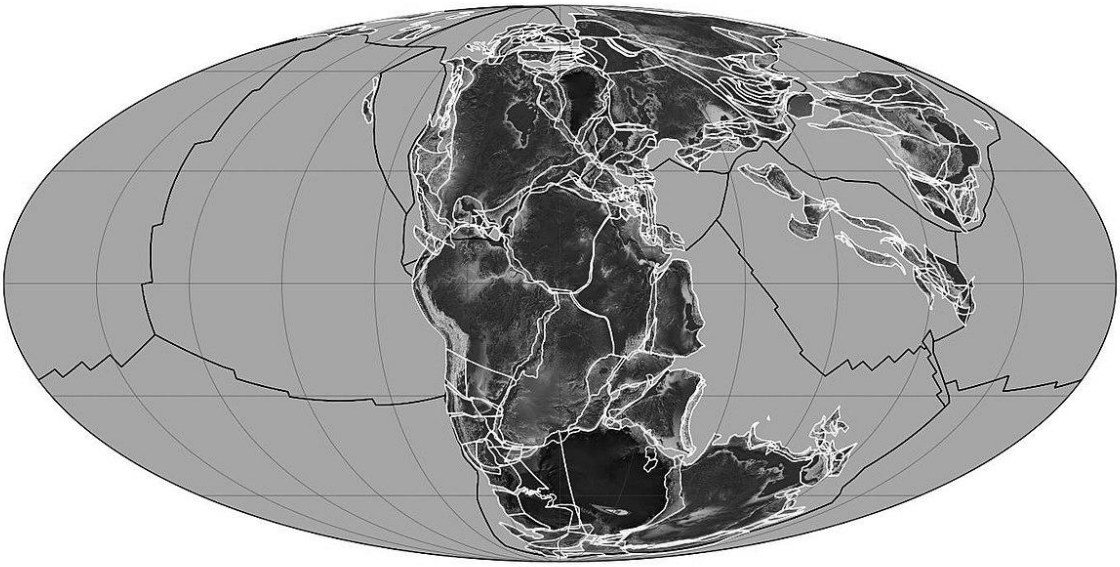
Maps Matter!

How Choices in the Display of World Map Projections Are Related to the Perpetuation of Othering



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Cover:

Figure 0

Pangea200Ma

Note. Original caption: “Map of Pangaea 200 million years ago. Mollweide projection centred on 0°,0°. Made using GPlates and data sets listed below:[1] Amante, C. and Eakins, B. W. 2009., Matthews, K.J., et.al., (2016). Global plate boundary evolution and kinematics since the late Paleozoic, Global and Planetary Change, 146, 226-250., Müller, R.D., et.al, 2016. Ocean Basin Evolution and Global-Scale Plate Reorganization Events Since Pangea Breakup, pp. 107.” Adapted From F. Clamosa, 2019, Wikimedia Commons. CC BY-SA 3.0

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Thank you

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Abstract

This thesis seeks to strengthen the gap in the literature about the moral implications of certain choices made in the display of world map projections by answering the research question: ***How can the phenomenology of world map projections perpetuate injustice?*** In the existing debate, normative arguments about cartographic standards tend to be combined with social theory and the moral reasons for why one map projection or display should be used over another. Through the lens of postphenomenology and the theoretical framework of Othering, I seek to clarify the relationship between norms that govern the projection, cardinal orientation, and centering of a map with their moral implications. It is first established how the choices in the display of map projections have a moral dimension in addition to a normative one. Specifically, North-up Eurocentric map projections with shape distortions that favor more powerful regions serve to subtly reinforce and perpetuate the kind of Othering that is rooted in contemporary global power dynamics. In answering the subsequent research question: ***Are there moral reasons to determine which world map projection should be used?,*** it is suggested that morally conscientious choices in the display of world map projections should be made not with a set of rules or negative conditions, but with the general framework of belongingness as a guide.

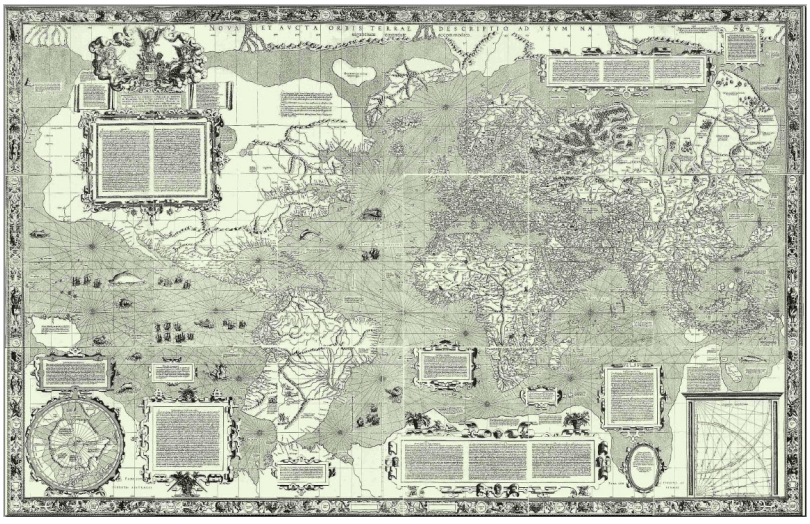
0) Introduction

In 1986, the Committee on Map Projections of the American Cartographic Association (ACA) published a pamphlet aimed at general audiences entitled *Which Map Is Best? Projections for World Maps*. This pamphlet aimed to educate and inform both "those who display maps and those who look at them" about the various map projections available to use as representations of the world, and their respective drawbacks and benefits (American Congress of Surveying and Mapping, 1986: 1). Most of these drawbacks had to do with the type of distortion that each map projection produces: whether in relative *size*, deformed *shapes*, depiction of *distance*, or in showing the shortest *route* as a curved line (Ibid.). Given that distortion is inevitable in all map projections, and especially so at a global scale, the type of distortion together with other display choices such as cardinal orientation and longitudinal centering are normative choices that the person displaying the map projection must make. Within the greater field of cartography this is established knowledge, and the debate has entered the public realm as well.

Often, however, the moral claims that some world maps are more unjust than others are presented with images and analysis that might make sense on an intuitive level but are not investigated or explained satisfactorily. A commonly used projection, the Mercator **[Figure 1]**, greatly distorts both size and shape of land masses near the poles, but has the benefit ot showing "compass directions between places as straight lines," which served its primary use starting in the 16th century for sea navigation in colonial exploration and conquest (Turnbull 1989:5).

Figure 1

The 1569 Mercator projection

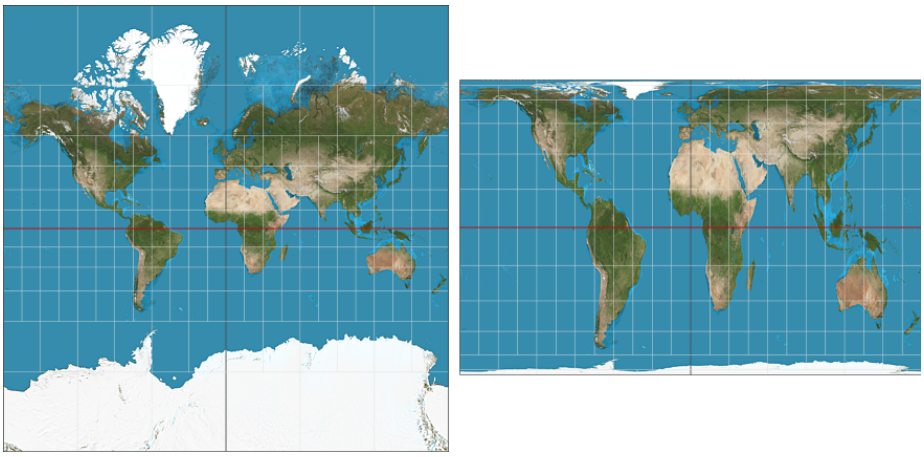


Note. Map by Gerardus Mercator. (1569). Nuno Tavares. 2008, Wikimedia Commons. Public Domain.

The Mercator continues to be employed as a general-use map today for reasons that perplex and frustrate those who are aware of its history and of the existence of "better" map projections. An example that I will revisit in subsequent sections of this paper is the case of the Massachusetts public school system in the United States that adopted the Gall-Peters projection **[Figure 2, right]** to replace the Mercator projection in classrooms statewide: this decision was reportedly made in the interest of "fairness," and of "decolonizing the curriculum" (Walters, *The Guardian,* 2017).

Figure 2

The Mercator Projection displayed on the left, with the Gall-Peters to the right



Note. Adapted from by Daniel R. Strebe, 2011, Wikimedia Commons. CC BY-SA3.0

Representatives of the school district explained their decision by stating that the Gall-Peters contributes to "decolonizing the curriculum" because it shows the relative sizes of regions accurately (ibid.). However, this explanation leaves an important question open: why is representing the sizes of regions accurately the most important factor for fairness? Besides regional size accuracy, are there other factors that would contribute to a "fairer" map? World maps are thus never neutral representations of Earth's geography. Moreover, certain choices in

the display of projections that continue to be used shape our perceptions of the world in ways that are arguably unjust, or so I argue here.

The central research question in this thesis is: ***How can the phenomenology of world map projections perpetuate injustice?*** On the basis of answering that question, I also discuss the subsequent research question: ***Are there moral reasons to determine which world map projection should be used?*** My aim is to argue that the choice of a world map projection can play a role in perpetuating structural injustice by way of Othering. After establishing the *normative* factors in choosing projections for displaying world maps, I go on to defend my central thesis: that these choices also have a *moral* dimension. I argue for this by analyzing examples through the lens of postphenomenology and the conceptual frameworks of Othering, and through this clarifying the link between map projections and the mediating effects that they have on the map viewers' perceptions, including their worldviews, preconceptions about power, and sense of identity.

In the rest of this expository chapter, I further explain my methodology, the focus on world map projections, and the distinct contribution made to cartographic ethics.

Why world maps?

The debate about the moral implications/ethical parameters for choosing map projections often occurs while addressing the many different scales of maps, from hyperlocal to local to global. My thesis will focus specifically on *world map* projections. I focus on world maps due to the fact that the nature of a world map projection, as a two-dimensional depiction of the surface of our spherical planet, are technological artifacts that allow us to conceptualize the planet as a whole. Their nature as projections also dictates that relevant questions regarding these maps would include the best way to depict all land and water masses in relation to each other. This in turn raises the question of how these depictions influence our perceptions of those relationships, and how this might then go on to influence our general knowledge of Earth's geography or the significance of some regions over others. From here questions can be raised about one's relation to the world, especially in a globalized society that increasingly emphasizes national membership as a central aspect of an individual's identity (Wright 2014).

Narrowing the scope of my thesis further is the focus on world map *projections*. I concentrate on projections as opposed to other forms of mapping in order to argue in a cohesive/ succinct manner about how a specific technology (in this case, map projections) and its applications (in this case, which projection is applied to a three-dimensional Earth to turn it into a two-dimensional map, in what way that projection is oriented cardinally, and which longitude it centers) can mediate the viewer's perceptions. Often, in addition to geographical information world map projections also contain political information, such as the borders of nations, but this is outside of the scope of this thesis.

Authority, cartography, and ethics: using postphenomenology as a clarificatory tool

There is a strong tradition of analyzing authority in social and cultural studies. Edward Said characterizes authority as "virtually indistinguishable from certain ideas it dignifies as true, and [...] above all, [it] can, indeed must, be analyzed" (2019 [1978], 19-20). World maps and cartography have been challenged as a form of authority within this tradition: Kupar (2015, 93) claims that "the ways we map are inextricable from violent forms of power," and Omrow (2020, 22-23) puts forward a framework of abyssal othering as a way to link critical geography with cartography such that it "disrupts academic cartography by linking epistemologies of geography with power." [1]

The existing literature in cartographic ethics, however, oscillates between ethics for the field of cartography and the ethics of presenting distorted maps. Cartography as a field concerns itself primarily with the making of maps, and so debates of ethics within cartography tend to follow both the definition of ethics within a given field, such as various considerations to make when designing maps for government versus private clients (McHaffie et. al 1990, Harley 1991, Crampton 1995, Perkins 2004) together with critical claims about how cartographic choices have ethical consequences outside the field (American Cartographic Association 1986, The Cartographic Journal 1989, Castex 1993, Fotiadis 2009, Wright 2014). These 'ethics' are very different but are often muddled, incorporating arguments from social theory and addressing maps at local and global scales, maps with borders, and map projections within the same papers. This

[1] My analysis has some aspects in common with Omrow's approach in that it criticizes cartographic methods as perpetuating othering, but argues a weaker thesis in contrast to Omrow's conception of 'abyssal' othering to embrace a framework of Othering and belongingness.

thesis regards a narrow focus within this debate, and as mentioned above, looks at world map projections as technological artifacts with the goal of linking cartographic norms with the mechanisms of dominance, specifically the phenomenon of Othering. I attempt to identify and link the perpetuation of specific norms in the display of world map projections with their moral consequences. Postphenomenology will function as a tool to clarify the connection between the choice of map projection and their moral influence.

The use of images

This thesis will employ the use of images as visual aids due to the fact that many of the arguments hinge on the visual factors of the maps in question.

1) Established debate in the world of cartography: the normative factors

In the first chapter of this thesis, I explain the basic mechanism of how a map projection works to translate the spherical surface of Earth onto the two-dimensional surface of a map. I introduce the various normative choices that go into the display of a world map projection, and explain the implied moral norms in the established debate. Finally, I introduce two relevant but less-acknowledged aspects: longitudinal centering and cardinal orientation.

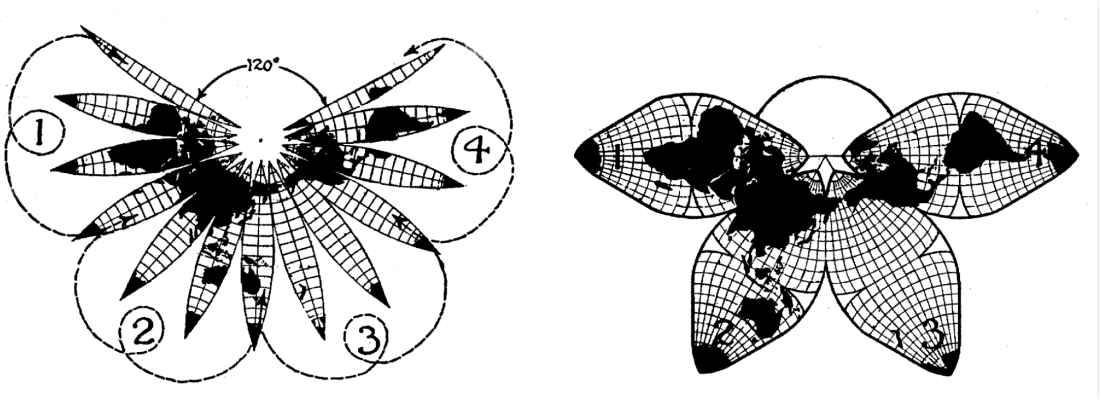
1.1) The nature of a map projection

The four distortion factors that come up when translating a 3D sphere onto a 2D surface are 1) *shape distortion*, in which "shapes of regions are deformed" 2) *size distortion* in which "sizes of regions appear larger or smaller [relative to] the globe" 3) *distance distortion* where "distances between points are shown as longer or shorter than [they are] on the globe" and 4) *route distortion* where "direct routes between points are not shown as straight lines" (American Cartographic Association 1986, 4). Distortion occurs in all three-dimensional to two-dimensional translations of the spherical surface of Earth onto a flat, two-dimensional map.

Introduction to cartography classes often use the analogy of peeling an orange and sticking it onto a flat surface to express the difficulty of the task. The peel of a spherical orange, laid flat on the table, does not form a continuous flat plane but instead has many gaps where the peel had to be torn in order to make it flat. Thus, in order to present a continuous image of the surface of a sphere on a 2D surface, distortion is inevitable. In **Figure 3,** a butterfly projection shows the Earth as if 'peeled' like an orange.

Figure 3

Flattening the globe



Note. Original caption: "The common sense origin of the Butterfly map. From *A World Map to End All World Maps, (98).* By B.J.S. Cahill, 1934, Taylor & Francis Ltd. on behalf of Swedish Society for Anthropology and Geography.

To create a visually cohesive representation of the curved surface of Earth on a flat surface like paper, mapmakers employed projections. Projections are mathematical tools (technologies) used to translate the 3D surface of the globe into a 2D representation. In **Figure 4**, the differences between a *cylindrical projection,* a *conical projection,* and an *azimuthal projection* are shown. Though all three are map projections, they produce starkly different results. Many maps employ a combination of projection methods to achieve the final visual result.

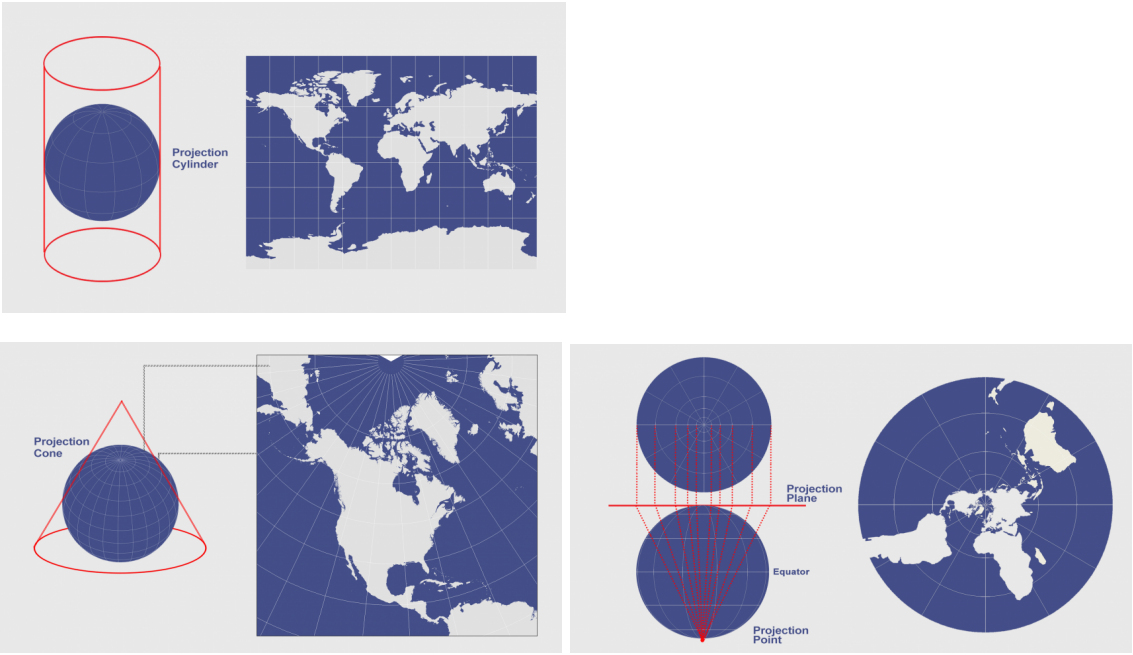


Figure 4
Clockwise from top left: a cylindrical projection, a cone projection and an azimuthal projection
Note. Adapted from GISGeography. (2021). Copyright 2022 by GIS Geography.

The "best" map projection for a cartographer (whose standards might include accuracy, function, or utility) would be the one that minimizes all four distortion factors, or optimizes the distortion for the specific intended use of the map. For the purposes of a world map intended for general use, this might be accuracy, or a realistic representation. However, due to the tradeoff nature of distortions in map projections, there is no one objectively 'best' option. Choosing a map projection is always a compromise, and cartographers argue that the choice of which compromise to make should be one based on practical intended usage (American Cartographic Association 1986, 2).

1.2) Normative arguments for and against certain projections

The main purpose of most two-dimensional world maps today is to inform the user about the geography of the Earth. World maps are no longer used by one empire or the other to express power over land claims. Nor are maps primarily used anymore to navigate the seas on colonial conquests. Outside the world of cartography, however, people who display maps are often uncritical of the type of projection used to convey Earth's geography. This could be for a range of reasons, among them the unquestioned acceptance, or an unarticulated norm, that one map is 'standard,' looks more 'normal' or 'right,' or that it is rectangular and therefore easier to use. A prime example of this phenomenon is the Mercator projection (see figure 1). A cylindrical projection that greatly increases the sizes of land masses approaching the north pole, it has retained its status as a 'standard' map since its original publication in 1569 (Pater 2016, 154). This is despite the fact that the Mercator's original innovation, to take account of the curvature of Earth for better navigation at sea has been rendered obsolete.

The Gall-Peters (see figure 2) is another cylindrical projection that is often turned to as an alternative to the Mercator, as in the example of the Massachusetts schools laid out in the introduction. As an equal-area map that minimizes size distortion, it is purportedly 'fairer' and less 'colonial' than the Mercator. The equal-area nature of the Gall-Peters, however, comes at the cost of severe shape distortion, squeezing vertically and stretching horizontally closer to the poles and stretching vertically and squeezing horizontally around the equator. Some cartographers would argue against the use of the Gall-Peters for general use due to the fact that, as a cylindrical projection, it is rectangular in shape and thereby promotes conceptions of Earth that deviate greatly from the reality that "...earth is round with a coordinate system composed entirely of circles" and would argue for world maps that are curved or elliptical as a better alternative (see figure 4 in section 1.3) (The Cartographic Journal 1989, 157). Others rail against the use of the shape-distorted Gall-Peters to replace the 'colonial' Mercator projection when other, less shape-distorted projections are also available (Šavrič, Patterson & Jenny 2019. These arguments seem to be invoking cartographic norms as a way to describe the moral merits or demerits of one map display over another.

1.3) The implied moral reasons for and against certain projections

The American Cartographic Association (ACA) argued that a critical eye is necessary when choosing any world map to display. They claimed that:

> "A poorly chosen map projection can actually be harmful. We tend to believe what we see, and when fundamental geographical relationships, such as shapes, sizes, directions, and so on, are badly distorted, we are inclined to accept them as fact if we see them that way on maps. This can lead to very wrong impressions, for example […] that North America is larger than Africa. Our mental maps, the brain's geographical "data base," are generated only from what we look at. Since globes are uncommon, most mental images of the earth come from flat maps. A badly distorted map seen regularly (such as one on a television news program backdrop) will look familiar after a while and thus "look right." This can cause one's mental map of the world to become permanently warped." (ACA 1986, 2)

Indeed, other sources introduced in prior sections of this paper have invoked the 'rightness' or 'wrongness' of world maps based on how they might perpetuate harmful preconceptions.

Cartographer's associations have been railing against the use of rectangular world maps [**Figure 4]** since the late 1980s, based on the argument that "showing the round earth as having straight edges and sharp corners" is wrong due to the fact that it promotes "serious, erroneous conceptions by severely distorting large sections of the world" (The Cartographic Journal, 1989). They instead strongly recommend the use of rounded map projections **[Figure 5]** that imply a spherical Earth (ibid).

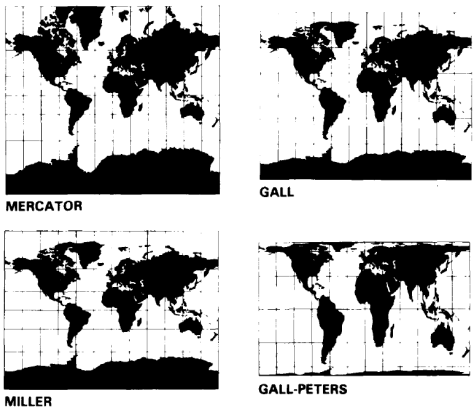


Figure 1. Unacceptable projections for general purposes.

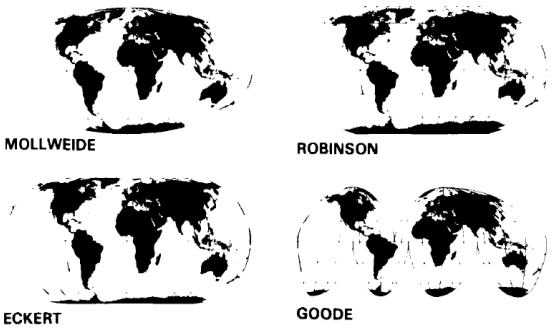


Figure 2.
Preferable alternative projections for maps of the world.

Figures 4 and 5
Rectangular world maps alongside rounded world maps
Note. From *The Case Against Rectangular World Maps*. Copyright by The Cartographic Journal, 1989.

The group of cartographer's associations that signed *The Case Against Rectangular World Maps* goes so far as to claim that portraying a heavily distorted map is morally wrong for the reason that it promotes misconceptions. However, they do not elaborate on *what* exactly these misconceptions are, *how* these misconceptions can be harmful, and thus, *why* the rounded projections are really morally worse than other, rectangular ones.

In the Massachusetts school case, it seems that the choice to switch to the Gall-Peters projection was based on the assumption that displaying the sizes of regions with an equal-area projection was a 'fairer' way of portraying the world, and that by instilling this equal-area image of the world into their students, they had improved upon the status quo. However in this case both the cartographic and moral rationale for choosing the Gall-Peters projection remain unarticulated. They do not explain *why* an equal-area map is so important to have, even at the expense of severe shape distortions.

1.4) Less established debate in the world of cartography

Up to this point I have introduced the most common debates and issues that come up in the normative choices made in displaying map projections for general use. Though the topic of projection choice usually takes center stage in this debate, there are two additional, less-commonly raised issues that are equally important: longitudinal centering and cardinal orientation.

Longitudinal centering

The American Cartographic Association defines maps as *normal* when a map is "centered at the equator, the graticule [grid that the map is displayed on] will appear orderly and symmetrical around two straight lines: the equator and meridian in the center of the map" (ACA 1986, 4). [2] The *equator* is the line that is created by the plane that perpendicularly bisects Earth's axis. In contrast to this, choosing a *meridian*, or longitude, to center a world map around is a much more arbitrary choice. There are 360 meridians on a world map, starting at 0 degrees and going to 180 degrees in the east and west directions **[Figure 6].**

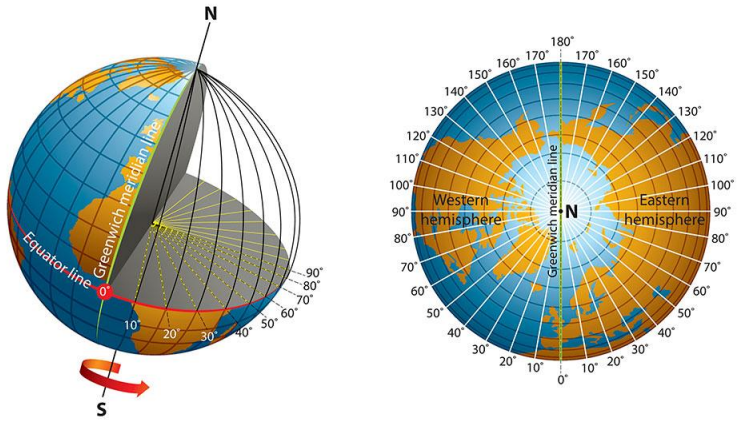


Figure 6

Longitudes, the equator, and the prime meridianNote. From NOAA, National Oceanic and Atmospheric Administration, 2022.

[2] These maps are also referred to as *conventional* but due to the fact that other literature in the social sciences use the term "conventional" to refer to the idea that a map is not readable without the knowledge of certain conventions, I will not use this term in reference to world maps.

It is a cartographic norm to center the *prime meridian,* or the line of zero degrees, in world maps, and because the line of zero degrees runs through Greenwich, UK, (a norm decided at the 1884 International Meridian Conference) this results in most world maps using a longitudinal centering that puts the region of Europe and Western Africa in the middle of the map.

Other maps centering other regions exist, most notably the Sinocentric world map. This centering is credited to Jesuit priests in China, who in the 1600s adapted a Eurocentric map to Chinese sensibilities by centering that region in the map **[Figure 7]**.

Figure 7
Wanguo Quantu
Note. By World Imaging, 2008. Wikimedia Commons. Public Domain.
In general, world maps produced for display in specific regions tend to center the region that they are displayed in (Saarinen 1987).

Cardinal orientation

Another less-discussed norm in mapping is that of cardinal orientation. Given that Earth is situated in space, (and space has no up or down), it is a normative choice to orient a world map as north-up, as opposed to south, or any other cardinal direction. Even within the existing debate in cartography, the hegemony of north-up orientation of most world maps is overlooked in favor of other questions. This norm likely originated with the ubiquity of the Mercator projection

beginning in the 16th century, and has continued through present day because repeated use of the orientation made it seem more 'right'. Notably, the original "Blue Marble" photograph taken by members of NASA's Apollo 17 mission had Earth in a south-up orientation; prior to publication the image was rotated to fit with the north-up norm [**Figure 8]**.

Figure 8
The Blue Marble, Apollo 17
Note: Original title: *AS17-148-22727*. Copyright Lunar and Planetary Institute 2022.

Another prominent example of a south-up map was made as a political statement by the Australian Stuart McArthur in 1979 **[Figure 9].** Looking at this south-up oriented map, it is clear on an intuitive level how the north-up map feels more 'right'.

Figure 9
MacArthur's Universal Corrective Map of the World
Note. by S. MacArthur, from raremaps.com. Copyright S. MacArthur 1979

In the set of images below, both maps are displaying the same information: the migration of Homo sapiens around the globe based on patterns found in mitochondrial DNA. The map in **Figure 10** shows this information on a north-up Gall-Peters projection, and the map in **Figure 11** shows it on a Dymaxion projection, with the north pole at the central position and south fanning out in all directions (see section 2.2 for an image of the original Dymaxion projection). The difference that cardinal orientation and map projection make on the way this information is conveyed is visually very apparent.

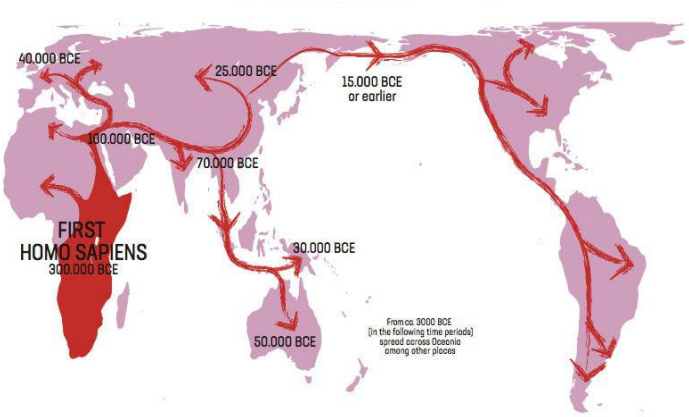


Figure 10
Migration of Homo Sapiens on Gall-Peters projection
Note. by The Black Archives, (n.d.) CC-BY-SA-4.0

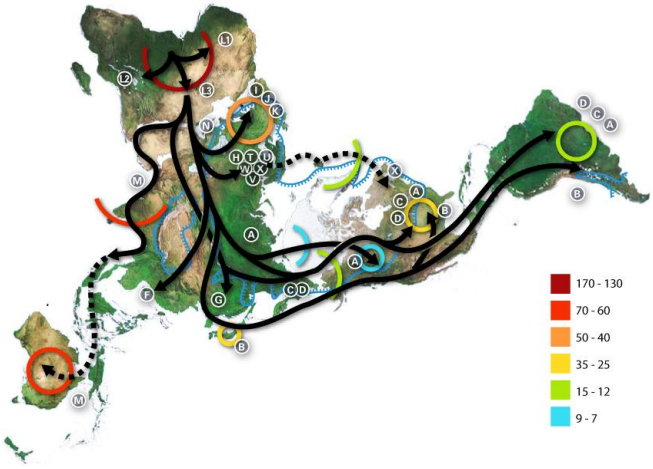


Figure 11
Migration of Homo Sapiens on Dymaxion projection
Note. by Avsa, Wikimedia Commons, 2005. CC-BY-CA 3.0

As such, while different actors recognize that there are normative reasons concerning functionality, accuracy, and realism involved in choosing a map projection, how they weigh these reasons remains could be further clarified. In addition, there are other factors in the display of world maps that remain at the margins of the debate, including the centering of projections around the prime meridian and the norm of north-up orientation. Moreover, beyond *normative* reasons, *moral* reasons concerning the impact on viewers seem to be involved, too, but these reasons remain even more implicit.

In chapter 2, I look into the moral reasons concerning the impact of map projections and norms.

2) Moral choices in the display of world map projections

In the previous chapter I outlined the established debates and claims in the fields of cartography, explaining the normative choices in determining the display of a world map projection. In this section, I lay the groundwork for my contribution to the debate. I begin the chapter by providing explanations of four key concepts and (when applicable) subconcepts: *postphenomenology*, *cognitive mapping*, and *Othering*. I explain how each can be applied to the context of world map projections, going beyond the normative dimensions as introduced in chapter one and showing *how* the moral dimension of projection choices can manifest. In chapter three, I apply the connections between maps and the theory to three real-world examples, analyzing the moral consequences of map centering, size and shape distortion, and cardinal orientation.

2.1) Langdon Winner and political artifacts

World map projections are technological artifacts, and as such exist in a relationship with humans in their use. People use world maps to interpret their general location on Earth relative to its oceans and continents. They also use them as visual aids to conceptualize the planet's vastness that is invisible to them while they are immersed in their immediate, day to day surroundings. How, then, can the ways in which a world map gets presented have moral implications?

In his 1980 paper, "Do Artifacts Have Politics?" Langdon Winner puts forward the thesis that technological artifacts can be imbued with politics that go on to influence their uses in political ways. Winner goes beyond *technological determinism*, or "the idea that technology [...] unmediated by any other influence, molds society to fit its patterns," while also answering his opponents, who argue that only "the social or economic system in which [technology] is embedded" is what matters (Winner 1980: 124). He instead challenges the idea of a *neutral artifact*: the idea that technological artifacts are "neutral tools that can be used well or poorly, for good, evil, or something in between." As evidence against the idea of technology as a neutral artifact, he introduces the example of Robert Moses' construction of highway overpasses that were deliberately built too low for public buses to drive under. "Automobile-owning whites of "upper" and "comfortable middle" classes, as he called them, would be free to use the parkways for recreation and commuting. Poor people and blacks, who normally used public transit, were kept off the roads because the twelve-foot tall buses could not get through the overpasses" (Winner 1980, 123-124). The built environment, in this case the highway overpasses, influenced

human movements in a way that produced moral consequences (in this case, discrimination and racism). The bridge example leads him to this statement:

> "there are instances in which the very process of technical development is so thoroughly biased in a particular direction that it regularly produces results counted as wonderful breakthroughs by some social interests and crushing setbacks to others […] the technological deck has been stacked long in advance to favor certain social interests, and that some people were bound to receive a better hand than others" (Winner 1980: 126).

With this statement, Winner ties together ideas from social justice regarding structural inequality together with ideas in phenomenology. Taking this claim as a starting point, I will embed my argument in both (post)phenomenology and the idea of Othering, as it creates parallels between the non-neutrality of technologies and issues of belonging and justice.
Winner's paper went as far as to express how artifacts have politics, and how this can influence *actions*, but in order to analyze how they influence *perceptions*, I now look to postphenomenology.

2.2) Postphenomenology: technological mediation

Technological mediation helps to deepen the claims about why and how artifacts are political. By "organizing perceptions and interpretations," Verbeek postulates that "technologies embody subtle forms of power" (Verbeek 2020, 144). This is because the non-neutral nature of technology arises from the mediation of perception via the artifact. Ihde uses the terms *amplification* and *reduction* to indicate how "mediation always strengthens certain specific aspects of the reality perceived and weakens others" (Verbeek 2001, 128). For example, a world map projection gives the viewer an image of all the land and water on earth in one fell swoop, at the cost of distorting shape, size, distance, and routes.
In this section, I introduce three key concepts from postphenomenology and explain how they relate to maps as technological artifacts.

Microperception and macroperception

Don Ihde, in his 1990 book *Technology and the Lifeworld,* describes two types of perception that can be mediated by technology: *microperception* and *macroperception* (Ihde, 1990, 29). He puts "what is usually taken as sensory perception (what is immediate and focused bodily in actual seeing, hearing, etc.)," in the category of microperception, and puts "what might be called a cultural, or hermeneutic, perception" in the category macroperception (ibid.). Importantly, he emphasizes that the two types of perception can never be wholly distinct from one another: "there is no micro-perception (sensory-bodily) without its location within a field of macroperception and no macroperception without its microperceptual foci" (ibid.). This can be applied to world map projections as well: the visual experience of a world map is intrinsically tied to informing a sense of the geography of the world, because without one the other would not be possible.

Microperception and macroperception are mediated by technology by way of different types of human-technology relations. In the following subsections, I will introduce two: *hermeneutic relations* and *background relations,* and explain how they apply to world maps.

Hermeneutic relations

The technological mediation of maps can constitute a *hermeneutic relation*: "the artifact [...] provides a representation of the world, which requires interpretation in order to impart something to us about it" (Verbeek 2001, 127). Map projections provide us with a literal visual representation of the world. However, to understand that this image is a projection of Earth's surface, one must understand the concept of scale, the basic premises of geography, and perhaps even have knowledge of the coordinate system. When these are understood, the projections can be interpreted as a flattened depiction of Earth's surface. Along with the interpretation of *what it is,* when someone looks at a map they also interpret *what it means.* This could be anything from their current geographic location, the importance of certain regions, or their figurative 'place' in the world. The interpretation of what a map means always happens within the greater personal and societal context in a person exists.

Background relations

In *background relations,* "technologies shape the context of our experience in a way that is not consciously experienced" (Verbeek 2001, 133). The characterization of background relations fits closely with claims made by the American Cartographic Association and The Cartographic Journal, that "frequently seeing a greatly distorted world map tends to make it 'look right,'" and that "world maps have a powerful and lasting effect on peoples' impressions of the shapes and sizes of lands and seas, their arrangement, and the nature of the coordinate system" (The Cartographic Journal 1986, 157). Artifacts with a background relation to people go unnoticed until "they stop functioning." Once they do stop functioning, the "context shaped by the background technologies, which we otherwise take for granted, is suddenly not self-evident any more" (Verbeek 2001, 133). World maps do not 'stop functioning', but when one is accustomed to a north-up, rectangular projection and is shown a map that deviates from those cartographic norms such as the upside-down map [figure 4, section 1.4] or a novel type of projection such as the Dymaxion [Figure 12] for the first time, that deviation from a person's idea of what "looks right," will challenge their preconception of the arrangement of land and water on Earth. What seemed to be a neutral, objective-scientific representation of Earth will suddenly feel much more subjective than before.

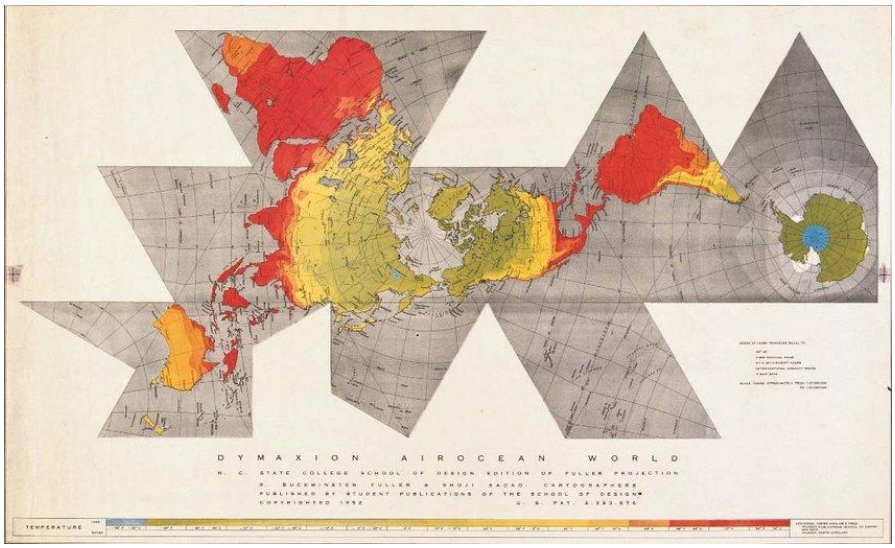


Figure 12
Dymaxion Map
Note. By B. Fuller, 1943. CC BY 3.0

2.3) Cognitive mapping and sketch maps

What are sketch maps and what can they tell us?

Cognitive mapping is the study of a person's externalized internal spatial map. It is "a cognitive map is a mental devise and store which helps to simplify, code and order the endlessly complex world of human interaction with the environment" (Walmsley, et al., 1990 as cited in Kitchin 1994, 2).

Cognitive mapping is based on the premise that, "because of the amount of information condensed on maps, they provide a rich resource for studying the geographical knowledge and values of the mapmaker and the mapmaker's society" (Henrikson 1979, as cited in Sudas and Gokten 2012, 52). *Sketch maps* **[Figure 12]**, or maps hand-drawn by people depicting their mental map of an area or place, are "a frequently used method to externalize individuals' environmental knowledge" (Blades 1990, 327) and are gathered from groups of people as data indicating their knowledge of a given environment. Their reliability and legitimacy as data has been experimentally validated (Blades 1990). A prominent sketch map study was conducted in 1986 by Thomas Saarinen, "sponsored by the International Geographical Union and funded by the National Geographical Society" collecting 3,863 sketch maps from first-year geography students in "71 sites in 49 countries" for the purpose of comparing the maps sketched in different regions to compare geographic literacy and worldview (Saarinen, 1987, 6-8).

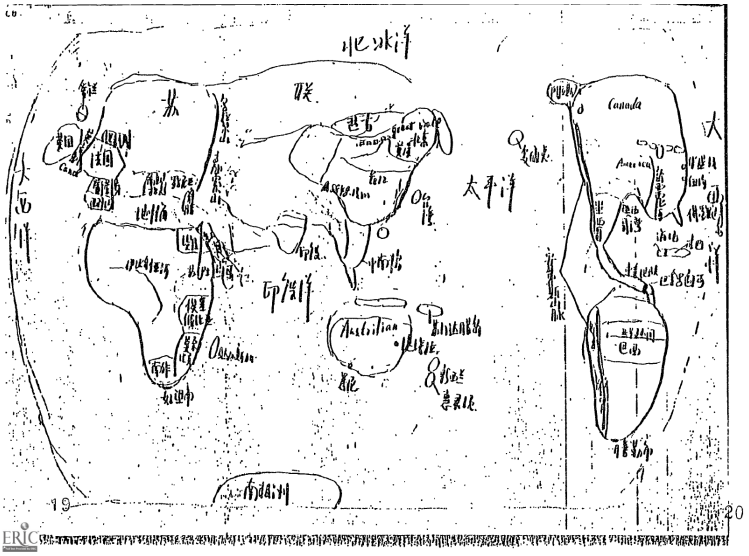


Figure 12

An example of a sketch map

Note. from "Centering of Mental Maps of the World." Copyright T. Saarinen, 1987

2.4) Othering

What is Othering?

The social science definition of *Othering* is that which happens when a group of people "attribute negative characteristics" to another group in a way that "set[s] them apart as representing that which is opposite to them" (Rohleder 2014, 1306). powell and Menendian argue that Othering, beyond just being about the phenomenon itself, "provides a clarifying frame that reveals a set of common processes and conditions that propagate group-based inequality and marginality" (powell & Menendian 2017, 17). They define Othering as "a set of dynamic, processes, and structures that engender marginality and persistent inequality across any of the full range of human differences based on group identities" (ibid.).

Orientalism as a form of Othering

Orientalism, as described by Edward Said (1978), is a specific form of Othering in that it refers to Anglo-European descriptions of the "Orient," and describes the ways in which the idea of the Orient and the way it is described ties in with colonial power dynamics and cultural domination. The Orient is seen as exotic and barbaric, in contrast to the sophistication and scientific prowess of the nations that study it.

In relation to Othering and identity, Said talks about how a sense of national and ethnic identity comes about negatively as well as positively:

> "A fifth-century Athenian was very likely to feel himself to be nonbarbarian as much as he positively felt himself to be Athenian. The geographic boundaries accompany the social, ethnic, and cultural ones in expected ways. Yet often the sense in which someone feels himself to be not-foreign is based on a very unrigorous idea of what is "out there," beyond one's own territory. All kinds of suppositions, associations, and fictions appear to crowd the unfamiliar space outside one's own" (Said 2019 [1978], 54).

A Eurocentric north-up map, as an established cartographic norm, though not the cause of the kind of Eurocentric attitudes or ideas of a poor "global south," perpetuates these ideas by consistently and repeatedly presenting one way of flattening the image of Earth and thereby making it feel 'right'.

Double Consciousness

Double consciousness is a term made well-known by W.E.B. DuBois in *The Souls of Black Folk* (1903) and was used to describe the alienation that occurs when living as a black person in the United States. Double consciousness is the *internalization* of "inappropriate, prejudicial, false and/or demeaning generalizations based on one's race" (Pittman 2016), or, in other words, it is the Othering of oneself. Though the original concept of double consciousness was based on the experience of African-Americans in the late 19th- early 20th century, the idea has also been applied to modern contexts involving other races and regions. Double consciousness can also result in:

> "A practical attitude or orientation, for strategic purposes related to the pursuit of socially recognized goods or personal goals, involving the ascription to others of beliefs, intentions, expectations or reactions to one's acts or words predicated on a falsely degrading, fearful, or dismissive judgment of who or what one is, on the basis of one's race, and revision or adjustment of one's plans on the basis of such ascriptions" (Pittman 2016).

It will be argued in section 3.1 how the de-centering of one's own region in a sketch map could be considered a form of double consciousness.

Cultural Imperialism as contributing to structural injustice

Iris Marion Young, in her account of injustice, postulates that injustice is made up of "two forms of disabling constraints, oppression and domination" (Young 1990, 39). She separates oppression into "five faces:" exploitation, marginalization, powerlessness, cultural imperialism, and violence (ibid). For this thesis I will focus on one of the faces of oppression: *cultural imperialism,* or the erasure of one's experience while simultaneously being "stereotype[d][...] and mark[ed] out as the Other" (Young 1990, 58-59). She mentions the "dominant cultural products of a society" and how they disseminate from a dominant group to turn that group's perspective into the societal norm:

> "Cultural imperialism involves the universalization of a dominant group's experience and culture, and its establishment as the norm. Some groups have exclusive or primary access to what Nancy Fraser (1987b) calls the means of interpretation and communication in a society. As a consequence, the dominant cultural products of the society, that is, those most widely disseminated, express the experience, values, goals, and achievements of these groups. Often without noticing they do so, the dominant groups project their own experience as representative of humanity as such." (Young 1990, 59)

Contemporary world map projections can be considered a "dominant cultural product." As all modern projections originate historically from mathematical and cartographic innovations in 16th to 19th century Europe, these projections coincide with the cartographic norms established alongside societal norms of the time. In this era, too, maps were used to assert land claims by colonial powers over colonized peoples. Though maps constitute less over forms of power today, this history could be what influences modern world maps in a way that perpetuates a North-up, Eurocentric map projection with distortions like the Mercator, which inflate the sizes of former colonial powers. As forms of oppression become less overt, the definition of oppression has shifted to reflect the dynamics and shifts of this past century:

> "In its new usage, oppression designates the disadvantage and injustice some people suffer not because a tyrannical power coerces them, but because of the everyday practices of a well-intentioned liberal society [...] Oppression in this sense is structural, rather than the result of a few people's choices or policies. Its causes are embedded in unquestioned norms, habits, and symbols…" (Young 1990, 41)

Cultural Imperialism and Occlusion

It is interesting to note the similarity of cultural imperialism as defined by Young to the phenomenon of *occlusion*, from the postphenomenological school of thought: occlusion occurs when "dominant users of technologies lose the capacity to see other stabilities than the one that is most obvious for them, and therefore they typically fail to see how the material environment excludes other forms of use and types of users" (Verbeek 2020, 133).
One account, cultural imperialism, describes the experience of the oppressed group and the other account, occlusion, is from the point of view of the "dominant user" (ibid.).

Returning to our touchstone, the Mercator projection: if it is known, both in the public and the academic debate, to be neither the most useful general world map nor the best projection for general use, on top of being characterized as morally worse map by some, then why has it remained ubiquitous for the past 500 years? Why too are the commonly proposed alternatives to this projection (such as the Gall-Peters) still Eurocentric? The conceptual convergence of cultural imperialism with occlusion could provide a key to answering this question.

On top of being a mathematical innovation, the Mercator conveniently increased the sizes of the ruling empires that dominated the globe by way of colonization from the 16th to 18th century. As this world order shifted into present day, formerly colonized regions were freed of their yokes but remained both politically and economically subjugated to the former colonial powers, which remain the politically and economically dominant group to this day. The Mercator projection, as a culturally dominant artifact, "express[es] the dominant group's perspective on and interpretation of humanity as such" as well as its "perspective on and interpretation of events and elements in the society, including other groups in the society insofar as they attain cultural status at all," (Young 1990, 59). Occlusion could explain why, even for the well-intentioned (i.e., those who propose alternatives to the Mercator on the grounds that it perpetuates colonial worldview), the Eurocentric nature of the maps proposed as alternatives remains overlooked due to a cartographic norm. This norm, of situating the east-west centering of a projection around the objective-seeming qualitative and scientific nature of the prime meridian (0˚ longitude) was in actuality politically determined in the late 19th century, but the background conditions of those politics goes unquestioned because the people producing the alternative maps are also the dominant users of the technology, rendering these background conditions invisible to them.

3) Application and analysis

In this chapter, I argue how the theoretical frameworks explained in chapter two can apply to cartographic norms using three examples: sketch maps and longitudinal (de-)centering, size distortion and associations of importance with economic development and political power, and cardinal orientation with associations of good and bad.

3.1) Longitudinal centering

Saarinen's sketch map study and the (de) centering of sketch maps

One of the analyses conducted on the sketch map study I introduced in the previous section (2.4) was to see how the sketch maps drawn by the study subjects were centered longitudinally. In his data analysis, Saarinen found that most subjects would center their world maps around the region in which they live. For example, sketches collected from the Americas had a high prevalence of Americentric maps, East Asia had a high prevalence of Sinocentric maps, and Africa and Europe had a high frequency of Eurocentric maps (Saarinen 1987, 37). However, he found that, "longitude, although a dominant factor does not entirely explain the world pattern of sketch map centering" (ibid). In India, Pakistan, and Bangladesh, all formerly colonized countries, "the sketch maps were virtually all Eurocentric," and, "even more indicative of the hold of European educational systems are the results for such places as Hong Kong, Singapore, the Philippines and Thailand, where most students sketched Eurocentric maps even though their countries were thereby in peripheral positions (e.g., Map 25 from Singapore)" **[Figure 13]** (Saarinen 1986, 47).

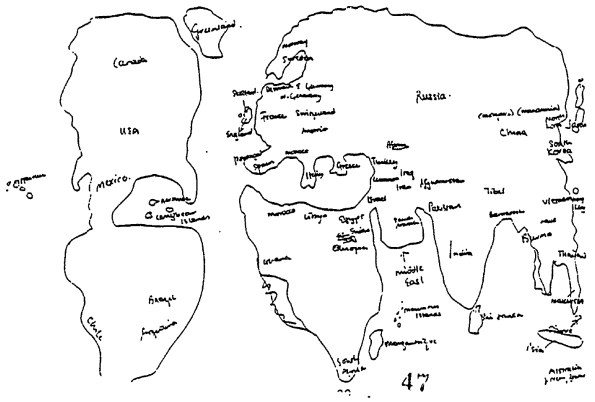


Figure 13
Map 25: a student from Singapore
Note. from "Centering of Mental Maps of the World." Copyright T. Saarinen, 1987

Saarinen claims that "this illustrates one of the unfortunate characteristics of colonial mentality, the idea that the center lies elsewhere" (Saarinen 1987, 40). A subsequent study based on the same data set focused on sketch maps involving Singapore. It credited the de-centering of Singapore and the centering of Britain, "where the earlier colonizing power was" to the fact that "Singapore was under British control (first as part of the East India Company possessions and then as a full-fledged colony) for nearly 150 years" (Kong, Savage, Saarinen, and MacCabe 1994, 259).

Linking de-centering to Othering

How can this de-centering be linked to Othering? Given that sketch maps are a composite of one's mental map of the world, as well as a reflection of the images that one is surrounded by, it is conceivable that the subjects of this study were raised in an environment in which Eurocentric maps were still pervasive. (Most colonial occupations of these countries ended only twenty to forty years prior to the year this study was conducted.) Within the background relation of technological mediation, the ubiquity of a Eurocentric world map would hold sway over one's image of a world map that looks 'right.' World maps also have the multistability of reinforcing colonial power via images: as a colonizing power, it is convenient to show an image of the world in which the colonizing country is at the center, and the colonial subject on the edge.

What are the ramifications for one's sense of identity when both the background information of your experience and explicit messaging are telling you that the center of the world does indeed lie elsewhere? And how can this effect on one's identity be amplified within a contemporary global context in which membership to a nation plays a large role in one's identity, both practically (in the form of passports, taxes, immigration, etc.) but also socially, in one's sense of belonging, both to one's own nation but also in the greater setting of the world? In this context, when one centers their own region of the world at the edge of the map, *especially when the rest of the world is centering their maps around their own respective regions,* it could be interpreted that this individual's image of the world continues to be shaped by the presence of the colonizing (or otherwise dominant) country, despite the fact that one's nation has, on paper, become independent from it. These subjects were othering themselves in their own maps by minimizing

their national presence on the world map and instead centering the region of the colonizing country, a symptom of double consciousness.

Conversely, a Eurocentric map that is consistently shown to a European could reinforce the view that one's region is not only at the top of the economic and political "food chain," while also cementing the conviction that they are located at the center of the world. As a method of countering this conviction, showing someone from the European continent non-Eurocentric maps could challenge this worldview in such a way that destabilizes this conviction, opening up space for reflection.

Discussion: Saarinen's study and claims

Saarinen's 'center lies elsewhere' claim immediately becomes weaker with his inclusion of Thailand on his list of countries with a high rate of Eurocentric maps: Thailand was never colonized by a European country. This factual error could have been a mistake that slipped past during editing, but the doubt is compounded by the lack of alternative explanation for the high rates of Eurocentric sketch maps from other countries on non-European longitudes. This weakens my argument insofar as it relies on his claim that the de-centering was a result of colonial influence as postulated by Saarinen. Additionally, though the legitimacy of sketch map data has been established as a reliable way of documenting people's mental maps, Saarninen's study did not conduct any follow-up questionnaires or gather additional information to determine *what* influenced the subjects of the study to center the maps in the ways that they did. Though it remains remarkable that in a data set of nearly four thousand maps, some formerly colonized countries were outliers in the frequency of Eurocentric sketch maps, the reasons for this could be education, the cartographic norm of centering a map around the prime meridian (automatically rendering it Eurocentric), colonial identity, or a combination, making the causality hard to determine. Thus, further empirical data collection would be necessary to fully substantiate the basis of my argument here.

However, though the information gaps in Saarinen's study do weaken the thesis of this paper, they do not undermine it completely. In an argument hung solely on a framework of technological determinism, causality *would* be the centrally important factor, and the argument presented here would indeed be undermined. As I employ a postphenomenological lens, though, causality is not the only factor at play: "for a phenomenologist, the interrelation between subject

and object always precedes the subject and the object themselves; the subject and the object are constituted in their interrelation" (Verbeek 2001, 130). So despite these weaknesses, it can still be said that regardless of colonial context, as artifacts that co-shape our perceptions, the high prevalence of Eurocentric maps in their *microperceptions* visually *amplify* Europe as the center of the map, shaping a person's *macroperception*–their mental map of the world–either confirming or enforcing one's conception of 'the center'. Additionally, though weakened by the lack of a strong colonial association, it could still be maintained that Eurocentric maps, when they mediate a user's perception to influence their mental map of the world as Eurocentric *despite the user basing their geographic identity in a different region of the world*, have a de-centering effect, causing a type of self-othering analogous to double consciousness.

3.2) Size distortion

In this section, I address an additional analysis of Saarinen's sketch map study based on the sizes of continents. I then introduce two more sketch map studies that do not concern the presentation of map projections per se but nonetheless help to establish a link between the mental importance of nations with their respective economic and political power. I introduce the basis of both cases before explaining my analysis of the links that they present.

Does size matter?

Saarinen analyzed a subset of the data collected in the 1986 sketch map study and uncovered the pattern that "the home continent was generally exaggerated. In addition, two unforeseen results were that Europe is always exaggerated, and Africa always diminished in size"(Saarinen, Parton, and Billiberg 1996). This seems to suggest a replication of the same kind of size distortion caused by the Mercator, but it could also be an association between size and global power. However, as I explain in the next section, the premise of measuring size on the sketch maps in this study not as reliable as the premise which measures significance in correlation to power. The next two subsections analyze the association between mental significance on sketch maps and political/economic power.

The Singaporean analysis

The Singaporean analysis of Saarinen's map study referred to briefly in the previous section looked specifically at which countries were named in the Singaporean subjects' maps, and which countries named Singapore in their maps (Kong, Savage, Saarinen, and MacCabe, 1994, 258). It concluded that:

> "[...] the places which emerge prominently in Singapore students' perceptions are culturally, historically, politically and/or economically important to Singapore. Physical proximity is also important. Conversely, places which are insignificant in Singapore students' mental images include those which are culturally removed; those which have little connections with Singapore (whether political or economic); those which do not appear in the media very much; those which are physically small [were not included in the sketch maps]" (Kong et.al. 1994, 262).

Again, due to the lack of additional data or interviews, the inclusion or exclusion of a country based on its physical smallness could have multiple reasons: small size *could* correspond to unimportance, which would substantiate claims that an equal-area map is fairer since it would mean that no region is unduly shrunk–but this could have also resulted from the practicalities of the study: the subjects were given a paper the size of an A4 to draw their maps on, the scale of which would have made it difficult to draw and label smaller nations.

More interesting for this analysis, then, is that the "the developed countries of the world invariably emerge prominently in students' sketch maps while third world countries generally tend to be less well known" (Kong et.al., 262).

Sketch maps of Europe and their inclusion of Turkey

Another sketch map study (not involving Saarinen's data) was conducted on geography students in Turkey with the goal of gaining insight into the ways in which the country is conceptualized relative to Europe in the minds of its students. The researchers found that:

> "Turkey's appearance on the cognitive maps is important as it provides us clues about participant thoughts about Turkey belonging to Europe [...] for some participants the idea of Europe is formed only within the physical borders and for others the idea is formed relatively to the economic development rate" (Sudas and Gokten 2012, 52).

This example suggests, too, how the mental inclusion and exclusion of a country, or parts of it, to a region such as Europe to which it belongs, in part geographically and in part economically (importantly, though, not politically), can be based on how developed or undeveloped that country or region is.

Associations of economic development and political power with mental significance

Both the Singaporean and Turkish sketch map studies do not apply to peoples' mental maps of the world as a whole, and thus are less related to the influence that world map projections have on one's perception of themselves and the world. However, both cases do show empirical links

between the perceived importance of a country or region with its level of economic development, and corresponding to economic development, its political power.[3]

Revisiting the Mercator versus Gall-Peters debate, the evidence from the Singaporean and Turkish sketch map studies could provide an explanation for why showing an equal-area projection was thought of as more 'fair,' and less 'colonial' than the Mercator. First, these studies show how the inclusion or exclusion of countries in people's mental maps can be correlated with the levels of economic development in those countries. This correlation makes common sense: we live in a globalized society in which economic growth is seen and pursued as a universal means to obtain the power and privilege which such growth affords nations and their peoples. Insofar as cognitive maps are reflections of one's internalized image of the world both geographically *and* as reflections of the "values of the mapmaker and the mapmaker's society," (Henrikson 1979, as cited in Sudas and Gokten 2012, 52), when the size distortion caused by a map projection results in regions with rich countries depicted as visually bigger relative to the globe than the regions with poor countries, it can serve to amplify the preconception that presents itself in the mental maps of these study subjects.

As a technological artifact, the Mercator projection's political power could be strengthening this interpretation. Within the continuous loop that is technological mediation, the phenomenological experience of the Mercator, or its microperception, strengthens the association between visual significance and economic development/political power. This in turn informs the viewer's macroperception, or their general mental conception of the economic or geographic importance of certain regions of the world. This general mental conception could then back into the user's attitudes, contributing to a generalized sense that economically developed countries are more important than less developed ones.

[3] There are some exceptions in which political power is not necessarily positively correlated with economic power (for example, North Korea has great political sway in the global arena despite being less economically developed.)

3.3) North-up orientation

The Brandt Line

The *Brandt Line*, **[Figure 14]** otherwise known as the north-south divide, was originally published in 1980 in the *North-South: a programme for survival* as a way of conceptualizing global inequality (Lees 2020). This line divides the "global north" from "global south" in terms of economic development as contribution to policymaking for economic development.

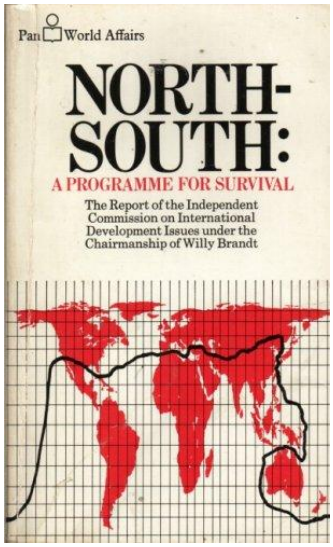
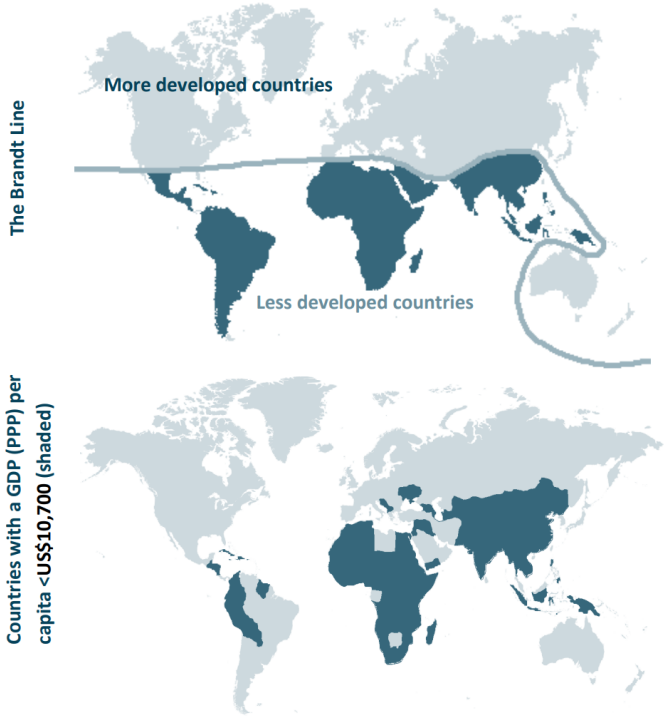


Figure 14
The Brandt Line
Note. The North-South line was conceptualized as a way to encourage cooperation and aid for development in the 'global south.' Copyright Pan Books, 1980.

Figure 15
Exceptions to the Brandt line
Note. Copyright Royal Geographic Society (n.d.)



Despite the seemingly empirical nature and geographic language that the Brandt Line is couched in, it has many exceptions [**Figure 15**]. Regardless of the numerous exceptions to the so-called 'North-South divide' and increasing intra-national economic and power inequality, the terms 'global north' and 'global south' persist. Why is this the case? One reason could be that the use of geographic terms is seen as more morally neutral than the use of

terms like ‘rich’ or ‘poor’, ‘developed’ and ‘developing’, or ‘first world’ and ‘third world’ (Mitlin & Satterthwaite 2012, 13). As the terminology became associated with and integrated into the literature and public dialogue surrounding global economic development and inequality, the terms ‘global north’ and ‘global south’ may have come to serve as shorthand for ‘countries or populations with more economic and political power’ and ‘countries or populations with less economic and political power’. Though the categorization in terms of geography may seem morally neutral, I argue that these terms nonetheless feed into oversimplified generalizations about geography and economic development, subtly reinforcing notions of ‘northern’ with ‘economically developed’ and ‘southern’ with ‘in need of aid’. Compounding this is the psychological link shown in the relationship between positive and negative affect with vertical position, as I introduce in the next paragraph.

The association between vertical position and associations of ‘good’ and ‘bad’

The relative position of ‘up’ is often associated with positive ideas like ‘good’ or ‘better’ in the English language. Take for example the following words and phrases: ‘upscale’, ‘up in heaven’, ‘keep your head up’; in contrast with ‘downgrade’, ‘down in hell’, ‘feeling down’. In a psychological study testing the association of vertical position with positive or negative affect, Meier & Robinson found that:

> “when making evaluations, people automatically assume that objects that are high in visual space are good, whereas objects that are low in visual space are bad [...] extending prior work [...] in suggesting that affect is grounded in sensorimotor perception” (Meier & Robinson 2004, 247).

We could also interpret this as related to a mediation of the north-up map: by arranging a map with north as ‘up,’ the viewer’s associations between ‘up’ as ‘good’ and ‘down’ as ‘bad’ can be amplified. In combination with the widely used terminology denoting ‘north’ as more developed than ‘south’, this is one element in a multilayered set of factors that could serve to reinforce the idea of an overgeneralized north-south divide, perpetuating the Othering of an entire hemisphere. Furthermore, the prevalence of north-up maps establishes this Othering as a global norm (*see section 2.4: Cultural imperialism and occlusion*). A north-up map can thereby be considered an instrument of oppression contributing to structural inequality.

4) So what? Moral conditions for the conscientious display of maps

In the first chapter of this paper, I introduced the cartographic norms that influence the display choices of contemporary world map projections, explaining the existing normative debate in cartography. In the second chapter, I established the theoretical framework that I use to explicate the moral dimension of choices in the display of world map projections. In chapter three, I analyze three cases exemplifying the Othering that can be mediated by choices made in this display. I put forward the argument that the Othering effects of certain choices made in the display of world maps could be considered one small but not insignificant part of the structural injustice that permeates society today. Due to the fact that world maps as technological artifacts are multistable, *any* world map, even one not meant explicitly for the purpose of education or general knowledge, has the function of influencing its viewer's microperceptions, which in turn help to shape their macroperception of the world. This suggests that there may be compelling moral reasons for those who display or replicate world map projections to pause and consider the moral implications of the choices made in their display. In this final chapter, I ask: in light of the ways of oppression that can be linked to choices in the display of world map projections, are there also moral norms that should be followed when choosing which projection to display and how to display it?

4.1) Summary of the elements of the world map projections that can perpetuate Othering

How can the choices or projection, centering, and cardinal orientation influence Othering in the mediation of maps? The first was the display of projections that distort size in a way that reinforces the viewer's association of size with power and importance. The second was Eurocentric projections as they are inextricably bound with the historical and present context of history and domination. Third was north-up displays of a given projection, which subtly reinforce automatic associations of 'north' with 'good' and 'south' with 'bad'.

4.2) A minimum condition?

Young's framework for addressing structural injustice endorses a *social connection model* of assuming responsibility for remedying it. This model "says that individuals bear responsibility for structural injustice because they contribute by their actions to the processes that produce unjust outcomes" (Young 2006, 119). Applied to the arguments made in this paper, the onus is on

both viewers of maps, to look at and reproduce maps that challenge their own prejudices (or at least do not reinforce them), and on those who display maps, to choose displays that counter the preconceptions of those who look at them (or at least do not confirm them).

Based on the elements summarized in section 4.1, I put forward (and then challenge) the moral claim that, as a minimum condition, displays of world map projections that reinforce existing structures of dominance and oppression should not be used by those displaying maps, nor should they be reproduced by those who view them. In addition to a choice that is cartographically sensible, there should be a minimum compelling moral reason not to use or reproduce world maps that contribute to the perpetuation of the kinds of Othering described in this paper; whether this be through de-centering, cultural imperialism, or the reinforcement of power structures. Fulfilling these conditions could have some implications for the display of world maps: it could be that to not contribute to the perpetuation of these kinds of Othering, maps would have to be *not* Eurocentric, be equal area, *not* have a north-up orientation, a combination of the three. In addition, they would likely have to be rounded, not rectangular, and be readable based on the coordinate system in order to be considered cartographically sensible as well.

The pitfall of this minimum condition is that it is absolute: as explained in previous sections, the multistability of maps changes their mediations based on their use context. The inflexibility of a minimum condition is that it is insensitive to the multistabilities that maps have. For example, to fulfill this condition in different regional contexts could mean different things: in the Singaporean context it would probably be to prioritize a Sinocentric projection instead of a Eurocentric one, because this opens the possibility of interrupting the cycle of mediation that contributes to Othering, to which Eurocentric maps can contribute. In contrast, within display in the European context, the appropriate choice might be to use a South-up map in order to disrupt the feedback cycle of cultural imperialism and occlusion that occurs for the culturally dominant users of North-up maps. In the United States, it might be a Sinocentric map, but in China, it might be one that centers the African continent. Furthermore, even within these regional contexts, there will be subcontexts that reveal different multistabilities: will the map be displayed in a school, in a business magazine, or in government offices? All of these subcontexts add another layer to the interpretation, and thus the mediation, of the maps in question.

Perhaps even more importantly, as the historical and sociopolitical conditions of the world change, so will the contexts in which these maps will be interpreted. How else, then, should the moral aspects of map choice be taken into account when choosing how to display these projections? In the following section, I introduce the concept of *belongingness* in relation to Othering and how it could provide a more productive framework for the conscientious display of world map projections.

4.3) Othering versus Belongingness

An antidote to Othering as conceptualized by john a. powell and Stephen Menendian is *belongingness*. Belongingness is based on "the right to belong [as] prior to all other distributive decisions since it is members who make those decisions" (powell & Menendian 2017, 32). Belongingness "widens the circle of human concern" by "'humanizing the other,' where negative representations and stereotypes are challenged and rejected" (ibid.). Belongingness as a starting point in a framework applied to the conscientious choice of map projection leaves the specific choices in map display and projection choice to the user or producer of that map. If belongingness could be taken as an important factor in the consideration of these choices, it might serve as a productive framework for countering the Othering effects of certain world maps.

In the final section of this paper I provide an account of the Equal Earth projection as an alternative that was proposed in the Massachusetts Public Schools case, arguing that it does not do enough for the goals of the school system. I suggest the AuthaGraph projection as an alternative and explain the ways in which it functions better as a tool for Massachusetts Public Schools' goal to "decolonize their curriculum."

4.4) Choosing a projection based on belongingness: back to Mercator vs. Gall-Peters

In section 3.2, I argued how there may indeed be moral reasons for choosing the Gall-Peters projection over the Mercator. This does not change the fact that the Gall-Peters projection is still a projection with serious shape distortion. Moreover, the extent of the shape distortion in the Gall-Peters projection goes against an explicit goal of Boston Public Schools when they decided on this change: assistant superintendent of opportunity and achievement gaps Colin Rose is quoted as saying, "The Mercator projection is a symbolic representation that put Europe at the

center of the world. And when you continue to show images of the places where people's heritage is rooted that is not accurate, that has an effect on students" (as quoted by Walters in *The Guardian,* 2017). Though not totally wrong about the Mercator projection, Rose seems to have overlooked the fact that severely distorting the shapes of land masses is also showing an image of "the places where people's heritage is rooted that is not accurate." The Equal Earth projection **[Figure 16]** was developed specifically to address the frustration of cartographers that their "message–that Gall-Peters is not the only equal-area projection–was not getting through" (Šavrič, Patterson & Jenny 2019, 454).

Motivated too by the Boston Public Schools case, the Equal Earth projection sought to address the issue of shape distortion in the Gall-Peters, going so far as to focus on the aesthetic aspects of the map so that it could be considered an obvious alternative choice for the Massachusetts Public School system (Šavrič, Patterson & Jenny 2019).

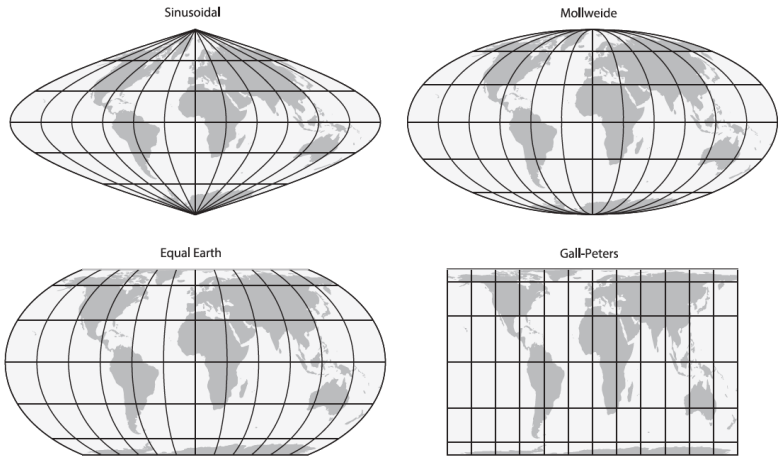


Figure 16
The Equal Earth projection compared to other preexisting options for equal-area maps
Note: Copyright Šavrič et al., 2019.

Nonetheless, both the Gall-Peters and the Equal Earth projection are Eurocentric, north-up maps. The developers of the Equal Earth projection made the choice to make their map Eurocentric with the explicit intention "to create a world map with an appearance familiar to as many people as possible," (Šavrič, Patterson & Jenny 2019, 455) so that it would be seen as a better alternative to the Gall-Peters. Curiously, though, as a Eurocentric, North-up map, it does not help

to further the goals of Massachusetts Public Schools to "start [...] [its] three-year effort to decolonize the curriculum" for reasons explained in chapter 3 (Rose, as quoted by Walters in *The Guardian,* 2017). How might this map have turned out had the cartographers considered the moral goals of its intended display in addition to the *cartographic* and *aesthetic* norms that they took into account in creating the Equal Earth projection? Approaching this project from the framework of belongingness could have afforded the mapmakers with the opportunity to "widened the circle of human concern" and "challeng[es] and reject[s] stereotypes" as a way to help further the school system's goal to decolonize its curriculum.

The AuthaGraph projection **[Figure 17]** is another equal-area world map, and is the projection that I suggest as an alternative to the Equal Earth when using belongingness as a framework and the context of the goals of Massachusetts schools as a guide. The novelty of the map is that the land masses are arranged in such a way that it can be tiled to infinity **[Figure 18]**. It is not Eurocentric, and though it is a north-up map, when tesselated it is possible to create new permutations of framing Earth's geography longitudinally and based on cardinal direction **[Figure 19]**. As a map for educational purposes, it provides opportunities for the students to actively re-frame the map and provides the teaching opportunity for students to notice how their perceptions change as the map that they create changes. This map, then, could have the potential not only to challenge and reject negative stereotypes, but present the opportunity to teach students how to actively identify and reframe these stereotypes for themselves.

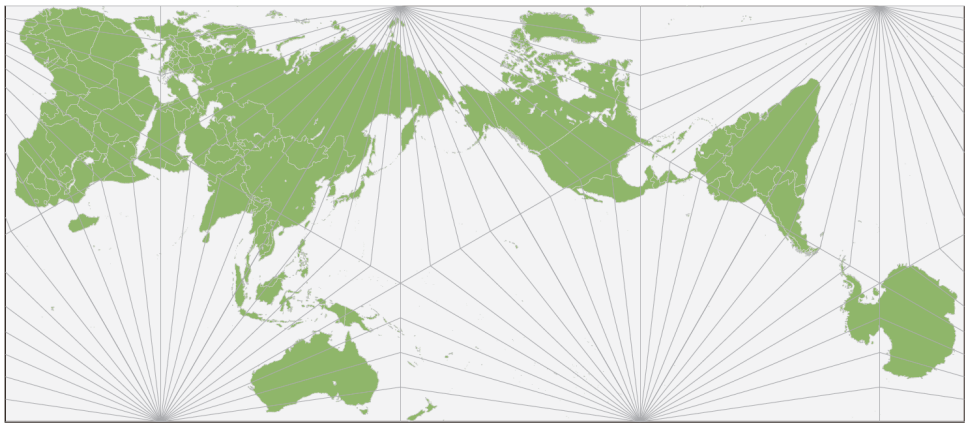


Figure 17
The Authagraph Projection
Note. by Hajime Narukawa, Copyright Hajime Narukawa Laboratory, 2015.

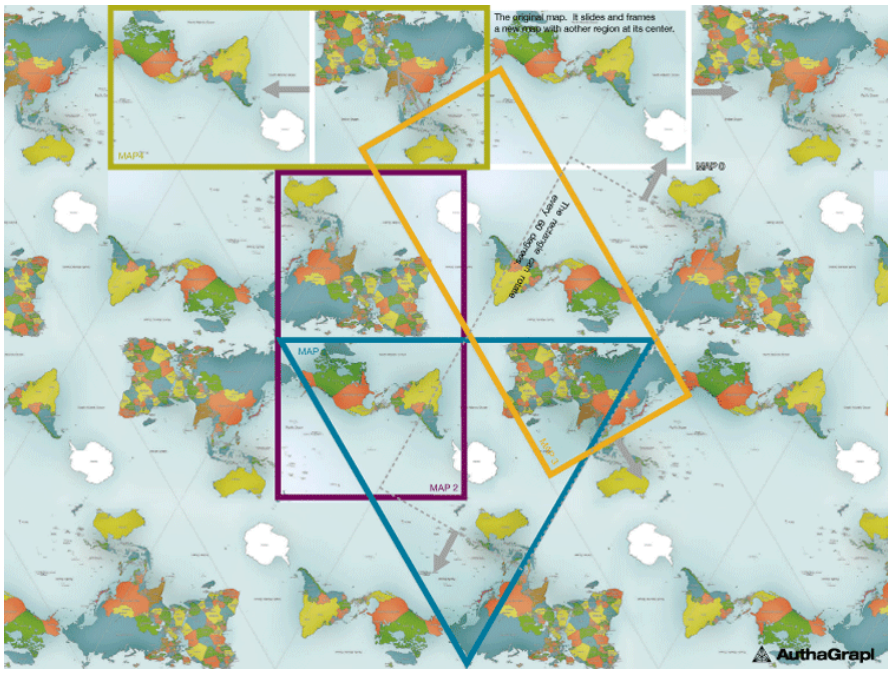


Figure 18

The AuthaGraph Projection, tiled

Note. Copyright AuthaGraph Co., Ltd. 2010.

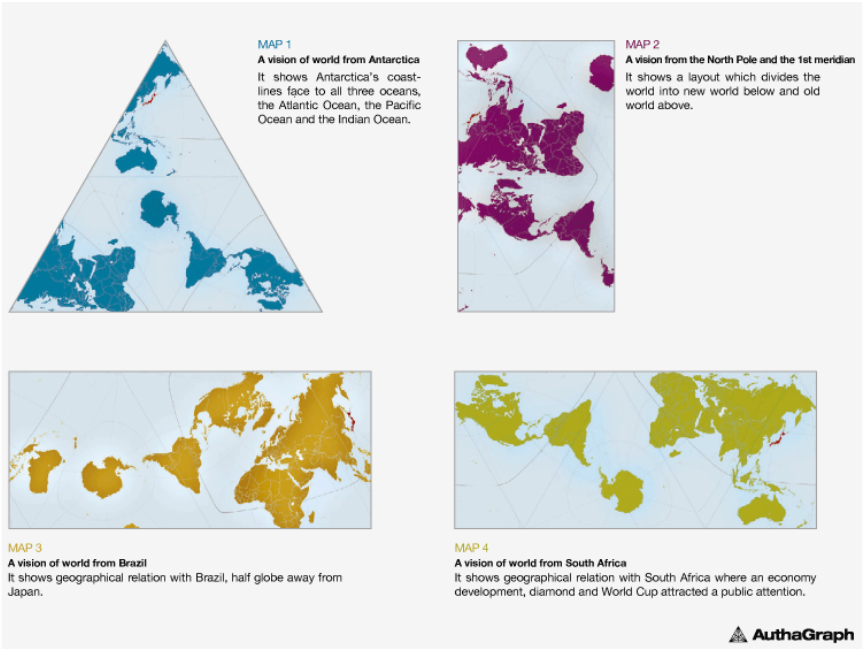


Figure 19

Different framings from the tiled AuthaGraph projection

Note. Copyright AuthaGraph Co., Ltd. 2010.

Conclusion

In this paper, I have attempted to answer the research question: ***How can the phenomenology of world map projections perpetuate injustice?*** I posed this research question as a way of clarifying elements of the existing arguments on cartographic norms regarding choices made in the display of world map projections and their social and moral consequences. By analyzing three main permutations of map display using postphenomenological theory to connect the technological characteristics of maps with some of the Othering effects they may have, I have suggested that the phenomenology of some decisions made in the display of world maps does indeed contribute to technological mediations in which Othering can occur or be perpetuated. In answering the subsequent research question, ***Are there moral reasons to determine which world map projection should be used?,*** the use of a set of inflexible rules or conditions is rejected in favor of a more tenuous, but also more dynamic, framework that takes belongingness as a starting point. Though one possible alternative was suggested to the Gall-Peters and Equal Earth map, further considerations should be made on adapting the framework of belongingness to the context of world map projection displays specifically.

Finally, in the context of belongingness as a moral guide, it would be important to extend further discussion beyond world map projections. This is because world map projections, even cartography as a field, only occupy a very small part in the vast possibilities of mapping. “The multistability of cultural relations to the world implies not only that artifacts can have different meanings in different cultural contexts, but also that the same goals can be technologically realized in different ways” (Verbeek ed. Achterhuis 2001, 135). Other than projections, methods of indigenous mapping, non-coordinate-based methods of mapping, and non-visual maps would all be options for further consideration in bringing more belongingness to world mapss.

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