or a map label directly identifying the icon. When depicting the body, the "square" completely removes the body as part of its sign-vehicle. The "square" could be a police officer, a swimmer, or maybe a cartographer. It could even be a feeling, an experience, or a house plant. The "square" icon provides flexibility in its abstraction.

When depicting the body, the "square" completely removes the body as part of its sign-vehicle. Despite the shape's ambiguity, geometric icons like the "square" can also be powerful. Unlike the "police," "stethoscope," and "swimming" icons, the "square" removes any default presumption or bodily prescription. By lacking iconicity and relatability, specific techniques of the mapped body are removed. Like Haraway's cyborg body Haraway (1991), all binaries are removed when the icon is completely abstracted. Similar to the cyborg, the square shape blurs binary differences between reality/fiction, mind/body, man/woman, white/Black, non-disabled/disabled, young/old, etc. Squares and cyborgs suggest "a way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves" (Haraway 1991, 181). Similar to Google's locative "blue dot," the "square" icon simultaneously recognizes uncertainty in a geographic location or perhaps fluidity in identity, difference, and partial connections. They "offer a way out of binaries and solid identities, a path to … fluidity of the subject" (English and Kim 2013, 222). In other words, the square resists categorization altogether and, instead, opens the door for situated knowledge and difference. Through abstraction, the square might offer inclusive and disruptive design possibilities!

The square also poses a series of important questions. Are there design scenarios where the body is necessary? Are there ways that bodied icons connect to us and draw us in more than abstract shapes? Can we see ourselves in a square? Can squares be emotive? Are they emotionally excited or, perhaps, subdued? Design context is the only way these questions can be truly answered.

FEMINIST ICON DESIGN

Feminist theory asks us to rethink bodies in icons as well as the role of the icon set. While using icon sets, cartographers and icon designers must always question their choice of symbols and assess their hidden meanings and potential impacts. This is particularly important for bodily symbols, especially when they are provided for easy download out-of-the-box. In using an icon set like Maki, understanding your selection is imperative because it specifies and reinforces a world view.

It is equally important to explore the iconography and research the organization providing it. Where did the icon set come from? How was it collated? Who managed it? And most importantly, why was it designed? Do they have documentation supporting their workflow? Have their icons changed over time, and if so, how? Who is included in the design process, and who is included in the icon depictions? What assumptions are baked into their designs? Do they provide multiple icons for the same thing? Questions like these support *data biographies* and *data user guides* that ask journalists, librarians, designers, and the like to explore the histories, processes, and context surrounding particular datasets (D'Ignazio and Klein 2020; Krause 2017). Krause (2017), for example, notes that we need to think of datasets with the same care and attention as we would any source in journalism as a way to unravel inconsistencies, errors, and power imbalances. Further, Stephens (2013) and Geochicas (Yang, Jacquin, and González 2019) illustrate data biographies that empirically analyze gendered discrepancies in OpenStreetMap data, user-generated data that directly shapes local data landscapes. Feminist icon selection is no different. It requires background research, along with reflective and transparent decision-making.

A data biography or *icon set biography* for Maki icons begins by digging into Mapbox's Github page (Mapbox n.d. d). Github provides versioning control, documentation, and collaboration tools for digital projects. At the time of this writing, Mapbox had 835 "repositories" or project folders that organize their tools, designs, updates, and workflows. Maki is one of Mapbox's repositories that focuses on the icon set. Box 1 provides an icon set biography following guidance from Krause (2017). Like data biographies, icon set biographies can vary in the depth of analysis. For this analysis, I manually explored online updates or "commits" to the Maki repository page-by-page to better understand the evolution of the icon designs. Additionally, I examined "issues" recorded in the Maki repository. Issues are tasks, recommendations, or questions that can be created by the public. Each issue is tagged with a "label" (e.g., icon request, question, problem, EMERGENCY, etc.) for organizational purposes. To better assess issues, I analyzed contributor data exported from the Github API on February 17, 2020. Anyone with a Github account, otherwise known as "users," can flag an issue or make recommendations for public repositories like Maki. "Collaborators," unlike users, are invited by the organization and have additional read/write access to the repository. For Maki, collaborators are Mapbox employees that accept/reject major changes. Issues are "closed" when a task is completed with each step documented or dismissed altogether. Drawing on this Github analysis, Box 1 provides a snapshot into the Maki icon set, yet calls for a deeper, empirical analysis similar to Stephens (2013). Lastly, the feminist semiotic analysis presented in this paper adds another dimension to icon set biographies and map design analysis.

Designing individual icons with bodies brings feminist theoretical principles like power, embodiment, situated knowledge, and embodied objectivity into practice. Power is central to feminist theory and icon design. Feminist theory aims to reveal, question, and challenge power structures that are too often invisible and marginalizing. Power was particularly evident in the design of the "police" icon. The direct relationship between its sign-vehicle and referent (*body–body*), its detail, and posture exemplify societal power structures through its design. A feminist redesign of this icon could further examine this power dynamic with associative depictions or subvert its power altogether by removing detail in its design. Figure 15 illustrates alternative design solutions centered on power. The first uses multiple bodies to convey a sense of over-policing and control, reflecting one possible perspective or one partiality. The second uses abstract, "x" symbols to tally up encounters with police, removing power and intimidation through generalization. The

final icon uses a target to subvert and expose police power and challenge policing practices in light of racism and police violence.

Maki Icon Set Biography

Where did it come from?

The Maki icon set (v0.1.1) was released on June 26, 2013, and consisted of 93 icons at three different sizes. Since then, Mapbox has released 20 additional versions of the Maki icon set. The most recent version (v6.2.0) has 187 icons at two different sizes (11x11 and 15x15 pixels). Maki is open-source and has a Creative Commons Zero v1.0 Universal license. As such, the icons are unrestricted in their usage and can be modified and distributed without permission. The icon set is dedicated to the public domain allowing it to reach the largest possible audience, making them prolific in the mapping community.

How was it collected?

Mapbox curates icons in three ways: stock icons, icon requests, and icon contributions. First, stock icons are created by designers at Mapbox. According to a GitHub commit on January 3, 2012, the initial bank of potential icons was based on OpenStreetMap features. Early designs were based on The Professional Association for Design (AIGA) designs (commit from January 9, 2012). These icons provide a baseline or a "stock" of icons for public use. As mentioned, the number of available icons has increased from 93 to 187. On Sep 19, 2016, one Maki contributor opened issue #296 titled "Alternate icons for the same concept." In this issue, collaborators created nomenclature conventions (e.g., "alt" icons) to make multiple icon designs possible for a single feature type. While moving in a more pluralistic direction, the only icons with alternatives in the latest version are building, entrance, and park. Further, icon design edits are tracked using an "enhancement" issue. Issue #428, for example, suggests removing the human from the playground icon and suggests a "playground with slide" in its place. Updates to the design are logged as they are refined, tested, cleaned, and prepared for release.

Second, Mapbox solicits icon requests from the public using GitHub issues. My analysis found 139 issues labeled as icon requests; 91 of the issues have been closed. The 48 open icon requests include, but are not limited to, the following: tunnel, racetrack, mountain biking, gym, taxi, garage, homeless shelter, traffic lights, and cat. There are three important caveats to icon requests. While icon request issues were typically singular, some exceptions grouped several requests into one icon request issue. As such, the reported number of requests is higher than 139 instances. Further, a "closed" icon request does not directly equate to inclusion into the icon set. Some requests were dismissed altogether. Issue #49 included the following concepts as icon requests: human population, government transparency, government regulation, climate change, agriculture, and farm. After review, a Mapbox employee replied with the following response, "We have farm, the other icons don't meet the 'represent common places or things in the world' criteria." This censorship of icon concepts and designs challenges the open and crowdsourced agenda painted above

in Maki's copyright statement. The review process controls icon additions. Lastly, Mapbox solicits icon designs from the general public and provides guidance on their webpage and GitHub. While open for public participation, this workflow requires familiarity with GitHub, its interface, and its jargon. The number of icon design contributions remains ambiguous with the methods used in this analysis.

Who is included in the design process?

At the surface-level, GitHub provides clear documentation for individual contributions to the repository. Forty-four contributors have participated in the Maki repository. Their contributions, however, are heavily varied. The user account, samanpwbb, is the number one contributor to the Maki repository with 212 commits. Samanpwbb is a Mapbox employee that created the repository and was the first to edit it. By comparison, the second-highest contributor (previously employed by Mapbox) has 50 commits. Of the 44 total contributors, over half (26 to be exact) have contributed three or fewer times. It is difficult, however, to calculate contributors that are Mapbox employees without looking into each account and an individual's job history. Further, most icon requests (81) came from 13 unique contributors that work or have most likely worked at Mapbox. By comparison, 26 unique users, who are least likely to be Mapbox employees, requested 32 icons in total.

Most importantly, why was it designed?

In an early GitHub commit from January 5, 2012, the Maki repository noted, "Maki is a point of interest icon set intended for use with Tilemill maps" (a mapping platform that is no longer supported). Today, the Mapbox website states that the Maki icon set was "made for map designers," shifting the "why" behind the icon set (Maki 2019b). The initial commit does not mention that the icon set is crowdsourced and open-source. Further, there is no mention of the creative commons copyright leading me to believe that the Maki was initially used as a proprietary icon set for use within the Tilemill platform. Open versus proprietary is an important distinction in thinking through this particular icon set's origins and vision. Maki was designed to fill specific company needs, not the mapping community at large. In other words, the original icon set was designed to support its own world view.

Mapmakers and designers alike turn to icon sets like Maki to save time. Like many icon sets, Maki icons can be downloaded and imported directly into interactive maps worldwide, alleviating the need to create our own. Icons generally provide context to any given map. Having out-of-the-box icons gives us time to focus on the overlying data or stories in an interactive map instead of focusing on icons that are often inconspicuously placed within the base map. Given their supposed universality, the icons can be shared and streamlined into collaborative workflows. This further alleviates the time needed to brainstorm, design, test, and incorporate individual icons. With Maki, Mapbox offloads the burden of icon design and decision making. Drawing on Ruha Benjamin's (2019) work on race and technology, this offload of responsibility and intent further re-inscribes sociocultural norms and default assumptions. Individually or in aggregate, the Maki icons present a limited world view.

FIGURE 15 Alternative icon designs for police that draw on and subvert power.

BOX 1

Cartographic design and the symbolization of bodies in maps are situated practice. Map design is contingent on our context, experience, and positionality. Cartographers select what to map (and what not to map) and how to convey that information or story. Reflexivity requires us to critically assess the power and impact of our positionally through transparent decision-making processes. The smallest map elements are similarly situated, yet icon sets like Maki are meant to present icons that fit across all mapping contexts. This is perhaps the largest tension within my feminist semiotic analysis. Maki icon design reflects the assumptions, perspectives, and world views of the designers that created them. Default bodies and default designs do not fit across all contexts.

Feminist icon design further re-conceptualizes icon sets like Maki as a whole, which raises the question, what would a feminist icon set include? A feminist icon set blends and expands existing icon set models. As an example, Maki utilizes a Github page to track changes to their icons and solicit icon ideas and edits from a larger audience. The public is asked to "push" changes to their Github archive. While relatively open, there are several barriers to contributing to the Maki icon set. With its "push, pull, clone, commit" jargon, Github is a daunting feat for many novice-users. Submitting icons with Maki's specifications requires design "know-how" and technological resources to create pixel-perfect designs with 11 × 11 or 15 × 15 pixels. A feminist icon set could make crowdsourcing easier by incorporating a more user-friendly and broadly accessible platform for gathering icons and ideas in whatever form they are designed, whether digital, sketch, tactile, or descriptive icons. An inclusive platform would empower a broader collective of mappers and designers, supporting icons that relate to more people.

Since 2016, Maki has included alternative options for a small selection of their icons (e.g. "park," "alt park," "entrance," and "alt entrance" in Figure 3). The "entrance" icon is the only Maki icon related to bodies that provides a secondary option. Icon platforms like the Noun Project provide a more nuanced and pluralistic approach. The Noun Project website allows us to search for an icon like "park," to gather numerous design interpretations from various designers. Icon designs are then downloaded and used with attribution to the website and original designer. A feminist icon set could similarly collate a gallery of icons for all referents, not just those related to bodies. This pluralistic approach would, in the words of D'Ignazio and Klein (2016), would move the icon set "away from its current emphasis on 'objective' presentation in favor of designs that facilitate pathways to multiple truths." Further, a feminist icon set would contextualize each icon submission making space for design explanations, usage, and reflexivity. Who created it, and why? What is the icon meant to portray? What power dynamics inform its viewpoint? What does the icon do well, and what are its limitations? What design contexts has the icon been used in? A feminist icon set would prioritize context

over product, supporting a wider and more inclusive swath of bodied and unbodied icons available to us.

CONCLUSION

Despite exciting work in feminist design and mapping, there remains room to create alternative cartographic languages that grapple with bodies, embodiment, and map symbols. Feminist critiques of objectivity inherently question the role of universal icon sets and, instead, ask for situated context across designs. Default designs exemplify the power differentials within systems of oppression. Feminist design frameworks work toward recognizing and dismantling default design by situating design and designers within context and power constructs. Bodies in maps do not have to be homogeneous and silenced: they can be embodied, nuanced, and powerful. In response to Rose (1993, 31), mapped bodies can be *colorful*.

In sum, icon design needs feminist theory. Feminist icon design poses new questions and design possibilities that prioritize feminist principles, like bodies, embodiment, situated knowledge, context, and power. In this paper, I apply a feminist semiotic analysis to Maki icons—a prominent open-source mapping icon set—as one way to understand and problematize how bodies are depicted, abstracted, or erased. More specifically, I analyze the techniques utilized in their symbolization, including the presence/absence of bodily forms, the presence/absence of an embodied object, and the iconicity of a given icon. Semiotics offers one approach, a representational approach, to understand the intersection between icon design, bodies, and feminist theory. My feminist analysis reveals the underlying ideologies, silences, defaults, and power dynamics in Maki icons that depict bodies. I argue that cartographers and designers need to rethink the depictions of bodies in map symbolization and the role of "universal" icon sets, more broadly, through a feminist lens.

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REFERENCES

Benjamin, R. 2019. *Race after technology: Abolitionist tools for the new jim code*. Cambridge, UK: Polity Press.

Brown, M., and K. Larry. 2008. Queering the Map: The productive tensions of colliding epistemologies. *Annals of the Association of American Geographers* 98 (1):40–58. doi:10.1080/00045600701734042.

Caquard, S. 2015. Cartography III: A Post-representational perspective on cognitive cartography. *Progress in Human Geography* 39 (2):225–35. doi:10.1177/0309132514527039.

Chandler, D. 2002. *Semiotics: The basics*. New York, New York: Routledge.

Chief Lady Bird. 2018. Aaniin everyone! Happy friday! I am so so so honoured that i was asked to create an emoji for #indigenoushistorymonth. *@chiefladybird* (blog). Accessed June 1, 2018. https://twitter.com/chiefladybird/status/1002595976002105346?lang=en

Collins, P. H. 2009. *Black feminist thought: Knowledge, consciousness, and the politics of empowerment*. New York, New York: Routledge.

Combahee River Collective. 1977. The combahee river collective statement.

Costanza-Chock, S., 2018. Design Justice: Towards an intersectional feminist framework for design theory and practice. Proceedings of the Design Research Society 2018. https://ssrn.com/abstract=3189696

Costanza-Chock, S. 2020. *Design justice: Community-led practices to build the worlds we need*. Cambridge, Massachusetts: MIT Press.

Crampton, J. W. 2009. Cartography: Maps 2.0. *Progress in Human Geography* 33 (1):91–100. doi:10.1177/0309132508094074.

Crampton, J. W. 2010. *Mapping: A critical introduction to cartography and GIS*, Vol. 11. West Sussex, UK: Wiley-Blackwell.

Crenshaw, K. 1989. Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *University of Chicago Legal Forum*, 139–67.

D'Ignazio, C. 2016. Designing for other (than straight, white, rich men). *Medium*. Accessed October 7, 2016. https://medium.com/mit-media-lab/designing-for-other-than-straight-white-rich-men-b144481ec8a1

D'Ignazio, C., and L. F. Klein. 2016. Feminist data visualization. Workshop on Visualization for the Digital Humanities (VIS4DH), Baltimore. IEEE.

D'Ignazio, C., and L. F. Klein. 2018. *Data feminism*. Cambridge, Massachusetts: The MIT Press Open. https://bookbook.pubpub.org/data-feminism.

D'Ignazio, C., and L. F. Klein. 2020. *Data feminism*. Cambridge, Massachusetts: MIT Press.

Elwood, S., and A. Leszczynski. 2018. Feminist digital geographies. *Gender, Place & Culture* 25 (5):629–44. doi:10.1080/0966369X.2018.1465396.

English, D. K., and A. Kim. 2013. Now we want our funk cut: Janelle Monáe's neo-afrofuturism. *American Studies* 52 (4):217–30. doi:10.1353/ams.2013.0116.

Ferzoco, J. (2018) The new LGBT neighborhood: Everywhere. Paper presented at North American Cartographic Information Society, Norfolk, Virginia, October. Accessed September 25, 2020. https://www.youtube.com/watch?v=b3ctGGDGuxs

Fraser, M., and M. Greco. 2005. *The body: A reader*, ed. M. Fraser and M. Greco, New York, New York: Routledge.

Gieseking, J. J. 2018. Size matters to lesbians, too: Queer feminist interventions into the scale of big data. *The Professional Geographer* 70 (1):150–56. doi:10.1080/00330124.2017.1326084.

Graziani, T., and M. Shi. 2020. Data for justice. *ACME: An International Journal for Critical Geographies* 19 (1):397–412.

Haraway, D. 1988. Situated knowledges: The science question in feminism and the privilege of partial perspective. *Feminist Studies* 14 (3):575–99. doi:10.2307/3178066.

Haraway, D. 1991. *Simians, cyborgs, and women: The reinvention of nature*. New York, New York: Routledge.

Harding, S. G. 1986. *The science question in feminism*. Ithaca, New York: Cornell University Press.

Harley, J. B. 1989. Deconstructing the Map. *Cartographica: The International Journal for Geographic Information and Geovisualization* 26 (2):1–20. doi:10.3138/E635-7827-1757-9T53.

Horsky, N. n.d. Symbology of struggle. *Horskyproject*. Accessed March 4, 2019. http://horskyprojects.com/projects/selections-from-a-symbology-of-struggle/

Kanarinka, F. A. 2006. Art-machines, body-ovens and map-recipes: Entries for a psychogeographic dictionary. *Cartographic Perspectives* 53 (53):24–40. doi:10.14714/CP53.360.

Kelly, M. 2015. Mapping syrian refugee border crossings: A critical, feminist perspective. Thesis, University of Kansas.

Kelly, M. 2019. Mapping syrian refugee border crossings: A feminist approach. *Cartographic Perspectives* 93:34–64.

Kelly, M., and A. Bosse. 2019. Mapping and positionality: A call for reflection and action. Paper presented at the North American Cartographic Informatio Society, Tacoma, Washington, October 17.

Kelly, M., and A. Bosse. Under Review. *Pressing pause, 'doing' feminist mapping*. ACME: An International Journal for Critical Geographies.

Kitchin, R., and M. Dodge. 2007. Rethinking maps. *Progress in Human Geography* 31 (3):331–44. doi:10.1177/0309132507077082.

Knigge, L., and M. Cope. 2006. Grounded visualization: Integrating the analysis of qualitative and quantitative data through grounded theory and visualization. *Environment and Planning A* 38 (11):2021–37.

Knigge, L., and M. Cope. 2009. Grounded visualization and scale: A recursive analysis of community spaces. *Qualitative GIS: A Mixed Methods Approach* 95–114.

Krause, H. 2017. Data biographies: Getting to know your data. *Global Investigative Journalism Network*. Accessed September 25, 2020. https://gijn.org/2017/03/27/data-biographies-getting-to-know-your-data/.

Kwan, M.-P. 2002. Feminist visualization: Re-envisioning GIS as a method in feminist geographic research. *Annals of the Association of American Geographers* 92 (4):645–61. doi:10.1111/1467-8306.00309.

Kwan, M.-P. 2008. From oral histories to visual narratives: Re-presenting the post-september 11 experiences of the muslim women in the USA. *Social & Cultural Geography* 9 (6):653–69. doi:10.1080/14649360802292462.

Ladin, J. 2014. I am not not me: Unmaking and remaking the language of the self. *Lambda Literary*. Accessed September 25, 2020. https://www.lambdaliterary.org/2014/12/unmaking-and-remaking-the-language-of-the-self/

Longhurst, R. 1995. Viewpoint: The body and geography. *Gender, Place & Culture* 2 (1):97–106. doi:10.1080/09663699550022134.

Loukissas, Y. A. 2019. *All data are local: Thinking critically in a data-driven society*. Cambridge, Massachusetts: MIT Press.

Lucchesi, A. 2019a. Mapping geographies of canadian colonial occupation: Pathway analysis of murdered indigenous women and girls. *Gender, Place & Culture* 26 (6):868–87. doi:10.1080/0966369X.2018.1553864.

Lucchesi, A. 2019b. Decolonizing cartography: Revitalizing indigenous mapping traditions and mapping against settler occupation. Paper presented at Doing Critical GIS Workshop, Balitmore, Maryland, April 1.

MacEachren, A. M. 1995. *How maps work: Representation, visualization, and design*. New York, New York: Guilford Press.

Mapbox. n.d. a. Maki icons. *Mapbox*. Accessed September 25, 2020. https://labs.mapbox.com/maki-icons/

Mapbox. n.d. b. About mapbox. *Mapbox*. Accessed September 25, 2020. https://labs.mapbox.com/maki-icons/guidelines/

Mapbox. n.d. c. Showcase | Mapbox. *Mapbox*. Accessed September 25, 2020. https://www.mapbox.com/showcase/

Mapbox. n.d. d. Mapbox. *GitHub*. Accessed September 25, 2020. https://github.com/mapbox

McGill, A. 2016. Why white people don't use white emoji. *The Atlantic*. Accessed May 9, 2016. https://www.theatlantic.com/politics/archive/2016/05/white-people-dont-use-white-emoji/481695/

McKay, A. F. 1889. The man of commerce. https://www.wdl.org/en/item/6770/.

Muehlenhaus, I. 2012. If looks could kill: The impact of different rhetorical styles on persuasive geocommunication. *The Cartographic Journal* 49 (4):361–75. doi:10.1179/1743277412Y.0000000032.

Münster, S. 1570. Europe regina. https://commons.wikimedia.org/wiki/File:Europe_As_A_Queen_Sebastian_Munster_1570.jpg

Nestel, C. n.d. Sum. http://nestelmaps.azurewebsites.net/Content/images/BodyMap-Web.jpg.

Nöth, W. 1995. *Handbook of Semiotics*. Bloomington: Indiana: Indiana University Press.

Noun Project. n.d. The noun project. https://thenounproject.com.

Onuoha, M. 2018. *MimiOnuoha/missing-datasets*. https://github.com/MimiOnuoha/missing-datasets.

Pearce, M. W. 2008. Framing the days: Place and narrative in cartography. *Cartography and Geographic Information Science* 35 (1):17–32. doi:10.1559/152304008783475661.

Price, J., and M. Shildrick. 1999. *Feminist theory and the body: A reader*. New York, New York: Routledge.

Queering the Map. n.d. https://www.queeringthemap.com/.

Ricker, B. 2017. Reflexivity, positionality and rigor in the context of big data research. In *Thinking big data in geography: New regimes, new research*, ed. J. Thatcher, A. Shears, and J. Eckert, 96–118. Iowa City: University of Iowa Press.

Rose, G. 1993. *Feminism & geography: The limits of geographical knowledge*. Minneapolis: University of Minnesota Press.

Rose, G. 2012. *Visual methodologies: An introduction to researching with visual material*. London, UK: Sage.

Rosenfeld, H., S. Moore, E. Nost, R. E. Roth, and K. Vincent. 2017. Chernoff zombies. Paper presented at North America Cartographic Information Society, Montréal, Canada, October 12. https://www.youtube.com/watch?v=CGTfBll_sas

Schuurman, N. 2000. Trouble in the heartland: GIS and its critics in the 1990s. *Progress in Human Geography* 24 (4):569–90. doi:10.1191/030913200100189111.

Slocum, T. A., R. M. McMaster, F. C. Kessler, H. H. Howard, and R. B. McMaster. 2009. *Thematic cartography and geographic visualization*. Upper Saddle River, New Jersey: Pearson.

Sovereign Bodies Institute. n.d. https://www.sovereign-bodies.org.

Sprunk, D. 2010. Geography of the body. In *Encyclopedia of geography*, ed. B. Warf, 289–91. Thousand Oaks: Sage. doi:10.4135/9781412939591.

Stephens, M. 2013. Gender and the GeoWeb: Divisions in the production of user-generated cartographic information. *GeoJournal* 78 (6):981–96. doi:10.1007/s10708-013-9492-z.

Tyner, J. A. 1982. Persuasive cartography. *Journal of Geography* 81 (4):140–44. doi:10.1080/00221348208980868.

UCGIS. 2019. Cartography and visualization. *GIS&T Body of Knowledge*. https://gistbok.ucgis.org/knowledge-area/cartography-and-visualization

Vision Archive. n.d. http://www.visionarchive.io/#/

Welles, B. 2014. On minorities and outliers: The case for making big data small. *Big Data & Society* 1 (1):205395171454061. doi:10.1177/2053951714540613.

Westerveld, L., and A. K. Knowles. 2018. I was there. *Visionscarto*. https://visionscarto.net/i-was-there.

Wood, D., and J. Fels. 1992. *The power of maps*. New York, New York: Guilford Press.

Yang, S., C. Jacquin, and M. González. 2019. Geochicas: Helping women find their place on the map. *The Mapillary Blog*. https://blog.mapillary.com/update/2019/05/28/putting-women-on-the-map-with-geochicas.html

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