Aesthetic Epistemology in Cartography: A Genealogy of "Really Good Maps"

By

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For my father
Thomas Alfred Gilliam
1940-2018

the aesthete of the family

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ABSTRACT

Aesthetic Epistemology in Cartography: A Genealogy of “Really Good Maps”

Chelsea Nestel

This dissertation analyzes aesthetic epistemologies in cartography, a neglected topic in cartographic theory. Using concordance analysis, a method from linguistics, I develop a genealogy of cartographic aesthetics. My genealogy explores how cartography arrived at its current design-based aesthetic epistemologies through studying six aesthetic key words interpreted through philosophy of aesthetics: design, aesthetics, taste, beauty, art, and style.

The dissertation consists of eight chapters. Chapter 1 introduces problems associated with aesthetics in cartography: a need for more clarity of usage of aesthetics and related terms, and the dominance of a singular aesthetic, the aesthetics of science and technology. Chapter 2 reviews and synthesizes aesthetic philosophy within cartography, explaining how aesthetics became marginalized within cartographic epistemology. Chapter 3 introduces corpus analysis and describes the selection process to form a representative textbook corpus, as well as the selection of aesthetic key words. Chapter 4 provides a quantitative overview of my concordance analysis results, revealing that usage of the key word design and the key word aesthetic increased across the corpus while all other key words decreased. Chapter 5 provides a history of the aesthetic dimensions of design as a singular noun, identifying aesthetic judgment and value as primary foci of design. Chapter 6 develops a history of aesthetic synonyms and stand-in terms aesthetics, taste, beauty, and art, revealing that as the key word aesthetics increased in use, aesthetics lost clarity of use. Chapter 7 outlines a history of style, which became associated solely with typography by the end of the corpus. Chapter 8 is my conclusion, in which I explain how design and aesthetics gained meanings while taste, beauty, art, and style lost meanings. I identify aesthetic attention and

experience as underutilized concepts within cartography's aesthetic language and opportunities for cartographic aesthetic development.

Chapter 1: How did Academic Cartography arrive at its current aesthetic epistemologies? Introduction and Research Question

1.1 When are Maps Good? Problem and Motivation

I came to aesthetic theory in cartography through five years teaching map design to UW-Madison undergraduate and graduate students. My goal was to teach students how to make good maps so they would become good cartographers. What made a map 'good' was not an abstract question: It was a concrete question on which I had to grade.

When people hear 'good maps', they often think *ethically good*, that is, good defined by a group, institution, or community, or *morally good*, which for some people has a more personal or normative charge. Over the past 200 years, 'accurate' maps have been considered ethically and morally good (Edney 2019). Maps also can be culturally good. For instance, people in Finland prefer Finnish styles maps best, with forests symbolized in white rather than in green (Kettunen 2024). Finally, maps can be *politically good*, or bad (Figure 1).

When cartographers think of 'good maps' they likely think of what can be considered as *psychologically good* (although unlikely in those terms), as empirically-derived cartographic design recommendations drawing on visual psychology have been academic cartography's main goal since the former head of the Office of Strategic Service (OSS)'s Maps Division and UW Cartography Professor Arthur Robinson called for a more scientific cartography in *The Look of Maps* (1952). Robinson's call led to a new era of functionalism in cartography. Accordingly, "good maps" to many conform to the limits of human perception and cognition (MacEachren 1995).

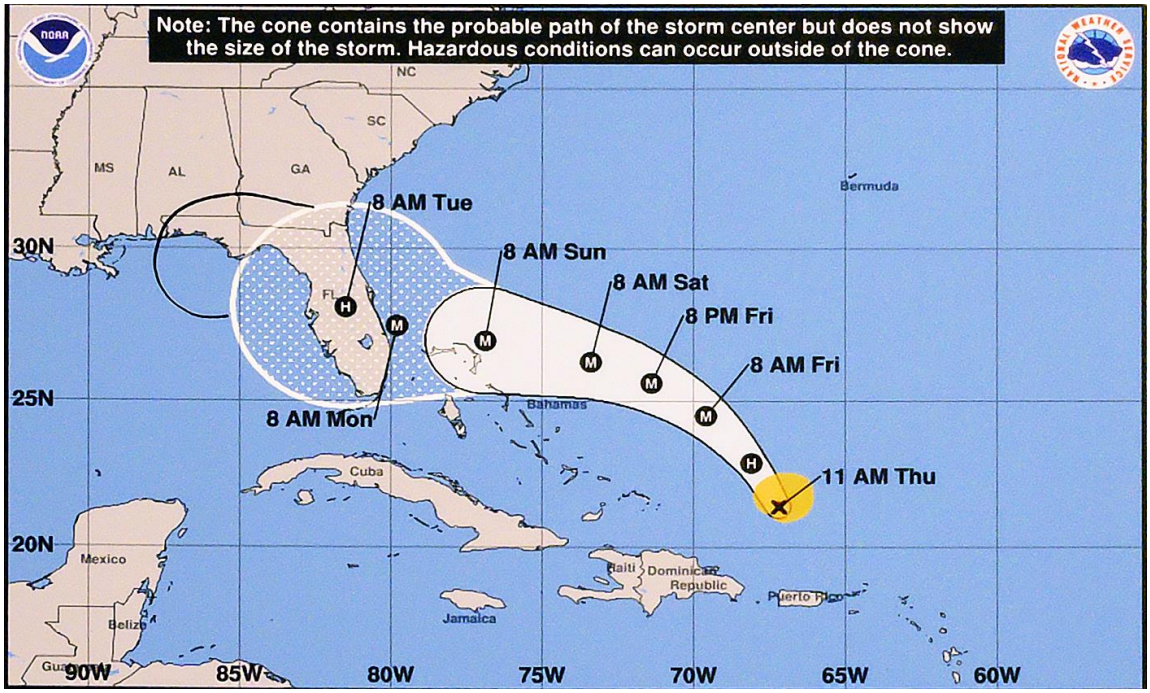


Figure 1.1: Sharpiegate. A NOAA map that then President Trump altered with a Sharpie pen. Trump's political alterations changed the area scientific models predicted would be impacted by Hurricane Dorian on September 1, 2019. Birmingham's National Weather Service contradicted the altered map, informing the public that it was not accurate. In response, NOAA issued a statement in support of the altered map and the President. As a result, NOAA's reputation took a hit, because the nonscientific map was considered unethical by meteorologists (Sobczyk 2020).

But how good is good? Academic cartography measures how a map is good through epistemology. By ***epistemology***, I refer to the theory of knowledge belonging to a field of study. Epistemology helps cartography determine what constitutes valid knowledge, and cartography's epistemology is often quantified to enhance measurability. The metric development was part of the functionalist paradigm that Robinson introduced to cartography. Prior to that point, determining whether a map was good often was an artistic question as much as it was a question of timeliness and accuracy, as will be discussed in this dissertation.

Ultimately, there is something that ties these dimensions, and others together, helping to navigate the question of what a 'good' map as we engage with maps through creating and experiencing them: ***aesthetics***. So, what is/are aesthetics?

Aesthetics matters to most every field, but aesthetics matters to cartography in a way that it does not in other fields, like GIS. Aesthetics is essential to the success of a map, just like aesthetics is essential to the success of an ice-skating routine in a way that it is not compared to a sport like ice hockey. Thus, aesthetics holds critical importance to the epistemology (knowledge theory) of modern Euro-American academic cartography because aesthetics is part of how maps "work."

The first attestation of aesthetics is from Alexander Baumgarten in 1750, who introduced the term *aesthetics* to describe sensory perception (Guyer 1998, 227). Since 1750, the term has grown in frequency of use, and is today "one of the 5,000 most common words in written English, occurring about 20 times per million words in modern written English." As a noun, aesthetics is most closely associated with the philosophy of Kant. Aesthetic also can appear as an adjective, referring to "perception, appreciation or criticism of that which is beautiful" (OED 2023; Figure 1.2).

Yet within everyday cartographic practice and within formal academic journal and textbook writing, *aesthetics* is an unstable word. The term has a near synonymous usage with 'art', 'beauty', 'clarity', 'taste', 'style', and, most importantly, 'design', making it difficult to understand what cartographers mean when they use 'aesthetic' to describe a map.

Beyond issues with definitions, aesthetics itself has had a bad reputation. Both within and outside of cartography, aesthetics has been accused of being superficial, dangerously subjective, unscientific, and hedonic. Some cartographers contend that aesthetics is simply about making maps "pretty," often at the expense of functional concerns (e.g., Woodruff 2012, online). Others, most influentially Robinson (1952), have argued that aesthetics is unstable because taste appeals to emotions. After all, what delights one's taste is emotional, and emotions just cannot be trusted as the basis for objective map design. Furthermore, aesthetic pleasure corrodes a map's primary purpose: functional use, and feelings can hijack one's appropriate response to a map. Thus,

although some cartographers regard aesthetics positively (e.g., Buckley and Jenny 2012), aesthetics often is written off as a “Lost Cause in Cartographic Theory” (Kent 2005, 182).

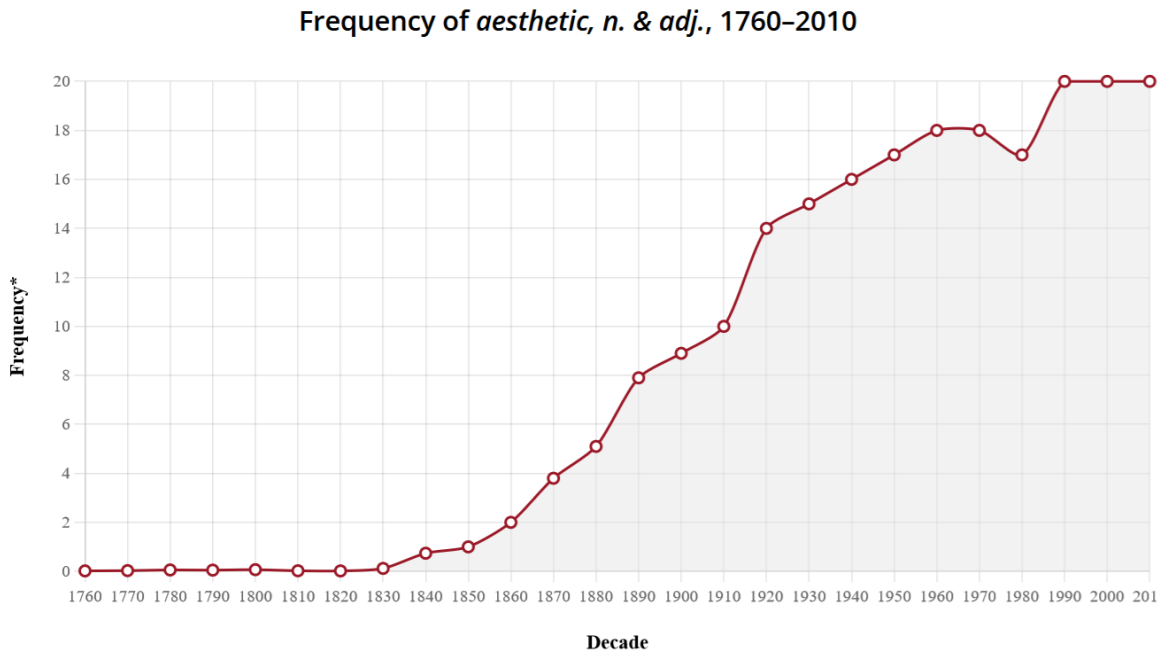


Figure 1.2: Frequency of aesthetic as a noun and adjective over time. Graph from the Oxford English

Whether or not cartographers consciously engage with aesthetic theory, cartography still has aesthetics. Euro-American academic cartography has developed one dominant aesthetic over the past century, ***cartographic scientific aesthetics***, or the appearance of science (Dodge, Kitchin and Perkins 2011). The functionalism of scientific aesthetics tends to universalize, pushing out other design considerations while objectifying maps, the map viewer, and reality into static images.

This objectification has led to influential iconoclastic[1] critiques of cartography. These critiques are often aesthetics-based, sometimes taking aim at the *discipline of cartography itself*, the most extreme forms of which (e.g., Wood 2003) call for the abandonment of cartography altogether.

Understanding aesthetics *in* cartography, and the aesthetics *of* cartography, are interconnected goals. Both are of crucial importance to the future of the discipline, especially considering iconoclastic critiques. Aesthetic theory has resources to increase cartographic design range, articulate theory, and envision new worlds.

Therefore, it is worthwhile to examine our assumptions about aesthetic theory, and to study how cartography has constructed aesthetics without aesthetic theory. Thus, my research question puts a historical spin on the question opening this dissertation, *when are maps good,* by instead asking: *how did Academic cartography arrive at its current aesthetic epistemologies?*

To answer this question, I first outline aesthetic concepts in Philosophy and relate them to cartography; this outline is an abbreviated summary on which I expand in Chapter 2. I then provide a chapter-by-chapter overview of the dissertation, outlining the structure and purpose of each chapter.

1.2 Aesthetics Concepts and Cartographic Epistemology: A Brief Introduction

In this section, I briefly introduce aesthetic concepts from Philosophy treated in more detail across the dissertation. A simple way to understand aesthetics is to think of aesthetic experiences as "special" kinds of experiences, distinct from everyday, nonaesthetic experiences that "we really care about" (Nanay 2019, 2016). In the European canon, aesthetic concepts include aesthetic judgment, aesthetic attitudes, aesthetic objects, aesthetic value, and aesthetic experience

[1] While the most well-known form of iconoclasm is religious iconoclasm, the term is used in art history and philosophy of art to describe *any* antagonism towards images, such as ideological iconoclasm like the Nazi destruction of 'degenerate art' or political iconoclasm like Roman *damnatio memoriae* (Freedberg 1989).

(Shelley 2020). However, this list is necessarily reductive: these concepts overlap, are debated, and do not adequately respond to nonwestern aesthetic traditions.

Aesthetic judgment commonly refers to judging beauty (Nanay 2019). However, here I am adopting a loosely Kantian (1790) constructivist[2] usage of the term to refer to our discernment and sense-making of the world: the mind actively constructs sensory knowledge, which Kant called the transcendental synthesis combining sensation and intuition. The transcendental synthesis requires a perceiver, an *a priori* mental categorization of reality, reality (the unknowable "things in themselves"), and perceived reality (Scruton 2001, 30). The sense perception of reality is sometimes called *aesthesis*, and scientific research on map design concerns aesthetic judgment.

Aesthetic attitude refers to the 'attitude' with which to approach a work of art. A dominant aesthetic attitude from Kant (1790) is *disinterest* or *contemplation* (Cooper 1995). The aesthetic attitude seems incommensurate with cartography since maps are generally ***interested objects***, meaning that maps have a functional (instrumental) purpose rather than an end in themselves. Additionally, Kantian disinterest disallows an external (conceptual) referent, which seems to be a necessary condition for a map. However, some aestheticians have argued against a binary distinction between interest and disinterest (e.g., Nanay 2019, Scruton 1974) so one may be able to take an aesthetic attitude with a map.

Some aestheticians have called for discarding the concept of aesthetic attitude altogether in favor of ***aesthetic attention*** (Nanay 2016; Dickie 1964, cited in Shelley 2020). We pay attention to things that we care about and pay attention in specific ways. 'Aesthetic' attention is therefore a specific kind of attention, "distributed with regards to properties but focused with regards to

[2] Kant did not use the term construct, as 'constructing reality' may imply more agency than the world actually allows.

objects" (Nanay 2016, 23). Aesthetic attention is thus a unique way of attending by focusing on one entity and many properties (Table 1.1).

Attention	Example
(1) Distributed with regards to objects and focused with regards to properties	• Visual search experiments, • Sorting by a property (pick out green countries)
(2) Distributed with regards to objects and distributed with regards to properties	• Wandering, 'aimless' attention
(3) Focused with regards to objects and focused with regards to properties	• Looking for a specific property of a specific object. • *Interested attention,* such as a map use scenario.
(4) Focused with regards to objects and distributed with regards to properties	• Less common experience; *disinterested attention*. • An object can be a whole (a landscape or a map) or a part (an icon); one's enjoyment of a map
Table 1.1: Attention. From Nanay (2016).	

Psychological research on attention has focused on entities (i.e., objects) and properties. Studies have examined how many objects to which humans can attend and the property dimensions of the perceptual space (Nanay 2016). Cartography breaks the 'map entity' into its constituent elements, or properties, for instance via the "visual variables" (Bertin 1967 [1983]). Thus, the visual variables can be viewed as ***properties*** of the map object and the map object as an ***entity***. Nanay's (2016) conception of aesthetic attention suggests that cartography could widen its study to *simultaneous* consideration of properties and entities, especially the role in which properties construct the experience of the entity (the map), rather than the interpretation of the referent (the external world) as an investigation of aesthetic attention. For design, this could be an emphasis on how changes in the visual variables or the addition of content affect the experience of viewing a given map as an entity in itself, rather than as a signifier of the outside world; to borrow Kent (2005)'s term, the "landscape" made on the map appreciated for itself (Kent 2005, 184), and without consideration of its reference to the external world, perhaps similar to a formalist analysis in art.

Related to the aesthetic attitude is the Kantian concept of an 'aesthetic' object**.** A ***functional object*** is an object with an instrumental purpose: one engages with the map to achieve some other purpose. An ***aesthetic object*** does *not* have an instrumental purpose. Aesthetic objects exist for the pleasure of beholding them, referred to by Kant (1790) as *disinterest* (also taken to be the aesthetic attitude). Kant did not use purposelessness and disinterest to distinguish art from non-art but to describe the aesthetic experience: that is why Kant uses the term aesthetic objects rather than art objects. Breaking a map down into its parts through visual variables is a definitional way to turn a map into an aesthetic object, in line with the formalist program in art.

Related to Kantian aesthetic objects is Kantian beauty. Kant describes two kinds of beauty: free beauty and dependent beauty. ***Free beauty*** does not require conceptual thought, has no interests, and has an indeterminate purpose. Aesthetic objects are objects of free beauty. For Kant, part of an aesthetic experience is seeing objects as individual objects (rather than a concept or Platonic form), whose purpose is an experience of "the purposiveness of nature" (Scruton 2001, 110). In contrast, ***dependent beauty*** requires preconception.

Aesthetic value judgments are arguably the most common kind of conscious aesthetic engagement, especially within cartography, where aesthetic disagreements are common (e.g., the kneejerk reaction to typefaces such as Papyrus and Comic Sans). Kant frames aesthetic value judgments around subjective universals (Scruton 2001). An aesthetic judgment is a subjective judgment because aesthetics is subjective. However, judgment implies universality, and to some degree, objectivity. Subjective judgment therefore is an antinomy (contradiction) between two valid principles because aesthetic judgment has both a subjective and objective aspect (Scruton 2001). Loosely, the ***subjectivity*** of aesthetic judgment relates to individual ***taste*** (itself, the verb form of aesthetics), whereas the ***objectivity*** of aesthetic judgment relates to the universality of experience.

Aesthetic value judgments are among the most problematic applications of aesthetics. The "beauty shop" or "beatification" applications (Nanay 2019, 8; Danto 2003, 79) characterizes a common western view of aesthetics as synonymous with vulgar 'beauty'. According to the beauty shop approach, things ought to be 'beautiful', and to the extent that they are not, they ought to be 'fixed' and made to be 'beautiful' (Nanay 2019). While it is impossible to avoid aesthetic value judgments, they can preclude thinking about other aspects of aesthetic experience, such as attitude or attention. Furthermore, there may not be any 'universal' principles that make a work of art 'good' (Shelley 2022).

Aesthetic experience is a dimension of other aesthetic concepts. Dewey (1934) critiqued the sequestration of aesthetic experience from the public through museums and the distinction of 'high' and 'low' art (Leddy and Puolakka 2023). For Dewey (and others), aesthetics describes the unifying experience of creation, an experience of resistance and tension. An artist, a scientist, and a mechanic can all be "aesthetically engaged" by creating with care, and their work—or the work of any craftsperson—can be an object of fine art if the artist or creator "lived fully while producing it" (Leddy 2020, 16). Aesthetic experience expresses the unity of the mapping *process* between mapper and viewer, in line with post-representationalist discussions on the natures of maps (e.g., Azócar, Fernández and Buchroithner 2014, Dodge, Kitchin and Perkins 2011; 2009). Objects made and used in unpleasant conditions lack aesthetic value (Leddy and Puolakka 2021).

1.3 Map to Dissertation:

My dissertation proceeds in eight chapters:

Chapter 1: Introduction and Research Questions. The introduction has focused on defining the problem: cartography is an aesthetic field that has a complicated, sometimes antagonistic relationship with aesthetic theory. I have outlined key concepts and defined my

research question, *how has Academic cartography arrived at its current aesthetic epistemologies*? I conclude Chapter 1 with this roadmap.

Chapter 2: Theorizing "Really Good Maps": Cartography and Aesthetic Philosophy. In Chapter 2, I expand the introduction to aesthetics in cartography found in Chapter 1 into a full review and synthesis piece outlining aesthetic philosophy and cartography's difficult relationship with aesthetic theory. This work has predecessors in Kent (2005, 2012, 2017, 2018a); Dodge, Kitchin and Perkins (2011), and Denil (2012). I introduce in detail aesthetic concepts such as judgment, value, objects, attention, and experience, connecting these concepts to existing aesthetic epistemology. Then, I emphasize new developments in philosophical aesthetics regarding aesthetic normativity, experience, and value. These developments provide language for aesthetic concepts in cartography, and resources for cartography to argue for its value as a discipline, as well as build out cartographic aesthetic theory.

Chapter 3: A Concordance Analysis of Aesthetic Themes in Cartographic Textbooks. In the methods chapter, I introduce corpus linguistics as a tool to study changes in language use and semantic meaning over time, helping to understand how aesthetics has been marginalized in cartography. I explain the formation of the cartographic textbook corpus, including my selection criteria, which I varied by era to follow changes in indexing and cross-referencing. I then explain my selection of my key words associated with aesthetics in cartography: design, taste, beauty, art, and style, and describe the procedure I followed to conduct my concordance analysis, from digitizing textbooks to cleaning up the Optical Character Recognition (OCR) scans and assessing OCR quality for concordance retrieval. I briefly explain the coding scheme that I applied to my text, providing the full concordance spreadsheets in supplementary materials on my website. I conclude with a description of the analysis to follow in Chapters 4, 5, and 6: first, a six-word Key Word in Context (KWIC) analysis used to provide a summary overview of all concordances in

Chapter 4, followed by Chapter 5, which provides a detailed overview of the most common key word part of speech (POS) found in the corpus, *design nn* (design as a singular noun). Chapter 6 takes an in-depth look at the concordances of all other aesthetic key words, which were attested much less frequently than *design nn*. This analysis uses 101-word concordances, contextualizing the results with a close reading of the text. I conclude with an outline of the analytical products produced by the analysis.

Chapter 4: Overview of KWIC Results. The results chapter outlines the quantitative findings from the six-word KWIC analysis, providing an overview of results by part of speech and by era. I discuss results by part of speech, then by key word, and finally by analysis era, providing statistical overviews, noting unexpected patterns, and summarizing overall trends. The statistical analysis in Chapter 4 results guide the selection of key word POS to examine in detail in Chapters 5, 6, and 7, making decisions based on the information provided by each POS.

Chapter 5: *design nn*. In Chapter 5, I examine *design nn* (design as a singular noun), the most common aesthetic term found in the corpus, which comprises 43.4% of all concordances. This analysis is driven by the six-word KWIC, which considers the entrance of all design noun phrases into cartography. I show how cartography turns to design in times of disciplinary stress, using design to signpost cartography's identity as a scientific discipline distinct from GIS. I then discuss the extensive development of the important noun phrase *design process* within cartographic textbooks through examining 101-word concordances containing the noun phrase *design process*.

Chapter 6: *aesthetics*, taste*, beauty, and *art***. In Chapter 6, I analyze all POS related to these key words, using the six-word key word in context to identify the most commonly occurring phrases. I then analyze the most commonly occurring key words for each POS through examining the full 101-word concordances containing them. I connect the key words to aesthetic concepts

and highlight vague and contradictory meanings, emphasizing how key words change over time and meanings shift between words.

Chapter 7: *style.** In Chapter 7, I examine *style**. This discussion is grounded by the network theory, described in Chapter 2. This analysis is driven by an overview from the six-word KWIC, followed by an examination of 101-word concordances that describe uses of *style**. Focusing on typography, I examine how style* both calibrates cartography's aesthetic profile and reveals antagonisms within the field.

Chapter 8: Towards an Expanded Epistemology of Cartographic Aesthetics: Discussion and Outlook. Chapter 8 is the conclusion, in which I review the findings from my study. I discuss limitations before characterizing the relationship between design, a word that took on explicit meaning, and aesthetics/aesthetic synonym terms which were absorbed by design. Next, I show how *design nn* noun phrases develop the aesthetics of cartographic epistemology as objective, scientific, and technological. Limits in aesthetic language may be limiting cartography's range, particularly in relationship to aesthetic attitude and aesthetic experience. I discuss how limitations may be addressed through developing additional cartographic aesthetic theory and theorize on how maps might be created emphasizing aesthetic attitude and experience that further Post-Representational design in cartography. I conclude with a brief outlook on the future of cartography and aesthetic philosophy.

A last note before I begin: much of this dissertation involves taking scholars (literally) at their word. The cartographers discussed in this monograph had (and have) long careers, over which their views develop and change. The views I discuss are cartographers' views from the year of their work's publication, unless otherwise noted.

Chapter 2: Theorizing "Really Good Maps": Cartography and Aesthetic Philosophy

2.1 Aesthetics: The Scarlet Letter 'A'

Cartography is an aesthetic discipline. Nevertheless, aesthetics remains neglected in cartographic theory, considered a 'design by-product' or somehow independent from data or the map (Kent, 2005, 2012). As a result, aesthetic theory has never been incorporated as a theoretical approach in cartography, even though cartographic aesthetics has been a topic of analysis over cartographic history.

Even as a term, aesthetics has had unclear and confusing usages by cartographers. Aesthetics is *not* synonymous with art, although art has aesthetics. Aesthetics is *not* synonymous with beauty, although aesthetics theorizes beauty. Aesthetics is *not* synonymous with style, attractiveness, or appearance, although all may be related to aesthetics. So, what, exactly, is aesthetics? A simple way to understand ***aesthetics*** is as *"special* kinds of experiences," distinct from everyday, nonaesthetic experiences, which "really matter" to us (Nanay 2019, 2). Aesthetics is a noun with a surprising verb form: ***taste*** (Shelley 2022).

When cartographers write about aesthetics, they often think of it in hedonic terms (i.e., aesthetic pleasure). Cartographers sometimes have a positive view of aesthetics (e.g., Keates 1996; Kent 2005; Denil, 2007; Case 2012), but others are critical of it. They problematize aesthetics as unscientific or detracting from map function (Robinson 1952; Woodruff 2012). Some writers have critiqued cartography *itself* on aesthetic terms, engaging the hermeneutics of suspicion to reveal the masked ideologies in maps (e.g., Wood & Fels 1986; Harley 1989; Wood 2007; Edney 2019).

The concerns with aesthetics are well-founded. They tell us that either: (A) we should abandon aesthetics—and possibly, cartography—or (B) we should reform it. Option B is worth considering.

I argue for Option B. Abandoning or neglecting cartographic aesthetic theory comes at a high cost, whereas reforming aesthetic theory helps cartographers theorize 'really good maps' and articulate cartography's values. I make my case for Option B by first making my best case for Option A, cartography's status quo, which rejects or neglects aesthetic theory. Option A contends that aesthetics in cartography is optional, detrimental, or unneeded. I examine influential American cartographic theorist Arthur Robinson as a representative of 'traditional' (Euro-American academic) cartography. I show how Robinson's rejection of art and aesthetics in cartography echoes traditional Euro views on aesthetics from Immanuel Kant. Then, I examine Marxist critiques of aesthetics and show how aspects of these critiques appear within influential critiques of Robinsonian cartography.

Through this examination, I demonstrate Option A is, at the very least, self-contradictory: Robinson's attempt to replace aesthetics in cartography with reified scientific design is simply aesthetics by another name. Rejecting aesthetics in cartography led to the promotion of a narrow aesthetic: the aesthetics of science and technology. This default aesthetic was subject to iconoclastic critiques (e.g., Wood 2003; Harley 1989), which received broad acceptance in academic cartography.

To form Option B, I look at a commonality between Robinson's critique of aesthetics in cartography and Marxist critiques of aesthetics. Both positions assume aesthetic hedonism, which holds that aesthetic value is *always* hedonic (based on pleasure). Discarding the assumption of aesthetic hedonism opens options for cartographic aesthetic theory beyond Kant (and Robinson!) to incorporate new developments in aesthetic theory regarding aesthetic normativity (Lopes 2018)

and experience (Nanay 2016). These developments, along with aesthetic concepts such as aesthetic value, aesthetically relevant properties, aesthetic attention, and aesthetic experience, provide a useful lens on cartographic aesthetics, allowing cartography to better articulate its aesthetic theory and value as a discipline invested in making 'really good' maps.

2.1.1 What Makes a Map 'Really Good'?

Questions regarding when maps are good cannot be disaggregated from aesthetics and answering these questions is maddeningly difficult, perhaps especially difficult within the epistemology of scientific cartographic design research. How is 'good' to be understood? Objectivity? Resemblance to a real-world object? If so, in what way? Is 'good' pleasing a client? Success on a map use task? A Likert-scale rating of 1-5 'I like this map?' —a hedonic value? What is the intersection between a 'good' map and an ethical map?

Some may want to capitulate and say aesthetics is all relative and there can be no real accounting for taste. However, that position is incompatible with the facts of cartographic practice. Simply put, it is not the case that anything goes—as suggested by ***vulgar aesthetic relativism***, which does not acknowledge the extensive cartographic epistemology on map design or the disciplinary norms of cartographic practice.

Disclaimer: by invoking a potentially radioactive phrase like 'disciplinary norms', I am *not* arguing in favor of the concept of 'Map Police[3]', nor do I advocate a 'beauty shop approach' to cartographic aesthetics in which maps ought to be beautiful, and if they are not, they ought to be fixed and made to be beautiful (Nanay 2016). Instead, I am looking at facts of professional cartographic practice: there are *some* design choices, in *some* circumstances, that cartographers

[3] The 'Map Police' is an informal term used in academic and professional cartography to refer to prescriptive, 'insider' critique of map design. See Krygier (2007).

commonly consider 'bad', from the seemingly trivial (e.g., typeface selections such as Papyrus and Comic Sans) to design choices that exclude people (such as a map intended for public use that is not red/green colorblind friendly, and thereby is illegible to 4-10% of the population), to evil maps that should never have been made at all (like redlining maps, which sanitize violence to red marks on a page). The distinction between a 'good' and 'bad' map is *not* a notional (superficial) difference but a real difference to disciplinary cartography, in which cartography has real epistemological commitments. Seemingly notional differences on maps matter whether one takes a universalist or perspectivist attitude towards the value of a particular map.

This argument is not meant to pin down cartographic aesthetic epistemology or even to offer a comprehensive outline. As I hope to demonstrate, cartographic aesthetic theory is expansive, and this paper cannot hope to approach more than part of the story. Furthermore, cartographers have strong opinions on aesthetic matters and often disagree (cartographers: how do you feel about the Gall-Peters projection?) Aesthetic disagreement is not only inevitable but serves a functional purpose. As Lopes (2018) explains, aesthetic disagreements indicate that cartography is calibrating its aesthetic profile, or just what 'it' is that makes a 'good' map. Instead, I provide an introduction to traditional philosophical aesthetic concepts, an aesthetic agenda for cartography and an invitation to cartography to contribute its rich epistemology to aesthetic theory.

2.2 Option A

The best-known objections to art and aesthetics in academic cartography come from Robinson (1952), who rejected Eckert's placement of aesthetics in cartography (Robinson 1952, 17). Robinson replaced aesthetics with reified design (Nestel 2019). His rejections hinge on the argument that *the purpose of a scientific map is to be a functional object* (Robinson, 1952), which he views as incompatible with art and aesthetics. In rejecting aesthetics, Robinson echoes a well-

known philosophical position, whose most famous exponent was Kant (1790), that aesthetic things cannot be functional objects. Kant's argument is important to understand Robinson's aesthetics rejection as well as later critiques of cartography.

2.2.1 Kant: Maps are Interested Objects

Cartographers (probably) agree that maps are interesting objects, but according to Kant (1790), they really are *interested* objects. They are tools used for a functional purpose, i.e., in the *interests* of completing another task, like wayfinding or problem-solving. They are *not* ends in themselves, such as a work of art hanging on the wall in a gallery, whose purpose is to be experienced for its own sake. In fact, if someone is contemplating a map's design—that is, focused on the map as an object, without reference to outside objects or purpose—then the design interferes with the map's use as a tool, a concern expressed by Robinson (1952).

For Kant, a functional object—a map—cannot be an aesthetic object because it cannot be regarded with disinterest. If someone takes an *interested* attitude towards an object, then they do not appreciate the object on its own terms, without reference to anything besides the object. Beautiful things, like a work of art or a sunset, are to be appreciated as their own ends and thus purposeless: they serve no interests whatsoever. Maps, at least functional maps, are thus incompatible with a *disinterested attitude*: they have real-world referents, and they are made for a functional purpose.

Kant believes there are things that humans seem to universally agree are aesthetically beautiful (i.e., give hedonic pleasure) because of how the human mind is structured. This pre-structuring creates *normativity*: people really ought to appreciate a sunset, and if they do not, then there is something wrong with them. Either they did not take the correct aesthetic attitude of disinterest, or their sensory apparatus was not functioning properly. If both conditions are met, failure to have an aesthetic experience is a result of poor *taste*. Thus, disinterest is subjective

because it varies by person—pleasure is subjective—but there are objective universals: a person really *ought* to appreciate that sunset, and if they do not, there is something suspect about them.

2.2.2 Robinson: Beauty Degrades Cartography

Post-WWII academic cartographers have rejected aesthetics for various reasons, including a perceived similarity to art (Varanka and Krygier 2016). Here I discuss Robinson's *The Look of Maps* (1952) as the standard bearer of post-WWII cartographic aesthetic rejection, noting that Robinson was by no means the only exponent of this position. *The Look of Maps* was a foundational research agenda of postwar cartography (McMaster and McMaster 2015). Its Kantian arguments against cartographic aesthetics still are echoed today. Perhaps most importantly of all, Robinson's replacement of aesthetics with scientific design language remains the basis for the epistemological validity of Euro-American cartography.

In *The Look of Maps*, Robinson characterizes aesthetics (and art) as hedonic, subjective, and anti-science. Objective, scientific cartography requires framing maps as 'functional' and 'purposeful' objects. This framing meant stripping away any design that might produce aesthetic experience in the map itself, for map beauty comes at the cost of functional map use. Worse yet, bad actors can exploit beauty to empower propaganda. Thus, to create an objective and moral basis for the 'look' of maps, Robinson must excise the place of beauty in 'scientific' mapmaking.

Robinson attacks 'artistic' taste as a hedonic and inappropriate basis from which to create a functional map. Taste is, for Robinson, a cartographer's artistic sensibility—what 'I' as a cartographer 'like' (Robinson 1952, 19). Given its subjective nature, there was no way to objectively choose between different designs by appealing to taste, and thus no way to form a scientific understanding of the map user, specifically, how the map user[4] will react or interpret the map, or for

[4] Note, here, that 'map user' is singular—this is a unitary conception of the map user.

a designer to argue that one design is better than another. Thus, taste cannot provide an objective standard for cartographic excellence, necessary to determine if a map is a functional object.

Because taste appeals to subjective feelings, and feelings can override intellectual responses, aesthetics can be manipulated by the mapmaker towards unsavory ends, such as wartime propagandistic abuse. For Robinson, this fear is the result of his firsthand experience during WWII as the head of the Allied Office of Strategic Service's (OSS) Maps Division. Robinson cites his colleague Hans Speier, a sociologist and expert on German political propaganda who headed an Allied department analyzing Nazi propaganda. Speier explains that by manipulating size, shape, and colors, cartographers can invoke "magic geography" and distort an objective understanding of reality (Speier 1941, 313-14). 'Magic geography' is an aesthetic experience to which all maps are vulnerable because all maps must have, in Robinson's words, a 'look'. The scientific cartographer must "guard against" this moral vulnerability by prioritizing the appropriate (objective) intellectual response (Robinson 1952, 21).

Robinson argues that the best prophylactic to aesthetics is scientific *design* investigation. Since trusting cartographer's taste is too dangerous, and standardizing all design decisions is "[obviously] absurd" (Robinson 1952, 19), perceptual and psychological studies of cartographic technique provide a seemingly objective basis from which to obtain cartographic design principles. Robinson emphasizes the importance of design as a concept not interchangeable with other words. By speaking of reified design (Nestel 2019), subjective and potentially subversive 'art', 'aesthetics', and 'beauty' could be controlled for in the new 'scientific' cartography.

Robinson's approach aimed to ward off critiques that cartography was not a science and establish American cartography as an academic discipline rooted in geography (Robinson 1952; Keates 1996,190) by helping cartography *resemble* a scientific discipline (Edney 2005)—aesthetics at work.

2.2.3 Cartographic Scientific Aesthetics: The Status Quo

The irony of Robinson's crusade against cartographic aesthetics is that the crusade was itself based in aesthetics by echoing Kant's talking points, emphasizing that maps are functional objects, not aesthetic objects. Nevertheless, as we have seen, all maps must have a 'look'. Thus, Robinson's scientific design language is aesthetics dressed up as science.

Aesthetics, however, is more than just a dress or a 'look'. Scientific design language confers to maps the epistemological validity of science, including universal applicability, objectivity, and a (purportedly) value-free presentation of reality, helping cartography *itself* present as an objective science. Scientific aesthetics produced by Robinson's scientistic design language often is employed as an argument for the value of professionalized cartography itself—what we might call *traditional cartographic value claims*. [5] Thus, Robinsonian cartographic epistemology actually *relies* upon aesthetics for its value. Option A, removing aesthetics from cartography, will not work.

What about a softened version of Option A, in which cartography accepts the existence of aesthetics, but ignores aesthetic theory? This softened position is academic cartography's status quo. Modern cartographic epistemology is not overtly hostile to art and aesthetics but uses Robinsonian scientific design language to frame design recommendations. This language elides aesthetics, emphasizing that many recommendations are derived from psychological research into perception and cognition. Bolstering cartography's aesthetic neglect is cartography's reliance on semiotic frameworks, which tend to push "aesthetic judgment into mere rhetoric" through deconstruction (Guter 2010, 188) of epistemology.

Commentators on maps have picked up on the effects of cartographic scientific aesthetics. In cartography, and cartographic epistemology, cartographic scientific aesthetics creates the

[5] Following scientific design guidelines, maps often mimic the appearance of science (Dodge, Kitchin, and Perkins 2011).

following common assumptions about maps: the View from Nowhere (Nagel 1986), The God Trick (Haraway 1988), and Progressivism (Edney 1993), which in turn reinforce cartographic conventions as authoritative and scientific.

However, a softer Option A must contend with further aesthetics-based[6] critiques on traditional cartography. Influential iconoclastic critics such as Harley (1989) and Wood (1992) have argued that maps are 'masks' for institutional power. The most extreme forms of these arguments (Wood 2003) claim that cartography is irredeemable and should be abandoned.

Although as a cartographer I do not agree with abandoning aesthetics (or cartography!), these critiques are worth taking seriously. In the next two sections, I show how a Marxist case for abandoning aesthetics results in arguments to abandon cartography.

2.2.4 The Mask and the Map: Marxist Critiques of Aesthetics in Cartography

A well-known exponent of Marxist critiques of aesthetics is Eagleton (1990) in *Ideology of the Aesthetic*. Like Kant, Eagleton's views are more complicated than the brief introduction I have laid out here.

Eagleton's position is a critique on Kantian aesthetics, beginning with the relationship between aesthetics and epistemology. Kant does not believe that we can ever know the 'things in themselves' but holds that our experiences of reality are mediated—'constructed' by our brains, which pre-filters information. In Kantian epistemology, this mediation is called the transcendental synthesis. Like perception, aesthetics relies on the transcendental synthesis, however, aesthetics does not provide knowledge of the world around us in a 'normal' way, such as through everyday perspectival experience. Aesthetic experience is a *special* experience that reminds us of how we

[6] These critiques are often expressed in semiotic terms rather than aesthetic, reflecting cartography's longstanding epistemological rejection of aesthetics and involvement with semiotics, which tends to elide aesthetics.

are embedded in the world itself, and the limits of our human perspective, by momentarily allowing us to transcend it through disinterested attention.

But… *really?* Can the relationship between aesthetics and knowledge be summed up so neatly? Or could it be that aesthetics *itself* is a construction functioning to disguise power relations? Eagleton (1990) argues that the Kantian aesthetic is an *ideology* that reinforces bourgeoisie power by providing a *mask* for bourgeoisie epistemology. The mask is policed by taste and underpinned by hedonism.

These are strong charges, and it may be hard to see how they relate to cartographic epistemology. To make these arguments more concrete, I examine them using the communication paradigm (although the charges are certainly not restricted to that model).

The cartographic communication model was developed by Board (1967)[7] and subsequently refined by Koláčný (1968) to describe the transmission of cartographic information on a map between mapmaker and viewer. The model reflects the influence of cybernetics and information theory, and in particular, Shannon's (1948) *A Mathematical Theory of Communication*[8] that describes the transmission of information in signals (Figure 2.1a).[9] In Shannon's linear and unidirectional model, a message is encoded in a signal from a transmitter, is contaminated by noise, and then is received; this model was then generalized to include human (semantic) communication (Shannon and Weaver 1949).

[7] Board (1973) credited the general concept to Robinson.
[8] Hackley and Jones (2011)
[9] Poore and Chrisman (2006) citing von Foerster (1950).

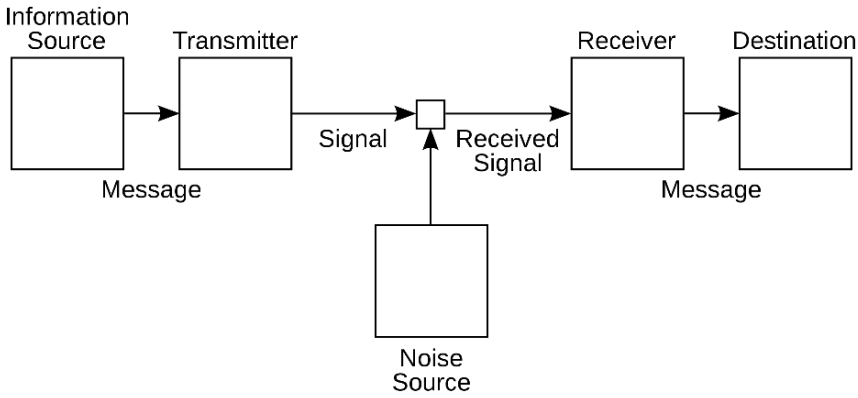


Figure 2.1 Claude Shannon's (1948) Information Communication Diagram, later known as the Shannon-Weaver model.

The general formulation of the cartographic communication model presents the map as a 'one shot' chance to communicate objective information between the mapmaker and the map viewer, as shown in Figure 2.2a (Roth 2013). The cartographer's goal is to mitigate individual subjectivity in information transmission—in Shannon's model, and Robinson and Petchenik 1976's words, "noise" (Kent 2018b, 99)—to match the reality of the cartographer to the reality of map user, resulting in 'intersubjective'[10] unity on 'objective' reality (Figure 2.2b)..)

How does this process work? The cartographer selects objects in the world to communicate on the map. This is the mapmaker's message. There is a one-to-one correspondence between the objects in the world and the objects on the map, and there is a one-to-one correspondence between the message sent about objects from the mapmaker and the message received about objects from the map user. It is an objective cartography, and if it is done 'right', the map is 'scientific', without ambiguity.

[10] *intersubjective* refers to a shared perception of reality between people

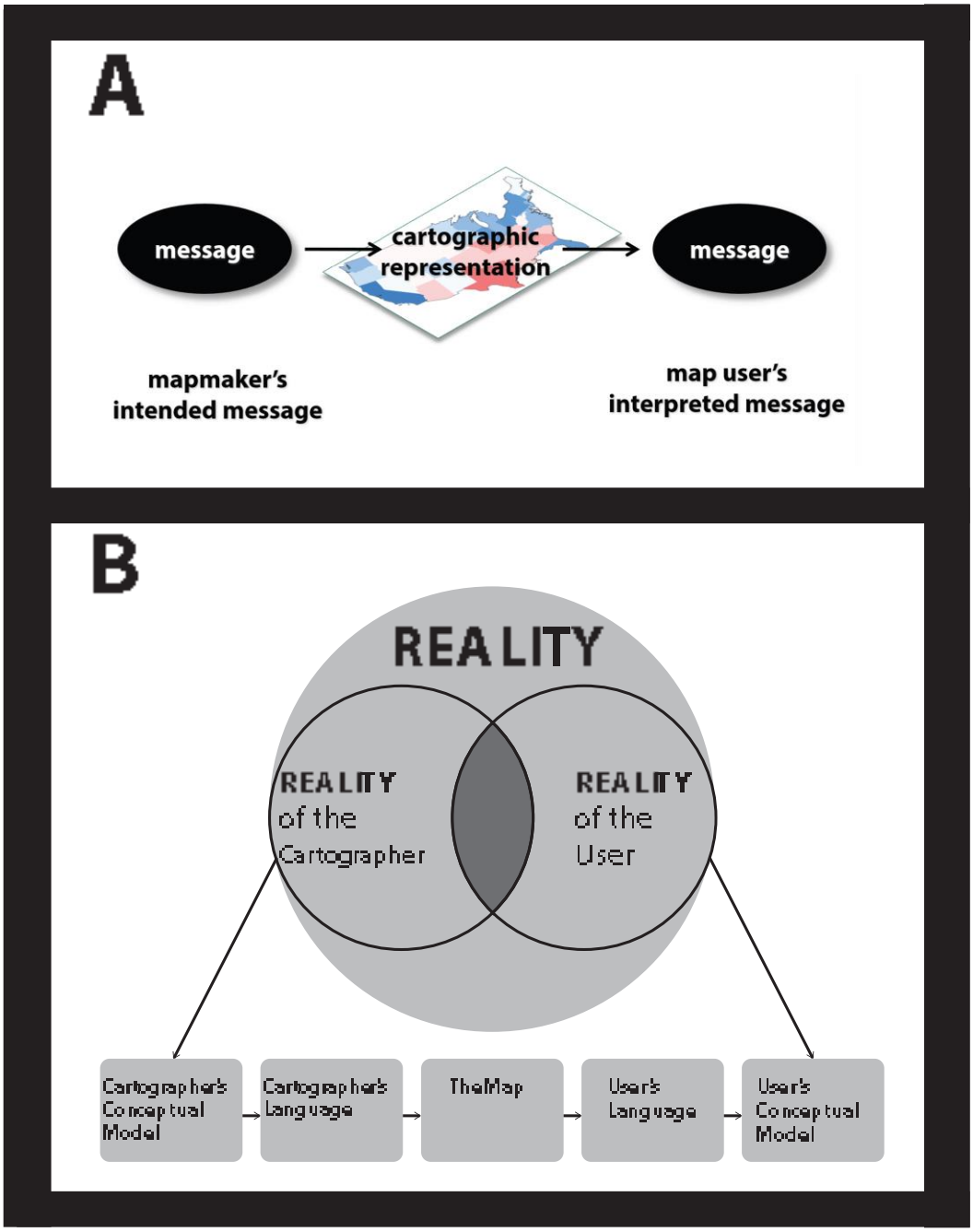


Figure 2.2. Views of the Communication Paradigm.
A: A general view of the communication paradigm (courtesy Robert Roth).
B: Koláčný 1968's view (redrawn by author from simplified image by Nivala and Sarjakoski, 2004).

To 'do' scientific cartographic communication 'right', the mapmaking process must become objective, *which requires objectifying not only reality on the map, but also the map viewer*, to determine if the 'message' was received. The communication paradigm defines the map viewer as a

Kant-like formal subject. The Kantian ***formal subject*** has a *normative* sensory apparatus and 'pre-structures' sense experience the same way. In that sense, the formal subject is not an individual, but 'a formal perspective on reality' (Eagleton 1990, 73). So 'constrained', the subject cannot remake the world and lose objectivity: intersubjective unity can be achieved.

A formal subject has other epistemological benefits. WWII led American cartographers to regard the correspondence between objects on the map to reality as critically important to ensure that the map message was objective, and not just manipulation or propaganda. Cartographic communication could be used for nefarious purposes, for even Shannon's model could suggest "A has communicated effectively with B when B responds in the way A desires" (Fiske 2011, 59). In Robinson's words, "if visual relationships are [to] accomplish a positive purpose," then *something* must be done "to establish principles for their employment" (Robinson 1952, 21) to ensure objective communication of an objective world.

The Kant-like formal subject has a ready answer to such critiques: adhere to the objects of science. It may be impossible to know the 'things in themselves' or certain knowledge of reality, but through assuming a formal subject, objects become knowable, and investigable through science.[11] These objects, when agreed upon, provide objectivity. Objects define and provide values for the subject, and they can serve as an objective basis on which to base decisions and to derive epistemology. 'Ethical' maps adhere to a 'scientific' objectification of reality and deserve trust. The 'good' cartographer produces a 'scientific' map that conforms to the objects of reality—cartographic data—and an (objectified) formal subject—cartographic design, forming the 'look' of maps.

Of course, *someone* must decide how objects and subjects are constructed scientifically, and the entity with the power to decide is not the individual cartographer or science, but the

[11] Thus countering Humean skepticism about whether anything can be known about the world at all.

institution: the bourgeoisie or ruling class. Subject and object serve the interests of their creators (the bourgeoisie) rather than the individuals. In short, by providing a formal subject that 'knows' and objects *to* know, Kantian epistemology constructs what 'they' want you to believe is neutral, universal knowledge, with no interests at all.

What 'they' want you to believe? Really? If the above reads to you like something out of the Matrix, you see exactly the problem aesthetics addresses. People need a sense of individual subjectivity to feel their knowledge of the world is their own. *Something* must make institutional epistemology palatable because naked power based on the "bloodless rigour of the understanding" (Eagleton 1990, 17) just does not inspire us to go along with its demands. That something is the aesthetic, which reinforces bourgeoisie power by hiding it behind a mask of intersubjective beauty.

This claim may sound strange, given that cartographic epistemology in the communication paradigm rejects the place of subjective beauty in a 'scientific' map. But rejecting 'beauty' is part of cartography's scientific aesthetics because 'beauty' is associated with subjective 'art'. From the standpoint of Eagleton's critique, rejecting subjective 'beauty' is not only part of the map's ideological mask, but how the map becomes a 'good' map, helping people *feel* the knowledge given to them by the map is 'reality', 'trustworthy', and most importantly, their own. Thus, taking the place of 'beauty' are phrases like 'looks right', 'well-designed', 'objective', or 'useful'. These refer to intersubjective beauty, indicating the correct (bourgeoisie) way to view the world; they are often accompanied by positive affective traits: 'good' or 'professional' maps tend to look 'soft', 'even', 'complacent', 'polite', and 'soothing' (Wood and Fels 1986).

Ultimately, there is a threat of coercion if we do not accept the knowledge given to us by the state. What keeps us in line with bourgeoise epistemology is taste. *Taste* is the bourgeoisie sense of 'rightness'. The map that 'looks right' is the map following aesthetic norms. 'Good' maps—that is, maps made in ways that comply with aesthetic ideology—secure compliance in viewers by being

socially constructed as ‘looking right’, ‘well-designed’, or ‘objective’. Maps that do not comply are rejected as ‘ugly’, ‘bad maps’ ‘art maps’, or ‘not a map’. Rejected with the ugly are maps that challenge the dominant ideology. Such maps are affronts to cartographic taste (Figure 2.3).

Figure 2.3. Taste and the Map Police.

Robinson (1988), the ‘dean’ of postwar cartography, famously complained that the Gall-Peters projection ‘is somewhat reminiscent of wet, ragged long winter underwear hung out to dry on the Arctic Circle’. From a Marxist perspective, his complaint upholds the bourgeoisie image of the world and its attendant values, embodied by institutionalized cartography, here, represented by the caption “I *HATE* you.”

Image adapted from Randall Monroe’s XKCD web comic (2022).

As institutions, academic and professional cartography teach, practice, and enforce standards of taste. These aesthetic ideologies are derived from and reinforce external culture. In turn, cartographer’s livelihoods depend on conforming to professional cartographic practice (Keates 1996, 201). ‘Good’ cartographers must conform to the scientific and apolitical construction of cartography or face institutional wrath.

Critical, feminist, and post-representationalist cartographers long have sought to make mapping more inclusive through participatory mapping and countermapping (e.g., D’Ignazio and Klein 2020, Kelly 2021, etc.). Nevertheless, the state of cartographic affairs remains bleak when viewed from the lens of Marxist critique. Maps produce images and masks, which may contain hidden values that suppress individual perspectives and naturalize the state. Through aestheticization, maps deny that they have any agenda whatsoever, that the knowledge they present is natural and uncontroversial. It seems like there is no escape from ‘Evil Maps’ so long as

cartography remains an institutional practice, leading Wood (2003) to conclude that cartography itself is irredeemable.

These are serious charges. Most academic cartographers find at least some of the iconoclastic critiques compelling, and they have extensive expression within critical cartography. However, these critiques conflict with traditional functionalist value claims for cartography. Furthermore, these functional value claims, themselves expressed through cartographic scientific aesthetics, produce the conditions of the critique.

If we partially accept these critiques, as most cartographers do, a softer version of Option A, neglecting cartographic aesthetics, is contradictory, because these critiques are at least partially, if not predominantly based in aesthetics. Thus, it seems impossible to answer these critiques without aesthetics, especially the most serious calls to abandon cartography itself. We are led towards a full Option A, abandon aesthetics in cartography—and cartography itself—on the grounds that cartography's aesthetic practices render it irredeemable.

2.3. Option B: Reform Cartographic Aesthetics

Rejecting cartography is unacceptable (at least to cartographers). It is worth re-examining the place of philosophical aesthetics in cartography to find a defensible option between Robinsonian aesthetic rejection or Marxist aesthetic critique of cartography, both of which seem to exist in unsatisfying dialectical opposition, and both of which underpin cartography's discussions and assumptions about aesthetic matters.

A starting place for Option B is a hedonic assumption shared by both critiques. Kantian aesthetics, Robinson's rejection of aesthetics, Marxist critiques of aesthetics, and aesthetics-based critiques of cartography carry an assumption of ***aesthetic hedonism*** in which the aesthetic value of a map (i.e., what makes the map *aesthetically* good) is a *hedonic value,* typically pleasure,

obtained by interaction with the map. Some paradigm examples of hedonic values related to maps are below.

- successfully understanding what the map creator is trying to communicate (the pleasure of 'aha!')
- delighting in how the map 'looks' or 'works' 'right'
- admiring a map's design
- taking pleasure in creating a map

To the *cartographic* aesthetic hedonist, aesthetic values lie in the experience of the map itself, as a 'special' experience of pleasure derived from interaction with the map. The site of the value can vary (is the map beautiful, or are the Swiss Alps? Keates, 1984). Finally valuable experiences may or may not be intrinsic. You may like a map because it gives a good impression of a certain area (an extrinsic final value), or you might like a map because of its abstraction as a map itself (an intrinsic final value). Cartographic aesthetic hedonists wish to maximize the *final* experienced aesthetic value of the map, either extrinsic or intrinsic. In practice, that generally means increasing pleasure.

Some cartographers writing on aesthetic theory in cartography have taken an aesthetic approach consistent with aesthetic hedonism, such as Keates (1984), Kent (2008), Kriz (2009), Kent, Field, et al. (2012), and Nestel (2019). Aesthetic hedonism has real benefits: it has a long history, and seems able to interface with postmodern, poststructural, feminist, and post-representational concerns through anchoring onto an individual subject. I argue that at a simple level, cartographic aesthetic hedonism seems to suggest the primacy of emotions, especially feeling good. In contrast with cartographic aesthetic hedonism, which states that aesthetic values in a map produce a finally valuable experience of some kind, I argue that *vulgar* (common) cartographic aesthetic hedonism holds that *all of aesthetics* is synonymous with pleasure or emotion and has nothing to do with the final value of the map. This position is held by Option A, which rejects aesthetics as incompatible with scientific cartography.

The suspicion that aesthetics is nothing more than vulgar hedonism is found in cartography today (noted by Denil 2012, 76; Fairbairn 2009, Crampton 2010,167). It is described by Kent (2012) as a "treat[ment] of aesthetics as no more than a way of injecting appeal or charm" (Kent 2012, 54), Case (2012) as the "pejorative 'pretty'" (Case 2012, 21), and Keates (1984) as "something indefinable, isolated, emotional and limited to a few objects created specially for some artistic purpose" (Keates 1984, 40).

Accepting *vulgar* cartographic aesthetic hedonism bypasses a richer understanding of aesthetic theory that engages deeply with questions of value, representation, and meaning on an experiential and holistic level. These questions—such as what makes a map 'good' (Kent 2012; Case 2012), how maps 'work' (MacEachren 1995) —are among the most pressing to cartography today as the field reassesses itself in relation to GIS and web mapping and responds to important challenges from critical, feminist, and post-representationalist scholars within and without the discipline.

Although a robust aesthetic hedonism may be an option for cartographic aesthetic theory, the philosophy of aesthetics has an alternative to aesthetic hedonism, *the network theory*, that may help manage the dialectical opposition between aesthetic rejection and iconoclastic critique, providing a framework from which we can account for cartographic normativity and articulate cartographic aesthetic value, including questioning these values.

2.3.1 Aesthetic Value and Cartographic Normativity

Before diving into the network theory, it is helpful to understand aesthetic value concepts in aesthetic philosophy. ***Aesthetic value*** asks questions about what makes a map 'good'.[12] Aesthetic value is often thought of in hedonic terms, typically the ability to cause pleasure. Debates in

[12] 'Good' is often heard as 'morally good', but that cannot be correct, for there are good umbrellas, good test questions and good ideas.

aesthetic value often intersect value and ethics. Aesthetic value also serves a regulatory function, such as aesthetic standards for communities: homeowner's associations and zoning laws are filled with aesthetic value judgments. So too are map style guides (Andersen 2019).

Aesthetic value judgements are among the most common kinds of conscious aesthetic engagement, especially within cartography, where aesthetic disagreements are common (cartographers: how do you feel about software default design options?). Without nuance, value judgments are problematic applications of aesthetics, leading to charges of elitism (the 'Map Police'), superficiality (Woodruff 2012), and alienation (Wood 2007). Nevertheless, aesthetic value judgments are also a primary means by which cartographers advocate for cartography's existence as a field.

An aesthetic value judgment is a subjective value judgment because aesthetics is subjective. However, judgment implies universality and, to some degree, objectivity[13]. Kant's account of aesthetic judgment is normative (Guter 2010; again, Kant's theory is more complex than outlined here). Generally, cartographers identify aesthetics with verdictive judgments of taste (Denil 2012) using hedonic terms, such as *pleasure*, emphasizing subjectivity (e.g., Keates 1984, Varanka and Krygier 2015).

Normativity in cartography often takes the form of the 'Beauty Shop Approach'. In Woodruff's (2012) piece 'The Aesthetician and the Cartographer', which contrasts the cartographer with the cosmetic aesthetician, we see an example of what Danto (2003) and Nanay (2019) respectively call 'beautification' or a 'beauty shop approach' to aesthetics. According to the 'beauty shop approach', a map ought to be beautiful, and to the extent that it is not, it ought to be 'fixed' and made beautiful. Woodruff rejects this position for cartography as that of the (cosmetic)

[13] From Kant, the subjectivity of aesthetic value judgment (a verdictive judgment of taste) relates to individual *taste*, whereas the objectivity of aesthetic judgment relates to the universality of experience.

'aesthetician', as a promotion of vulgar (common) cartographic hedonism at the expense of substantive cartographic design.

However, eschewing aesthetics has not closed the cartographic beauty salon but *expanded* it, replacing 'beauty' with 'scientific design', with the academic cartographer as 'Map Police' evaluating conformity to certain kinds of cartographic scientific aesthetics. According to the Map Police, bad cartographic design is a crime, and violating maps ought to be jailed until ~~reformed~~ revised by a 'skilled' cartographer, i.e., a cartographer complying with cartography's aesthetic norms. The result is an unreflective normativity that restricts the kinds of maps that can be created. In post-WWII cartography, it has resulted in the dominance of one aesthetic: the aesthetics of science as the 'look' of maps.

Critical, feminist, and post-representationalist cartography have commented on cartographic elitism, the inaccessibility of cartography to newcomers, and narrow cartographic beauty standards (e.g., Bosse 2020; 2022). Cartographers are increasingly uncomfortable with unreflexive aesthetic normativity, as demonstrated by North American Cartographic Information Society (NACIS) talks on improving cartographic criticism (e.g., Huffman 2021 a & b). The Beauty Shop Approach and Map Police reflect cartographic aesthetic value theory (i.e., theorizing the values that make a map aesthetically 'good') defaulting to vulgar aesthetic hedonism.

The ***network theory*** helps articulate a map's aesthetic value by managing problems with aesthetic disagreement (who gets to say a map is 'good'?) and the metaphysics of aesthetic value (where does 'good' come from?) that occur with the assumption of aesthetic hedonism (Lopes 2018, 11). Aesthetic value is located in a network of ***aesthetic domains*** with a plurality of ways of being 'good'. Networks of domains account for aesthetic normativity and value, rejecting total perspectivism and universalism by rejecting the assumption that aesthetic value must always be derived from a finally valuable experience (i.e., aesthetic hedonism).

Cartography is situated within a network of social contexts or communities identified as aesthetic domains. Neighboring disciplines, such as graphic design or geographic information science, are neighboring domains. Aesthetic domains are distinct but can intersect along nodes: a cartographer may have expertise in mapmaking, and they may also have skill in graphic design or coding (Lopes 2018). A 'good' map to a GIScientist may be quite different from a 'good' map to a cartographer because of differences between the disciplines' ***aesthetic profiles,*** which constitutes excellence within a domain, as judged from within the domain. Disagreements over what exactly constitutes cartography's aesthetic profile help us to calibrate it, including delineating the boundaries of the field and subfields[14] (Lopes 2018, citing Sundell 2011).

Aesthetic profiles are formed by traditions and conventions of cartographic practice, forming cartography's *core* ***aesthetic norms***. These norms have been relatively stable over the past hundred years, even as technology has changed, as demonstrated by the consistency in cartographic pedagogy. The core aesthetic norms of cartography give the cartographic expert reasons to act aesthetically, in certain circumstances, according to certain values of cartography, telling the cartographer what they 'should' do.

Such value judgments—the 'shoulds', 'oughts', and 'musts' of map design—define cartographic aesthetic *merits* and *demerits*. Cartography's emphasis on *active* design decisions in mapmaking as opposed to 'default' design underscores the importance of value judgments. Merits largely come from map design recommendations, which serve a regulatory purpose on cartographic practice. Together, these core aesthetic norms 'scaffold' cartographic ***aesthetic achievement*** and give cartographers potential reasons to act (or not to act) aesthetically.

The network theory can help explain cartographic values in practice, providing vocabulary for cartographers to speak about a plurality of situated and contextual aesthetic values without

[14] Swiss and Austrian mountain cartography have notoriously different aesthetic profiles.

descending into total perspectivism regarding cartographic aesthetic value and normativity or rejecting important critiques of cartographic universalism, to which critical and traditional cartographers respectively object.

2.3.2 Cartographic Aesthetic Judgement and Aesthetic Properties

The network theory provides a framework for interpreting cartographic aesthetic value and normativity, but cartography does not have extensive experience working in aesthetic theory. I now re-introduce additional concepts in aesthetic theory that can help cartography articulate its aesthetic profile, such as aesthetic judgment (Kent 2012; 2008; 2005) and aesthetic properties. Both aesthetic judgment and aesthetic properties can be used in discussions of aesthetic value, informing how to critique and evaluate maps, as well as to consider in detail questions of our pedagogy, such as when conventions and design guidelines are applicable in the creation of maps.

Aesthetic judgement commonly refers to judging beauty (Nanay 2019) or a more general value judgment (Guter 2010). Although aesthetic judgement can intersect moral concerns, disagreement on aesthetic matters is generally considered acceptable, unlike most moral judgments; moral judgments seem more severe and consequential. As a result, aesthetic judgment is perceived as "a more modest matter" than moral judgment (McGonigal 2018). However, recent scholarship has argued the distinction between moral and aesthetic judgments may be far less 'modest' than supposed, since such judgments are not just made by individuals, but institutions. ***Aesthetic immodesty*** describes the *immodesty* of aesthetic normativity, for aesthetic judgments can carry the force of law, and consequences of violation can be severe (Soucek 2021).

Among cartographers, the *extent* to which aesthetic disagreement is acceptable is debatable (and in practice, maps are ranked, graded, and judged, reflecting subjectivity in cartography). Cartographic epistemology emphasizes individual cartographic judgment, but the norms and standards of cartographic practice are professionalized. Thus, some maps are

considered unethical by cartographers for aesthetic violations, such as roadmaps not designed for colorblind users, propaganda maps that violate the careful 'neutrality' prescribed by scientific cartography, or maps that promote exclusion or bigotry in the name of being aesthetically pleasing. These aesthetic violations carry moral weight, especially in the context of public use.[15]

Of course, not all maps are intended for public use, and not all maps are intended for all uses. Context matters: for cartographers, the map's use context (physiological, psychological, political, sociocultural, and so on) is generally not fully separable from the map object. Therefore, before judging a map as cartographically 'good', cartographers often first put the map in the 'correct' aesthetic profile by use scenario or map type; a simple scalebar and north arrow on a choropleth map may be commonly considered a merit, but the same features on a topographic map a flaw or demerit.

In philosophy of aesthetics, debates center around how an aesthetic judgment is valid and on what criteria (subjective or objective). Kant (1790) and Hume (1757) posited universality of aesthetic judgment, with origins deriving from sense perception; this is the approach that cartography tends to take in its empirical research and why critiques of Kantian aesthetics and epistemology are particularly cogent when used to critique cartography. Aesthetic judgements could be described as any judgement in which an ***aesthetic property*** is attributed to an object, though this definition requires an aesthetic property to be identified independently of the object to which it is attached. This problem relates to *immediacy*—whether objects can be judged to be 'beautiful' by aesthetic principles, and if so, whether those principles are neutral or imply value (Shelley 2022). Some philosophers, like Kant (1790), did not believe in the existence of

[15] Danto remarked that in public art, the public "has invested… its feelings, beliefs, and values. They in effect are the public in the medium of art." If maps are indeed 'us', then as Soucek remarks, we have aesthetic reasons for not wanting them to look bigoted or exclusionary (Soucek 2021, 5-6; quoting Danto 1985).

aesthetic principles, holding instead that we 'taste' that objects are beautiful through free-play of the imagination rather than reason (Shelley 2022).

Aesthetic properties do not seem to exist without being perceived (and immediately understood), which questions whether aesthetic properties exist if they cannot exist independently of objects (Shelley 2022). Despite the conceptual vagueness—and apparent circularity—aesthetic theory often has focused on aesthetic properties. Debates center on whether properties are objective or subjective, how they are attributed to objects, and whether they are necessarily evaluative (Nanay 2016, citing Levinson 2001). Positions on aesthetic judgment have been described as particularist and generalist.

The ***particularist*** position is that there are no value-neutral aesthetic principles that can be used to form judgments of overall value. In other words, aesthetic principles can be value statements, but they cannot be used to form judgments of overall value *because* they are not neutral or able to be universally applied. A particularist might say that when a cartographer describes a map, they give 'directions for perceiving' a work by identifying salient details to help others see as they have seen (Isenberg 1949, cited by Shelley 2022).

Paradoxically, this experience may be resonant with cartographic educators explaining how to see and evaluate a map like a cartographer. Students new to cartography do not yet have a cartographic 'eye'—acquired through classroom and lab instruction. They learn how to 'look' at maps 'like a cartographer', which often entails deconstruction into visual variables and map elements, units that assist cartographers in following cartographic aesthetic norms, conventions, and traditions. Until they have acquired a cartographic eye, students trust the expertise of the (individual) cartographer's interpretation of cartography until they learn for themselves the (apparently) universal principles that inform cartographic design.

The ***generalist*** holds that some aesthetic principles can have value in specific contexts and that works *tend* to be better for having a particular quality. Academic cartography seems to take a generalist position. However, the generalist position requires proving the aesthetic principle 'true' before coming to a verdict on a map, which seems to require judging a map before viewing it. While some design guidelines derived from perceptual studies seem generalizable, in practice, it can be hard to know when a principle is applicable, or even that it exists (Shelley 2022), a difficulty articulated by Denil (2012)'s summary of discussions on aesthetic 'clarity'.

Cartographic recommendations to design for scenario or map type seem to fall into the generalist position since the design context changes both conventions and best practices. So-called 'general' cartographic design also takes a generalist position, as we teach students general best practices derived from research (e.g., perceptual scaling). These are the 'rules', conventions, and guidelines of cartographic practice. However, we also teach that these are merely ways of seeing aesthetic principles according to cartographic tradition, laden with explicit and implicit values, rather than *the* way to see or single correct way to make maps.

Nanay (2016, 72; cartographic example added) suggests replacing aesthetic properties with aesthetically relevant properties, "If attending to a property of a [map] (or particular) changes the valence of one's experience of that [map] (or particular), it is an aesthetically relevant property." This thesis explains the function of aesthetic properties in cartography, asking *when* properties become aesthetic. This definition is inclusive, suggesting we also consider when properties might *negatively* affect the aesthetic experience or judgment of the map. Sometimes aesthetic properties positive in some circumstances could be neutral or irrelevant, or detrimental in others, depending on the aesthetic profile and circumstances in which a map is experienced or judged.

The list of potentially relevant properties is endless. Some aesthetic properties commonly cited by cartographers—and notably, sometimes conflated with all of aesthetics – include 'clarity'

and ‘cohesion’ (Imus and Loftin 2012), ‘beauty’ (Imhof (1982 [1965]), ‘prettiness’ (Petersen 2009), ‘balance’ and ‘fluidity’ (Brewer 2005), ‘expression’, ‘intention’, and ‘imagination’ (Keates 1996); and ‘vividness’ (Fish 2020). Other aesthetic properties invoked in map critique include ‘cluttered’, ‘disorganized’, ‘software default’, ‘convention violation’, ‘inappropriate projection’, and ‘typo/misspelling’.

These properties are cited by cartographers as interfering with map experience—but they may not *always* do so. A map percipient may have no idea that a map uses an inappropriate projection, violates cartographic conventions, and reflects default software design settings. Or, another property of a map may cause so much delight as to render these violations irrelevant, such as a ‘Sharknado’ weather map or the affection that cartographers sometimes feel for their first map (or their child’s first map; Figure 2.4). Furthermore, aesthetically relevant properties can affect the experience of a map without being consciously perceived, a phenomenon that may resonate with cartographers designing small details in maps.

Aesthetic properties, and especially *aesthetically relevant properties,* are useful for understanding design recommendations and subjectivity, teaching how to engage cartographically, and assessing the aesthetic value of a map. Versions of the aesthetically relevant properties debate capture the difficulty of thoughtful cartographic critique and design. They reflect the nonexistence of a ‘one design fits all’ solution to cartographic challenges.

Figure 2.4. Aesthetically relevant properties: ‘Map’. By Erwin Nestel, age 2.

2.3.3 Beyond Disinterest: Aesthetic Attention

The aesthetic attitude is said to be one of disinterest. Although the existence of disinterest itself is not controversial, disinterest has proven unhelpful to philosophical aestheticians for providing constitutive explanations of aesthetic value, as objects seem better appreciated because we know their use. The viewer’s attention may determine when an object becomes an aesthetic object (Nanay 2016). Thus, disinterest could be conceptualized as a kind of aesthetic attention. Disinterest as aesthetic attention has several benefits: first, disinterest as attention enables us to approach aesthetics through perceptual research. Second, there is already precedent for disinterest as aesthetic attention in cartography: Ortag (2009) has identified attractiveness with

attention and beauty, and Kent (2012) cites Eaton (2008)'s observation that "what has aesthetic value sustains attention" (Kent 2012, 44).

How does disinterest as aesthetic attention 'work'? When map percipients attend to maps, their attention is characterized as focused or distributed. In psychological literature, the difference between focused and distributed attention often comes from "the size of the visual field of the number of objects one is attending to" (Nanay 2016, 22).

Aesthetic attention is a specific *kind* of aesthetic attention paid to maps, "distributed with regards to properties but focused with regards to objects" (Nanay 2016, 23). Aesthetic attention may be a unique way of attending by focusing on one or more objects and distributing attention over many properties (Table 2.1). Distributed attention can be simultaneous but does not need to be simultaneous (Nanay 2016, 25).

Attention	**Cartographic Examples**
(1) Distributed with regards to objects and focused with regards to properties	Visual search experiments, Sorting by a property (pick out green countries)
(2) Distributed with regards to objects and distributed with regards to properties	Wandering, 'aimless' attention
(3) Focused with regards to objects and focused with regards to properties	Looking for a specific property of a specific object. *Interested attention,* such as a map use scenario.
(4) Focused with regards to objects and distributed with regards to properties	Less common experience; *disinterested attention*. An object can be a whole (a landscape or a map) or a part (an icon); one's enjoyment of a map

Table 2.1. Attention. From *Aesthetics as Philosophy of Perception*, Nanay, 2016, 24.

Aesthetic attention, the fourth in Table 2.1, seems to be hedonic *as experienced by the individual*: aesthetic attention is a perspectivist way of understanding aesthetic experience. Aesthetic attention also places a particular value on the *whole* of the map in a way that seems difficult for semiotic approaches to achieve, given their focus on deconstruction. Critics such as Kent (2005) have pointed out this lacuna in cartographic epistemology within the context of aesthetics. Disinterested attention is one means to address it.

Aesthetic attention has been studied using eye tracking experiments to investigate the difference between experts and novices viewing works of art (Nanay 2016, 27; citing Vogt and Magnussen 2007). This approach has limitations, as Nanay points out: one need not be an expert to have an aesthetic experience—but demonstrates the potential for empirical investigation using a method familiar to cartography.

2.3.4 Aesthetic Experience and Cartographic Aesthetic Process

Traditionally, the aesthetic experience is supposed to be one of unity—one is drawn away from oneself to become one with the aesthetic object (e.g., Kant 1790). Versions of this position have been found in cartography, relating aesthetics to the holistic experience of the map (e.g., Kent 2012; McCleary 2012).

A central question of aesthetic experience is whether experience is internal or external. Externalists argue that it is hard to describe the experience of an object without describing the object itself, and as a result, many theorists have moved to externalism (Shelley 2022). However, Nanay (2016) notes that we attend to our emotional experience, which is internal (Nanay 2016); in that sense, aesthetic experience truly is in the eye of the beholder. I discuss aesthetic experience assuming an internal, individual perspective. Internal aesthetic experience has two traits: "(a) we do not have complete control over them and (b) they have a lingering effect" (Nanay 2016, 16).

We do not have complete control over aesthetic experiences. Sometimes we go to art galleries, and the art does not speak to us, no matter how long we look at it. However, a lack of control does not preclude us from evaluating what we see aesthetically. In cartography, it is possible to assess aesthetic value when grading maps while having no aesthetic experience whatsoever. I *prefer* to have an aesthetic experience while grading maps, but after several hours of grading, I just do not have control. However, I can still evaluate maps' aesthetic merits, even though my inability to let my attention wander over the map may preclude an aesthetic experience.

After aesthetic experiences end, they linger. I remember my initial delight when viewing my students' maps, and I carry that delight with me to this day (Figure 2.5).

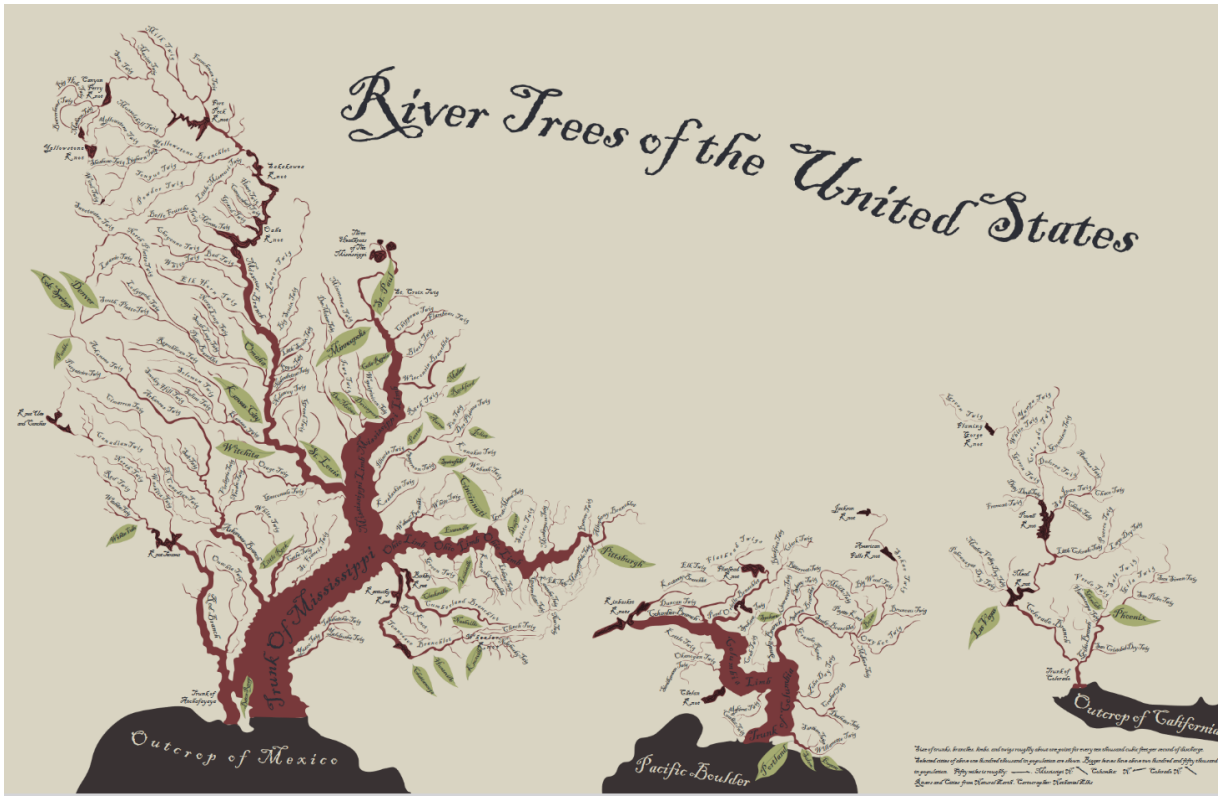


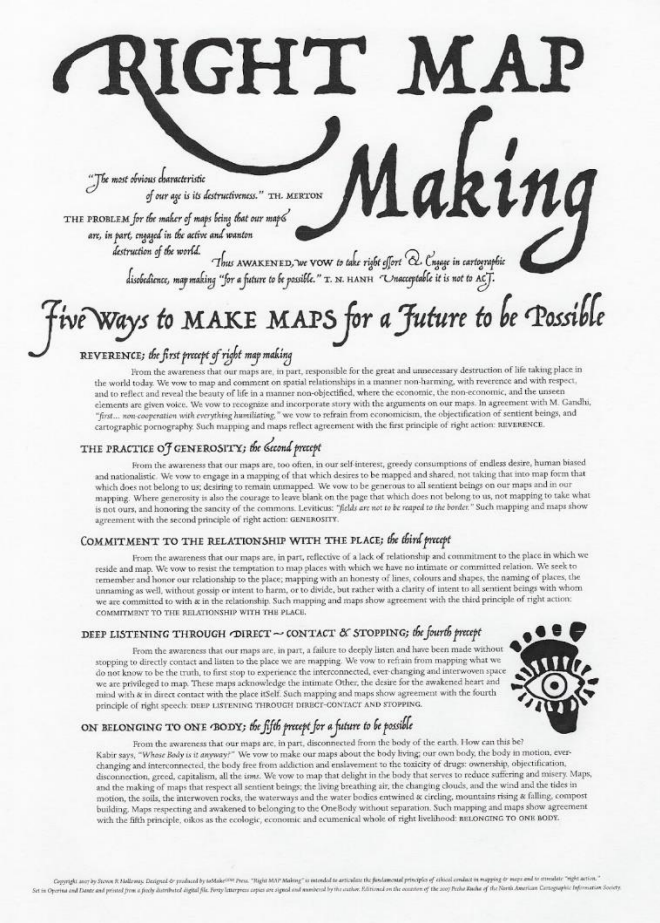
Figure 2.5. Aesthetic Experience: *River Trees of the United States*. Map by Nathaniel Ellis (2019).

Aesthetic experience has been criticized as elitist, with good reason. The normativity of disinterest—and the aesthetic attitude or correct stance to approach a work of art—has been in the past used to define art and the 'correct' way to enjoy art, but normativity is not necessary for aesthetic experience. Nor is expertise necessary, because there are many ways of attending beyond that of the "expert" (Nanay 2016, 18-19). A White, Euro-American, colonial, and masculinist perspective has been behind traditional constructions of 'expertise' at the expense of worldwide conceptions of aesthetic experience, including 'good' map experience.[16]

[16] By discarding normative disinterest, there are many ways to interact aesthetically with maps. Through an inclusive view of cartographic aesthetic experience cartographers can bolster arguments for inclusive design through inclusive aesthetics.

Discarding expertise as the sole means of attending to art returns aesthetic experience to everyone, a position advocated by Dewey (1934). Dewey advocates for a processual approach to aesthetics: the work of art takes place when a human being (the artist or the spectator) interacts with a product so that the outcome is an experience (Guter 2010, 57), breaking down binary distinctions between creator and viewer, object and subject, congenial to a processual approach in cartography (e.g., Edney 2019). Following Dewey, ***cartographic aesthetic experience*** describes the unity of the mapping process between mapper and viewer, map and world, using and appreciating.

An artist, a scientist, and a mechanic engage aesthetically by creating with care. The work of any craftsperson can be an object of fine art if the artist or creator "lived fully while producing it" (Leddy 2020, 16). Aesthetic experiences are experiences of being fully immersed in living, active processes called ***flow*** by psychologists (Nakamura and Csikszentmihalyi, 2014). Enhancing map aesthetics starts with enhancing the 'flow' states in map production. ***Human-centered design*** means design processes that respect the labor of map users *and* the creators. Hollowell's (2007) *Principles of Right Map Making* exemplify how morality intersects with aesthetic experience in map creation and map use (Figure 2.6). Designing maps means attending to one's existence as a living creature in a living system.



1. Reverence
2. The Practice of Generosity
3. Commitment to the Relationship with Place
4. Deep Listening through Direct Contact
5. On Belonging to One Body

Figure 2.6. *Right Map Making: Five Ways to Make Maps for a Future to be Possible*. Holloway 2007.

The 'Design Squiggle' (Newman 2002; Figure 2.7) used in discussions of the cartographic design process emphasizes the multi-stage, nonlinear processual nature of mapmaking. Design begins with perception, as 'noise' becomes 'patterns' and then 'insights'. Pauses, or apparent endings, are times of consolidation. Design does not have an actual ending, for the designer's subsequent designs are informed by the experience of previous designs.

This section may seem to have focused on aesthetic experience and the *designer*, but Dewey believed aesthetic creation and appreciation should be the same term (Leddy and Puolakka, 2021). In the Design Squiggle: the map viewer engages aesthetically with the design, and that engagement is an act of creation. Although there is an endpoint to the map viewer's aesthetic experience, the map viewer's aesthetic experience also informs subsequent aesthetic experiences.

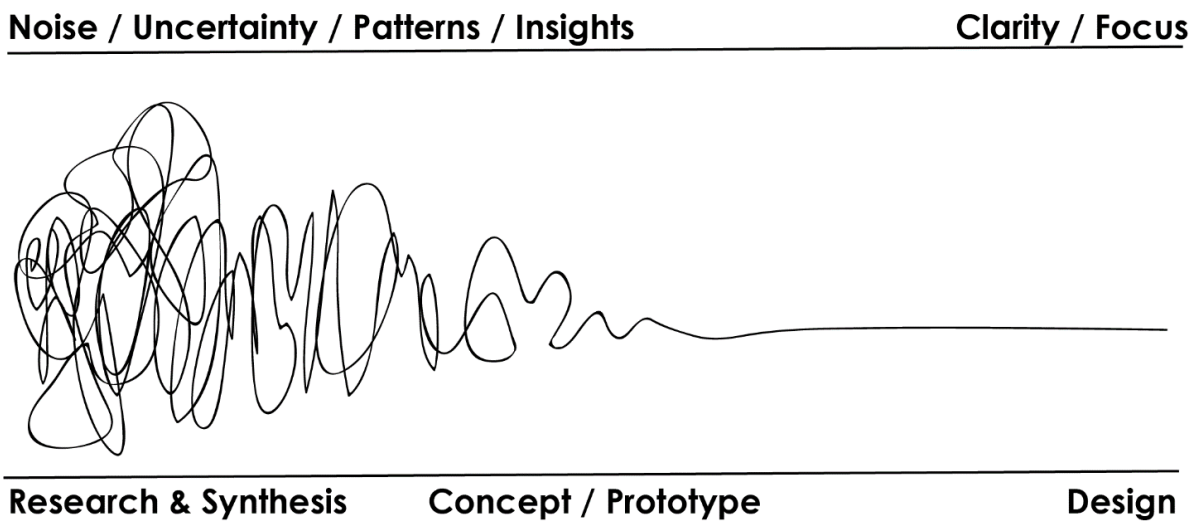


Figure 2.7. The Design Squiggle. Newman, 2002; redrawn by author.

Deweyan aesthetic experience helps center experience in mapping, from the creator and the map reader, the map and the world. Below are questions relating to cartographic aesthetic experience.

2.4 Aesthetics at Work

Aesthetics matters. Aesthetics is not synonymous with art or pleasure. Instead, aesthetics can be described as a set of networked perspectives, often holistic, on map creation and map use, producing experiences that 'really matter'. The boundaries between aesthetic and nonaesthetic are rarely straightforward, often intersecting with ethics, epistemology(ies), politics, and other domains. Aesthetics can be normative, and it is never optional.

Cartographers argue that they make 'really good maps', an *aesthetic value claim*. Cartographers say they are mapping experts because they design maps scientifically, from simple arguments of cartography as 'data presentation mode' to more complex arguments about the relationship between design, ethics, functionalism, and beauty.

Robinsonian aesthetic rejection in cartography has taken a Kantian view of aesthetics and epistemology. From a Kantian perspective, a functional map cannot be an aesthetic object, because aesthetic objects are purposeless and without outside interests. However, ignoring aesthetics does not remove aesthetics from cartography. Instead, aesthetic rejection has left cartographic aesthetic values unexamined, leaving cartography without adequate response to iconoclastic critiques of cartography. These critiques often take a Marxist track and sometimes call for the end of cartography itself. Cartographic aesthetic neglect and the dominance of unexamined cartographic scientific aesthetics reinforces iconoclastic critiques. Cartography's *image* problem is an *aesthetic* problem. Cartography deserves a working aesthetic theory.

Although a robust aesthetic hedonism may be an option for developing cartographic aesthetic theory, discarding aesthetic hedonism in favor of the network theory allows cartography to respond to iconoclastic critique and reassess its aesthetic values in relationship to communities while incorporating a grounding in everyday cartographic practice.

Aesthetic concepts help explain cartographic aesthetic practice and help cartography examine its values, theorize for itself, and advocate for its existence, something which all fields must do, but cartography has sometimes struggled (e.g., ICA, 2014). *Aesthetic judgment* and *aesthetically relevant properties* allow cartographers to articulate the importance of decision making in cartography and the many ways that maps can be 'good'. *Aesthetic attention* can be formulated as an empirical means for cartography to study aesthetics and may help address longstanding problems of studying maps holistically. *Aesthetic experience*, traditionally discussed as unity, emphasizes a processual, anti-elitist approach to mapping which breaks down the barriers between mapmaker and map viewer, map use and map appreciation, and map and world.

Aesthetics is fundamental to map creation and appreciation and helps us imagine the future of the field. This essay has introduced concepts from traditional (Euro-American) aesthetics.

Future work can look to global aesthetic concepts, beyond the Euro focus on judging beauty. I advocate moving cartographic aesthetic theory to an anti-elitist and anti-colonialist stance to when maps are good. Anti-elitist, by valuing a plurality of cartographic aesthetic properties, not just those of Robinsonian cartographic scientific aesthetics. Anti-colonialist by closing the cartographic 'beauty shop'—the normative aesthetic values of cartographic aesthetics—as the only means of making a 'good' map.

To conclude, cartography has a rich *aesthetic* epistemology expressed in the language of scientific design that can enhance not only cartography, but other domains as well. Philosophy of aesthetics provides new questions, new ways of seeing, and new ways to understand mapping.

I end with a quote from Nanay:

> "Aesthetic experience allows us to see and attend to the world differently: in a way that we don't, and couldn't, see it otherwise" (Nanay 2016, 36).

For many cartographers, the aim of cartography could be described similarly: to create maps that allow us to see and attend to the world differently, in a way that we don't, and couldn't see it otherwise.

Chapter 3: A Concordance Analysis of Aesthetic Themes in Cartographic Textbooks, 1928—2023

3.1 Introduction

In this chapter, I describe my method for gathering and analyzing materials to answer my research question, *how has cartography arrived at its current aesthetic epistemologies?* To answer this question, I implement corpus linguistics, a methodology from linguistics which uses digital texts to analyze patterns of language use (Lindquist and Levin 2018). A ***corpus*** is a body of texts and can be either a small body assembled by an individual researcher, or a large body assembled by a corporation or group of academics. Large corpora are designed to be representative of language used within a large community, such the British National Corpus, reflecting British English in the 1990s (Lindquist and Levin 2018, 14).

Corpus analysis generates ***concordances***, or segments of text containing an instance of language use, such as a key word or phrase of interest. Throughout the remainder of this text, I use the term ***attestations*** to refer to instances of language use, which provide written evidence of a word's use. In this analysis, the key words selected were ***lemmas***, or uninflected forms of words (e.g., 'design'). Lemmas form the stems of words, which are inflected to create grammatical categories, or ***parts of speech*** (POS) such as nouns, adverbs, adjectives, and adverbs. Because texts are digital, corpus analysis often uses automated POS tagging (Brezina, McEnery and Wattam 2015).

There are different systems used to classify POS. I used TreeTagger, which applies a probabilistic method to classify parts of speech (Schmid 1994). Table 3.1 provides an overview of the English tag set (Santorini 1990), with the POS I used in this analysis highlighted in yellow. I use the Table 3.1 tag abbreviations in the remainder of this dissertation to clarify different POS.

Tag	POS	Example	Tag	POS	Example
CC	Coordinating Conjunction	*and, but, or, &*	**CD**	Cardinal Number	*1, three*
DT	Determiner	*the*	**EX**	Existential there	*there is*
FW	Foreign Word	*d'oerve*	**IN**	Prep or subordinating conjunction	*in, of, like, after, whether*
JJ	Adjective	*green*	**JJR**	Adjective, comparative	*greener*
JJS	Adjective, superlative	*greenest*	**LS**	List item marker	*(1)*
MD	Modal	*could, will*	**NN**	Noun, singular or mass	*table*
NNS	Noun, plural	*tables*	**NP**	Proper noun, singular	*Robinson*
NPS	Proper noun, plural	*Vikings*	**PDT**	Predeterminer	*both the maps*
POS	Possessive ending	*friend's*	**PP**	Personal pronoun	*I, she, it*
PP$	Possessive pronoun	*my, hers*	**RB**	Adverb	*however, usually, here, not*
RBR	Adverb, comparative	*better*	**RBS**	Adverb, superlative	*best*
RP	Particle	*give up*	**SYM**	Symbol	*@, +, **
TO	to	*to go, to him*	**UH**	Interjection	*uhhunhuh*
VB	Verb *be*, base form	*be*	**VBD**	Verb *be*, past tense	*was | were*
VBG	Verb *be*, gerund or participle	*being*	**VBN**	Verb *be*, past participle	*been*
VBP	Verb *be*, non-3rd person singular present	*am | are*	**VBZ**	Verb *be*, 3rd person singular present	*is*
VD	verb do, base form	*do*	**VDD**	verb *do*, past	*did*
VDG	verb *do*, gerund/participle	*doing*	**VDN**	verb *do*, past participle	*done*
VDZ	verb *do*, pres, 3rd person singular	*does*	**VDP**	verb *do*, pres, non 3rd person	*do*
VH	verb *have*, base form	*have*	**VHD**	verb *have*, past	*had*
VHG	verb *have*, gerund/participle	*having*	**VHN**	verb *have*, past participle	*had*
VHZ	verb *have*, pres 3rd per sing	*has*	**VHP**	verb *have*, pres non 3rd pers	*have*
VV	verb, base form	*take*	**VVD**	verb, past tense	*took*
VVG	verb, gerund/participle	*taking*	**VVN**	verb, past participle	*taken*
VVP	verb, present, non-3rd p	*take*	**VVZ**	verb, present 3rd p singular	*takes*
WDT	Wh-determiner	*which*	**WP**	Wh-pronoun	*who, what*
WP$	Possessive wh-pronoun	*whose*	**WRB**	Wh-adverb	*where, when*

Table 3.1. TreeTagger Tag Set, automated by Schmid 1994. English tags from *Part-of-Speech Tagging Guidelines for the Penn Treebank Project,* Santorini 1990. Examples from Laurence Anthony, adapted from https://courses.washington.edu/hypertxt/csar-v02/penntable.html.
wayback machine link:
http://web.archive.org/web/20111117234432/https://courses.washington.edu/hypertxt/csar-v02/penntable.html

Corpus analysis produces descriptive statistics such as key word frequency (Carradini and Swarts 2023). A ***concordance list*** shows the contexts in which a word of interest appears within a text or corpus (Lindquist and Levin 2018, 5). ***Key word-in-context*** (***KWIC***) is a type of concordance list featuring the key word in the center (Figure 3.1, below) and context on either side of the word. Because KWIC is grounded to the text, results can be shared easily among researchers.

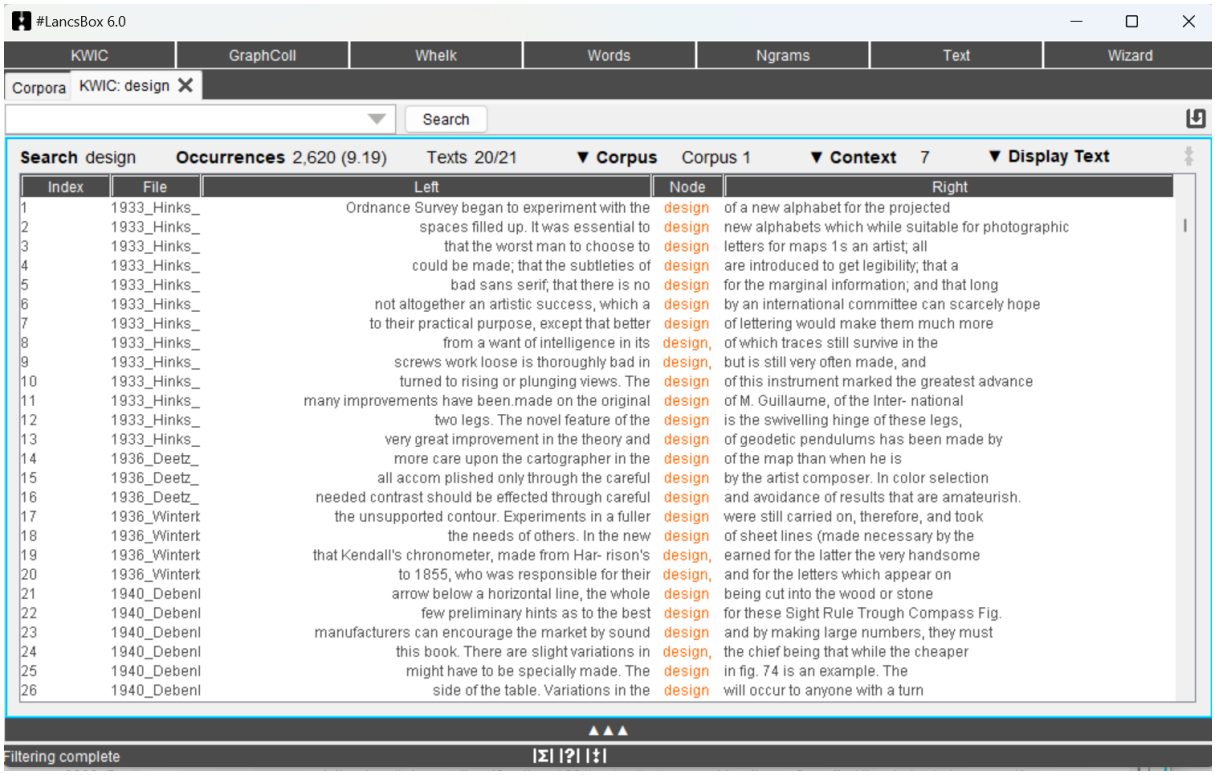


Figure 3.1. Concordance of 'design' as used in Hinks (1933), Deetz (1936), Winterbotham (1936), and Debenham (1940). Note that the text has not been filtered to isolate individual parts of speech: the lemma 'design' returns inflected forms. Thus, design as a verb appears with design as a noun. See Table 3.1., TreeTagger Tag Set.

In addition to descriptive statistics, the concordances can be analyzed to identify patterns of language use. These patterns pertain to morphology and syntax—both subfields of linguistics—but also semantics and discourse, which are of interest beyond linguistics. Thus, KWIC is highly useful for interdisciplinary work (e.g., Michelson-Ambelang 2015). The analysis reveals patterns of co-occurrence as well as how language use changes over time. In turn, the results can be studied contextually to find factors influencing language variation (Curzan 2012).

Cartographic researchers have previously formed cartographic textbook corpora in cartography (Kessler 2018; Lee 2022). My analysis builds on these earlier efforts by utilizing corpus construction recommendations from linguistics. As a method for studying word meaning, corpus linguistics is limited by the construction of the corpus. A corpus that is too large may be difficult to generalize because of large variations in language use (Carradini and Swarts 2023). Thus, forming a representative corpus is important to ensuring valid results. A ***balanced corpus*** reflects the community studied, qualitatively and quantitatively, however true balance is impossible to achieve in practice (Stefanowitsch 2020, 29).

In Section 3.2, I explain my efforts to form a balanced corpus, representing the community of American cartography, from 1928–2023.

3.2 Materials

The materials I used to assemble the final digital corpus and conduct the concordance analysis include LancsBox 6.0 Corpus Toolbox, Adobe Acrobat Pro DC, iPhone 12 with Microsoft Lens, Microsoft Excel, and the textbook corpus itself. LancsBox Corpus Toolbox is an open-source corpus analysis software from Lancaster University (Brezina, Weill-Tessier, and McEnery 2023) with the ability to automatically annotate corpus text for POS and extract concordances.

I selected textbooks as the unit of analysis because they represent the 'core values' that an academic field seeks to reproduce in its practitioners. By representing core values, textbooks delineate and limit practice through emphasis and omission. Given Robinson's outsized influence on modern cartographic epistemology in America, I chose to segment my analysis by Robinson's career. I selected seven books published prior to Robinson—the ***Pre-Robinson Era***—seven books contemporaneous to Robinson, including *Elements of Cartography 1E* (Robinson 1953) and *Elements of Cartography 6E* (Robinson, Morrison, Muehrcke, and others 1995)—the ***Robinson Era***, and seven books following Robinson—the ***Post-Robinson Era***.

I set several inclusionary and exclusionary criteria to inform the sample for each era. Textbooks eligible for consideration include those published in English over the past 100 years containing cartographic instruction. Exclusionary criteria include textbooks not published in English, textbooks over 100 years old, online databases, or my personal library, and texts that are significant sources to cartographic pedagogy but are not instructional-facing textbooks, such as *Semiology of Graphics* (Bertin 1967) and *How Maps Work* (MacEachren 1995) as these sources are referenced by cartographic textbooks and do not directly instruct on map creation. To avoid biasing the corpus, I permitted textbook authors to appear only once within the sample, except for Robinson because of Robinson's long-standing influence on cartographic pedagogy in America (e.g., Freundschuch 2005).

To select works in the Pre-Robinson Era, I created a citation chain beginning with *Elements of Cartography 1E* (Robinson 1953) and *General Cartography 2E* (Raisz 1948). I looked for citations of textbooks and textbook-like sources from Robinson and Raisz and added these citations to begin my web. Afterward, I examined the most cited sources between Robinson and Raisz to find the next book to add to my citation web. Using this process, I worked my way backward to *Topographic Mapping* (Beaman 1928) after four additional iterations (Figure 3.2). Through this process, I formed a web of citations, providing a snapshot of the sources informing academic cartographic practice up to 1953 (Figure 3.3), leading to seven final selections for the Pre-Robinson Era (Table 3.2)

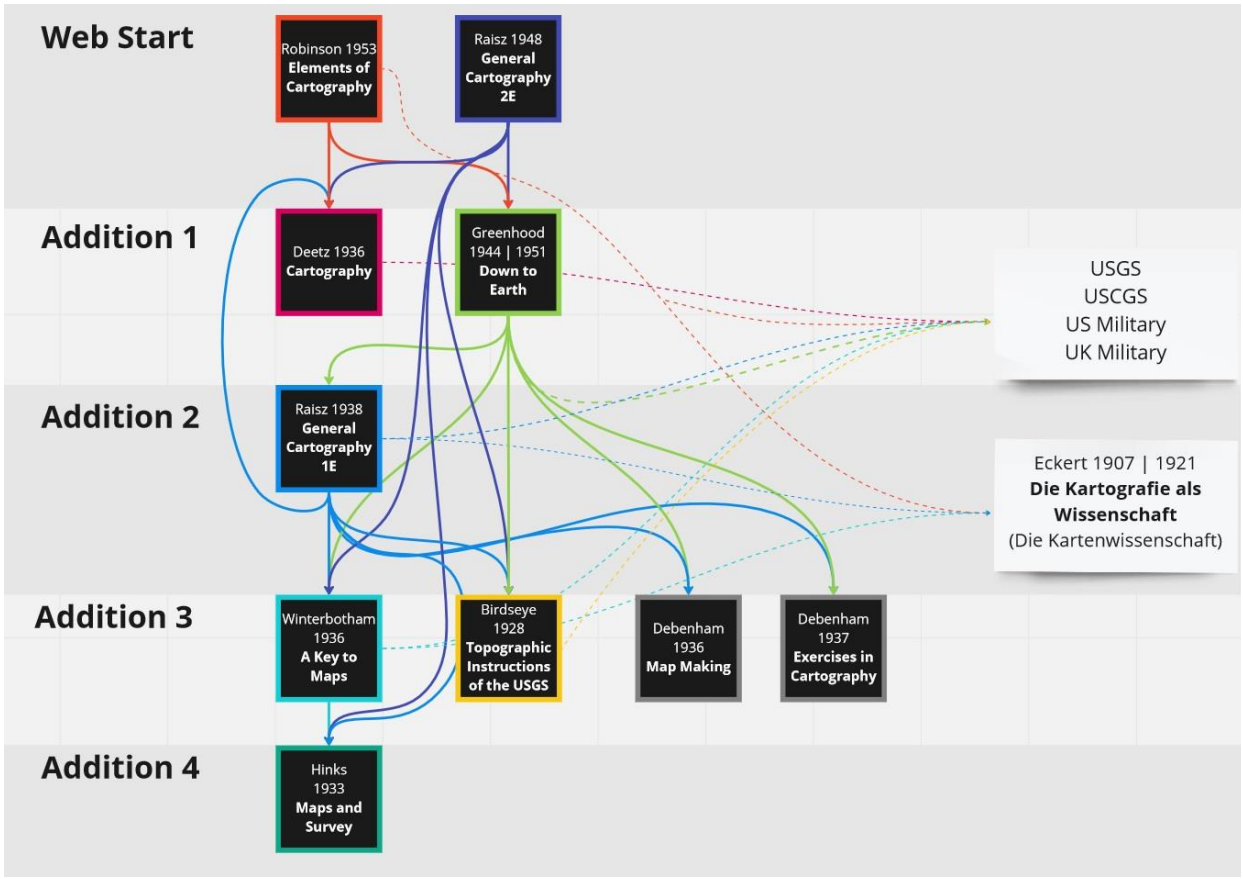


Figure 3.2. Citation chain, showing the selection of each textbook in the Pre-Robinson Era.

Citation clusters formed around the following categories of sources: UK Military (7), US Military (7), US Coast Guard (5), USGS (5), USDA (2), Miscellaneous Government (3), Industry (11), Engineering and Science (5), General Education, or Unknown (5).

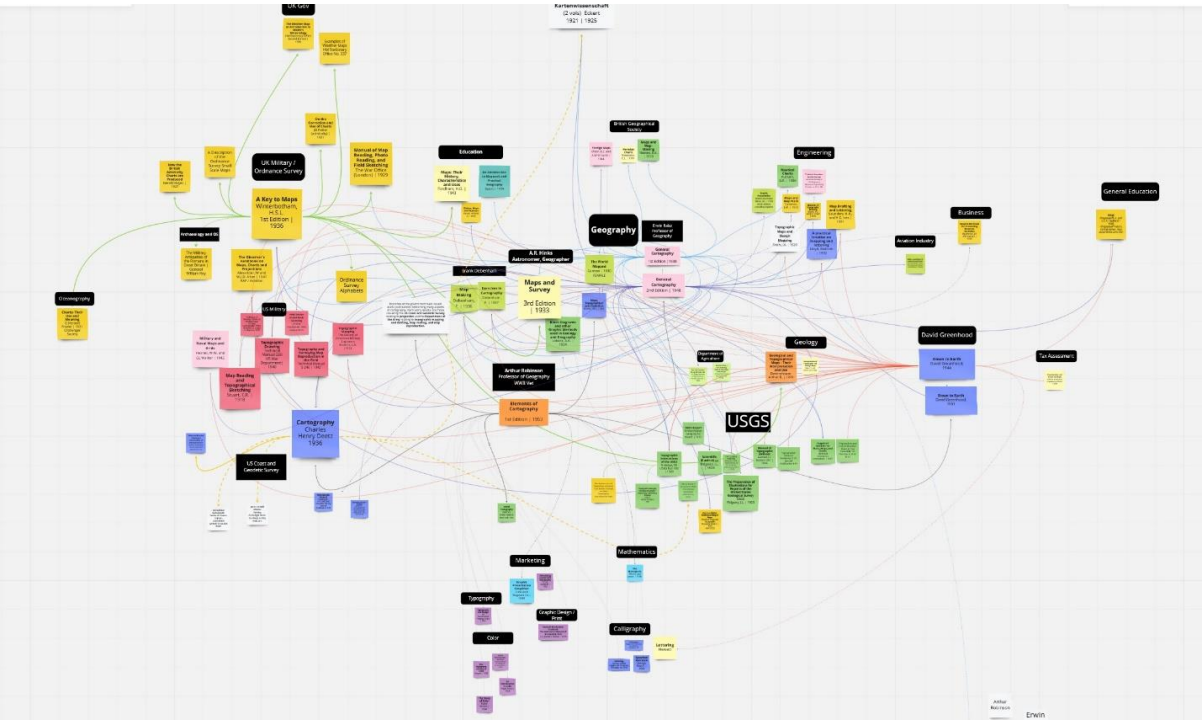


Figure 3.3. A citation web which shows textbook citations shared between textbook authors in the Pre-Robinson Era.

Notably, Robinson's citations diverged from other sources (Figure 3.4, below), which is curious because cartography credits Robinson with its 'scientific revolution'. Looking at textbooks, however, Robinson did not lean into the scientific and engineering sources of his predecessors, particularly USGS, USCGS, and the military. Instead, Robinson began citing new fields—art, graphic design, color theory, and advertising. These subjects were new bodies of knowledge Robinson brought into cartographic textbooks.

Year	Author	Title
1928	Beaman	*Topographic Mapping*
1933	Hinks	*Maps and Survey*, 3E
1936	Winterbotham	*A Key to Maps*, 1E
1936	Deetz	*Cartography*, 1E
1940	Debenham	*Map Making*, 2E
1948	Raisz	*General Cartography*, 2E
1951	Greenhood	*Down to Earth*, 2E, third printing
Table 3.2. Final selections, Pre-Robinson Era		

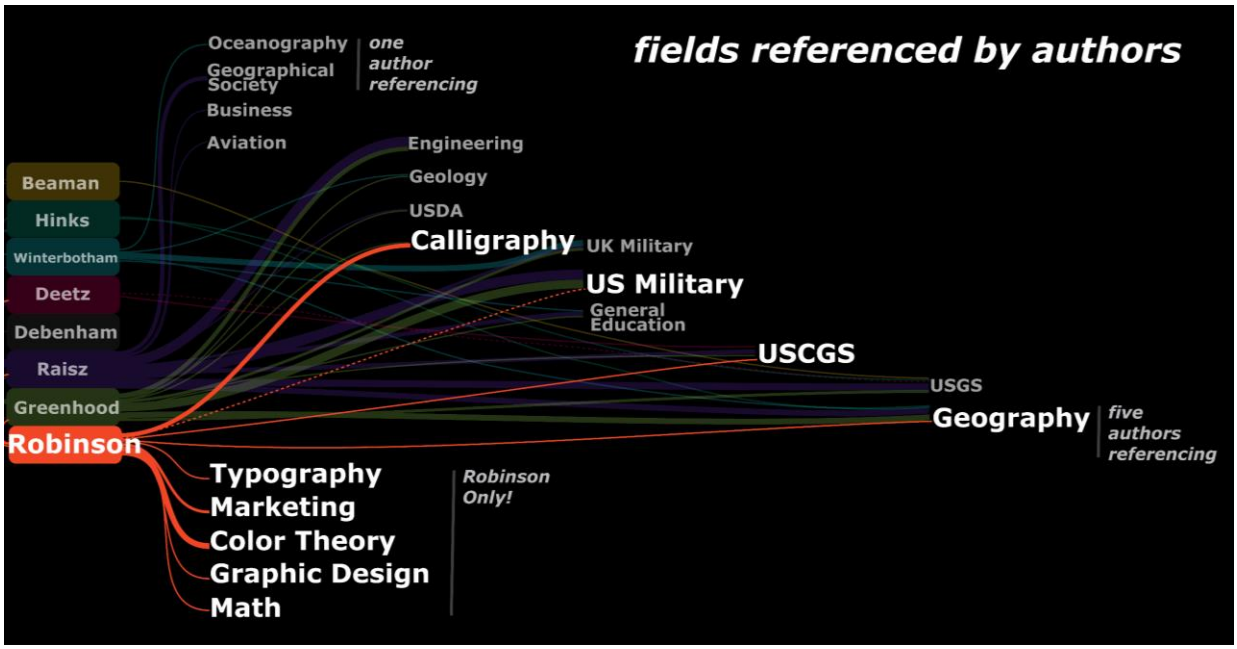


Figure 3.4. Fields referenced by Pre-Robinson textbooks compared to Robinson (1953).

To select works published contemporaneously to Robinson (1953–1995), I examined the article “Cartographic Textbooks” published as a summary list in *The Cartographic Journal* (Gardiner 1971) and reviewed two surveys of cartography courses in America in *Cartographic Perspectives* (Fryman and Sines 1990 / 1998) detailing textbook adoption. From these sources, I selected Robinson (1953) and (1995) to bookend the Robinson Era. I selected the most cited textbooks from Gardiner, and then selected the works appearing in Fryman and Sines used by 5% or more respondents (Table 3.3), excluding works as described in the section on limitations and exclusionary criteria, arriving at final selections (Table 3.4).

I relied on Google Scholar citations to form my corpus in the Post-Robinson Era, selecting seven works with the most citations following *Elements of Cartography 6E* (Robinson, Morrison, Muehrcke and others 1995). As a selection method, Google Scholar had limitations because book series with many entries often were privileged over series with fewer volumes, and citations between editions were unreliable. Therefore, I selected the later edition whenever I had access to a

copy of the later edition. I arrived at the final selections listed in Table 3.5. Five out of the seven most cited modern textbooks were written by Robinson's students, or the students of Robinson's students (bolded names, below), reflecting the continued influence of Robinson on cartographic education.

Required Textbooks, Introductory Cartography Courses			
Author	**Text**	**1989**	**1995**
A. Robinson, et al	*Elements of Cartography*	50%	33%
B. Dent	*Principles of Thematic Map Design*	19%	32%
J. Campbell	*Introductory Cartography*	4%	11%
J. Tyner	*Into to Thematic Cartography*	0%	5%
P. Muehrcke	*Map Use*	5%	3%
T. Rabinhorst	*Applied Cartography*	2%	2%
J. Campbell	*Map Use and Analysis*	0%	2%
J. Keates	*Cartographic Design and Production*	0%	1%
G. Brannon	*Practical Cartography*	0%	1%
D. Cuff, M. Mattson	*Thematic Maps*	12%	0%
D. Greenhood	*Mapping*	2%	0%
Others		6%	10%

Table 3.3. Survey results from Fryman and Sines (1989) and (1995). Reproduced and redrawn from *Anatomy of an Introductory Cartography Class Revisited* (Fryman and Sines 1998) appearing in *Cartographic Perspectives*.

Year	Author	Title
1953	Robinson	*Elements of Cartography*, 1E
1965	Imhof	*Cartographic Relief Presentation*
1971	Monkhouse and Wilkinson	*Maps and Diagrams*, 3E
1973	Keates	*Cartographic Design and Production*
1982	Cuff and Mattson	*Thematic Maps*
1984	Campbell	*Introductory Cartography*
1995	Robinson, Morrison, Muehrcke, Kimerling, and Guptill	*Elements of Cartography*, 6E

Table 3.4. Final selections, Robinson Era

Year	Author	Title	Google Scholar Citations
1995	Clarke	*Analytical and Computer Cartography,* 2E	582
2009	**Dent, Torguson, and Hodler**	*Cartography: Thematic Map Design*, 6E	1235
2010	**Tyner**	*Principles of Map Design,* 1E	256
2016	**Brewer**	*Designing Better Maps*, 2E	434
2016	**Krygier** and **Wood**	*Making Maps*, 3E	342
2021	Kraak and Ormeling	*Cartography: Visualization of Spatial Data,* 4E	1303
2023[17]	Slocum, McMaster, **Kessler**, and Howard	*Thematic Cartography and Geovisualization,* 4E	1216

Table 3.5. Final selections, Post-Robinson Era, 1995-2023, after filtering. (Citation data current Fall 2022; 2023 edition available at time of digitization and selected as most current work)

3.3. Procedure

I followed an eight-step process to conduct the concordance analysis, shown in Figure 3.5. I described the initial textbook selection process in the previous section. Here, I discuss steps two through seven of my process, detailing step eight in Section 3.4.

[17] The print edition of *Thematic Cartography and Geovisualization* 4E I used for this analysis has a copyright date of 2023, however, the online copyright date has since changed to 2024.

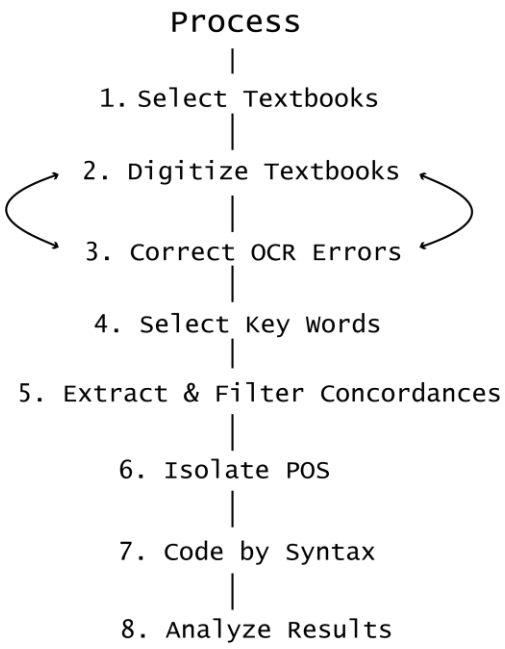


Figure 3.5. Concordance analysis process.

Step Two: Digitize Textbooks. Conducting concordance analysis requires machine-readable text documents. Some textbooks in the corpus were available in digital format or able to be compiled from online repositories such as the Internet Archive, Google Books, Hathi Books, and library databases. I scanned books unavailable in a suitable digital format using Microsoft Lens, a free PDF scanner application.

Step Three: Correct OCR Errors. With the corpus digitized, I used Adobe Acrobat Pro DC's OCR tool to render the scanned books text searchable and verified that the OCR of each textbook was of sufficient quality for concordance analysis (Figure 3.6). OCR accuracy can be measured by either character error rate (CER) or word error rate (WER) (Docparser 2023). To determine whether all materials in the corpus reached an acceptable OCR quality—set at above 90% accuracy—I selected a page at random and calculated the CER and WER. I rescanned the texts in several cases below 90% accuracy, and then manually corrected all OCR errors. I excluded marginalia such as table of contents, bibliographic entries, and figures since this content was not corrected in OCR

revisions and would not be included in the concordance analysis. The results of the OCR error calculations, presented in Table 3.6, estimate OCR accuracy at above 98% for CER and 92% for WER, with all but one work above 98% for both measures.

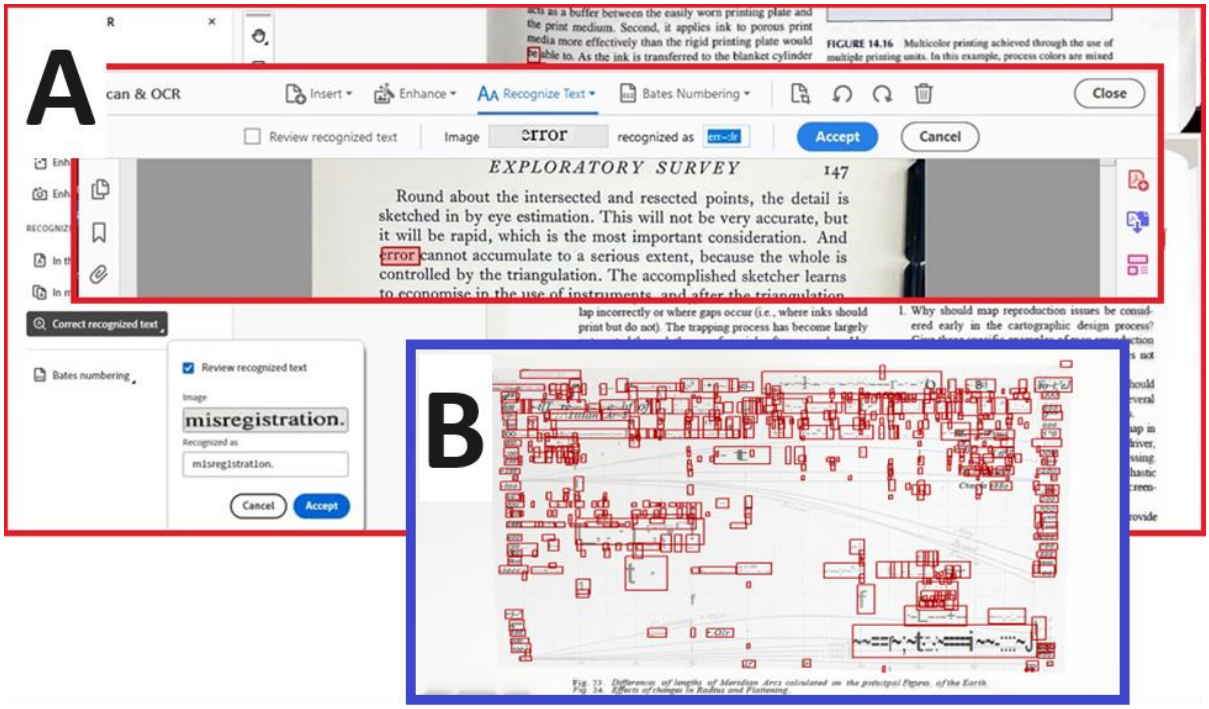


Figure 3.6. Text recognition errors.
A. Typical minor text recognition errors: “err~:lr” (error) and “m1sreg1strat1on” (misregistration)
B. An image (graph) misrecognized as text.

Digitized Text	Randomly Selected Page	Character Error Rate	Character Accuracy	Word Error Rate	Word Accuracy
Topographic Instructions of the USGS	46	0/2645; 0.00%	100%	0/476 = 0.00%	100%
Maps and Survey, 3E	127	1/2008; 0.05%	99.95%	1/376 = 0.31%	99.69%
Cartography, 1E	38	11/2772;0.40%	99.60%	11/557=1.97%	98.03%
A Key to Maps, 1E	44	0 /1573; 0.00%	100%	0/336 = 0.00%	100%
Map Making, 2E	72	2/1795; 0.06%	99.94%	0/405 = 0.00%	100%
General Cartography, 2E	245	5/1609; 0.31%	99.69%	5/354 = 1.41%	98.59%
Down to Earth, 3E	124	45/1894; 2.37%	97.63%	36/455=7.92%	92.08%
Elements of Cartography, 1E	140	6/1379; 0.44%	99.56%	4/290 = 1.38%	98.62%
Cartographic Relief Presentation	74	0/3090; 0.00%	100%	0/620 = 0.00%	100%
Maps and Diagrams, 3E	293	2/ 1823; 0.11%	99.89%	2/312 = 0.64%	99.36%
Cartographic Design and Production, 1E	44	2/1163; 0.17%	99.83%	1/202 = 0.50%	99.5%
Thematic Maps	133	1/1081; 0.09%	99.91%	0/219 = 0.00%	100%
Introductory Cartography	242	0/366; 0.00%	100%	0/77 = 0.00%	100%
Elements of Cartography, 6E	372	0/1514; 0.00%	100%	4/282 = 1.42%	98.38%
Analytical Cartography, 2E	160	2/2691; 0.07%	99.93%	1/564 = 0.18%	99.82%
Thematic Map Design, 6E	314	8/4037; 0.20%	99.80%	8/810 = 0.99%	99.10%
Principles of Map Design, 1E	198	0/1626; 0.00%	100%	0/317 = 0.00%	100%
Designing Better Maps, 2E	141	0/607; 0.00%	100%	0/117 = 0.00%	100%
Making Maps, 3E	106	0/574; 0.00%	100%	0/102 = 0.00%	100%
*Cartography: Visualization of Geospatial Data** 4E	76	0/2682; 0.00%	100%	0/5 = 0.00%	100%
Thematic Cartography and Geovisualization, 4E	371	4/2816; 0.14%	99.86%	4/528 = 0.76%	99.23%

Table 3.6. Text recognition errors. Orange rows are works manually digitized. *Digitization provided courtesy of Sangho Lee.

Step Four: Select Key Words. To identify aesthetic content, I selected key words that reflect aesthetic themes from the literature review. Three general requirements narrowed my selection.

First, a selected aesthetic term must be discriminant for aesthetics or aesthetic concepts, meaning that the term must relate to aesthetic philosophy or aesthetic concepts. All terms were selected from the literature review, and thus met the first selection requirement. Second, a selected aesthetic term must not refer to an aesthetic property (e.g., 'clarity' or 'elegance') as many aesthetic property terms were collocates of other aesthetic terms. Third, a selected aesthetic term must appear within at least half of the corpus. Although there are no official rules from linguistics regarding term frequency for concordance analysis, textbooks need to meet expectations of the field (here, cartography). Thus, if textbooks cover the same terrain, and a term appears in that textbook, there will be some agreement over what that term means. Additionally, more frequently used (attested) terms are easier to follow over time. The number of terms used is somewhat exceptional by the standards of disciplinary linguistics; however, the intent of the analysis is to produce a monograph rather than a single paper, making the selection more manageable. Lastly, this analysis assumes that all uses of design relate to aesthetics. Some uses of design may not be aesthetic or intended to capture aesthetic concerns, although it is my position that these uses still have aesthetic implications. My selected aesthetic terms formed the key words used in this analysis (Table 3.7).

Term	Sources	Hits	Justification
Aesthetics/ esthetics	11/21	104 / 8	Primary Term of Interest
Beauty	17/21	156	Conflated with aesthetics (vulgar aesthetic synonym)
Art	21/21	646	Conflated with aesthetics; separated from 'cartography' yet closely associated with Cartography
Taste	13/21	35	Verb form of aesthetics, aesthetic synonym
Style	21/21	721	Conflated with aesthetics (vulgar aesthetic synonym)
Design	21/21	4232	Conflated / synonymous with aesthetics, preferred term.

Table 3.7. Aesthetic terms selected as key words. One exception was made for an aesthetic property word—'beauty'—which is so commonly conflated with all of aesthetics, both in cartography and historically (Nanay 2019) that 'beauty' is considered as more than an aesthetic property for this analysis.

Step Five: Extract and Filter Concordances. I loaded my corpus within LancsBox, a free corpus linguistics analysis software, and conducted a KWIC analysis for each key word and associated POS. I set the software to return fifty words before each key word, and fifty words after each key word, to provide usage context, so that subjects could be more easily identified and semantic meaning examined. Thus, each concordance returned was 101 words long. LancsBox returned each key word and associated POS with TreeTagger POS annotation (Figure 3.7), resulting in 6,012 records retrieved.

In Excel, I removed bibliographic entries, table of contents, indices, tables, chapter headers, and chapter titles, which were not part of the analysis. I also removed proper nouns, e.g., International Cartographic Association. Filtering the corpus removed 2,245 hits, reducing the number of concordances to 3,767.

Step Six: Isolate POS. After filtering, I sorted all concordances by part of speech, following TreeTagger tags. Key words that differed in part of speech needed to be analyzed differently. The Part of Speech tagging functionality of LancsBox greatly improved the speed of this process, as LancsBox's automated POS tagging was generally correct, though each tag needed to be checked by hand, because some constructions were ambiguous and LancsBox did not have enough information to correctly parse them, a problem which remains in POS tagging (Santorini 1990; Schmid 1994; Brezina, Weill-Tessier, and McEnery 2023).

Step Seven: Code by Syntax. The coding scheme applied parsed each concordance down into its constituent parts to identify variations in word usage while remaining anchored to the text. In general, the coding scheme consisted of identifying modifiers on each side of the key word, identifying the subject and object, particularly through identifying prepositional phrases. Occasionally, when certain lemmas took an idiosyncratic construction, I added a category in the

coding scheme to reflect that construction. Appendix A lists codes applied, along with samples coded.

3.4 Analysis and Analytical Products

I discuss the results of my concordance analysis in the following Chapters 4, 5, 6, and 7. In Chapter 4, I provide a general statistical analysis of the concordances retrieved, discussing the results by part of speech and by era. In Chapters 5, 6 and 7 I conduct a deeper analysis of key words. In Chapter 5, I investigate *design nn* (design as a singular noun), the most common POS of design. In In Chapter 6, I use all POS to write a brief history of *aesthetics**, *taste**, *beauty**, and *art**. In Chapter 7, I analyze *style** and antagonism within cartography.

Analytical products include quantitative and qualitative reports and visualizations showing changes in discussions of aesthetic concepts in cartographic textbooks across the three eras of my analysis. The analysis is both ***synchronic***, considering usage of aesthetic key words within each era, and ***diachronic***, comparing eras against each other.

Quantitative products provide a summary examination of aesthetic concepts within cartographic epistemology. These products are derived from the binary identification of key words within the corpus and a six-word key word in context analysis to identify trends. The quantitative products produced include the following:

Quantitative products for Chapter 4 include:

- Bar chart showing frequency of all aesthetic key word use by author (diachronic)
- Bar chart showing frequency of POS use across sample (synchronic)
- Line graphs showing frequency trends
- Bar charts showing frequency of individual key word use by author (diachronic)
- Summary statistics showing aesthetic key word use per era (synchronic & diachronic)

From the quantitative analysis in Chapter 4, I then move to an in-depth analysis of the trends found in the corpus in Chapters 5, 6 and 7, which feature qualitative products. Qualitative products

provide an interpretive analysis of aesthetic concepts in cartographic epistemology, exploring discourse meaning. These products complement and add contextualization to the quantitative analysis.

The choice of qualitative products is informed by the outcome of Chapter 4, which provides an overview by: (1) differences in part of speech, as different parts of speech work differently from one another, and (2) the distribution of the corpus.

The key word *design** forms the bulk of the corpus, at 2,428 hits (66.7%; 2,428/3,767). Because *design** has such an outsize presence in the corpus, it receives its own chapter, and it is examined differently. Thus, in Chapter 5, I provide a detailed analysis of the most common aesthetic term, by part of speech: *design nn* (design as a singular noun), which comprises 43.4% (1,633/3,767) of all concordances. This analysis is driven by a six-word key word in context which considers the entrance of all design noun phrases into cartography. I use this analysis to construct a ***ngram*** of the five most used design noun phrases over time, as well as a timeline of design collocates entering the cartographic lexicon.

To understand the meaning of design noun phrases, I also examine 101 key word concordances, used to discuss the extensive development of design within cartographic textbooks. These selected quotations reveal how emerging design terminology expresses aesthetic concepts (i.e., aesthetic judgment, value, attention, objects, and experience), building the identity of cartography around design rather than other aesthetic key words.

Qualitative products for Chapter 5 include:

- Ngram for *design nn*, identifying the most commonly used noun phrases
- Concordance frequency tables organized by author and theme
- Semantic discussion of most commonly occurring key word phrases by POS, identifying usage patterns in each era (synchronic) and comparing eras together (diachronic)

In Chapter 6, I examine the usage of key words *aesthetics**, *taste**, *beauty**, and *art**. I analyze all POS related to these terms, using the six-word key word in context to identify the most commonly occurring phrases. Because there are far fewer attestations of these key words, I do not construct ngrams for them, as these words show much less consistency over time. Instead, I utilize bar graphs and frequency statistics. Then, I discuss the most commonly occurring phrases for each POS via an analysis of the 101 concordance passages, using this discussion to connect to aesthetic concepts and highlight vague and contradictory meanings while remaining grounded in the author's own words.

Qualitative products for Chapter 6 include:

- Concordance frequency tables organized by author and theme
- Semantic discussion of most commonly occurring key word phrases by POS, identifying usage patterns in each era (synchronic) and comparing eras together (diachronic)

I conclude the analysis with Chapter 7, which examines the usage of *style** a unitary key word that ties together concepts from *design**, *aesthetics**, *taste**, *beauty**, and *art**. I analyze *style** using the six-word key word in context to identify the most commonly occurring phrases. I then provide a discussion which touches on the antagonisms involved in *style**.

Qualitative products for Chapter 7 include:

- Concordance frequency tables organized by author and theme
- Semantic discussion of most commonly occurring key word phrases by POS, identifying usage patterns in each era (synchronic) and comparing eras together (diachronic)

Lastly, before I begin, the Pre-Robinson Era, and to a lesser extent, the Robinson Era, had a different way of thinking about and evaluating cartography because cartographic design epistemology was not as well developed as it is today. *Aesthetic*; taste*; beauty*; art** and *style** (*style** covered in Chapter 7) were all used as a means of evaluating maps—especially *beauty**. I am limited by my perspective as a cartographer educated in the United States during 2010–2024. Thus,

I am removed from the technology, processes, and political economic issues that affected cartography before I entered the field. I do not read and critique maps the same as the corpus authors. Therefore, in addition to the difficulties because of vagueness in usage, this analysis is limited by my modern identity.

Chapter 4: Overview of KWIC Results

In this chapter, I provide an overall statistical analysis of the KWIC concordances. I first provide a general overview of the results by part of speech, and then discuss by era.

Within the discussion, I follow coding from TreeTagger to refer to different parts of speech to avoid confusion as to whether I am referencing a key word or an inflected form of a POS, as some inflected forms are visually identical and thus cannot be distinguished without contextual clues for meaning. Table 4.1 explains the style conventions I use to refer to key words and to concepts as they exist outside of the corpus (i.e., the distinction between a reference to aesthetics/esthetics within the corpus, and aesthetics as a concept outside of the corpus).

Writing convention, with tag	Convention meaning
Aesthetic; Taste, Style	With no styling or annotation applied, I refer to the word or concept as used outside of the corpus, rather than a set of meanings internal to the corpus, e.g., aesthetic theory, theory of taste, style choices, et cetera.
*Aesthetics/esthetics**	An italicized word indicates I am referring to a key word's meaning internal to the corpus. The asterisk indicates corpus usages of all POS associated with the key word.
Aesthetic/esthetic nn	The annotation nn indicates a usage that is a noun, singular or mass.
Aesthetics/esthetics nns	The annotation nns indicates a plural noun usage.
Aesthetically/esthetically rb	The annotation rb indicates an adverb.
artistic jj	The annotation jj indicates an adjective* *NOTE: some usages of [key word] nn may be adjectival. However, these usages formed noun adjunct phrases, in which the adjective became essential to the meaning of the noun, for example: *Aesthetic judgment* | *Design process*
design vv	The annotation vv indicates a base form verb or to-infinitive, e.g., "I design" or "to design"
design vvz	The annotation vvz indicates a verb, present singular, e.g., "she designs"
styled vvn	The annotation vnn indicates a past participle usage
styled vvd	The annotation vvd indicates a simple past tense usage
styling vvg	The annotation vvg indicates a gerund participle usage

Table 4.1. Text reference style conventions.

4.2 Overview of Key Words by Part of Speech

The concordance analysis retrieved a total of 3,767 concordances (Table 4.2) across six key words and 29 inflected forms: *design** (2,428/3,767; 64.4%), *aesthetics** (89/3,767; 2.4%), *taste** (28/3,767; 0.7%), *art** (483/3,767; 12.8%), *beauty** (119/3,767; 3.2%), and *style** (620/3,767; 16.5%). Below, I discuss the results, providing a top-level overview of the observed patterns by part of

speech, as some parts of speech proved more informative than others. This information is used to scope the analysis in Chapters 5 and 6.[18]

I discuss all POS coded in this section. Some key words are not able to be found in all parts of speech. For example, *aesthetic** can be used as a noun (*aesthetics*), adjective (*aesthetic depiction*), or adverb (*aesthetically pleasing*), but it cannot be used as a verb: one cannot 'aesthete' something. Some words change in meaning when they take a different form: *taste** as a noun (*good taste*) often takes a different meaning from taste* as a verb (*tastes good*)[19]. The bolded terms in Table 4.2 are the terms I selected for further analysis in Chapters 5 and 6. Concordances for all POS below, and additional key words not included in this overview (*good*, cartography*, interest*, whole*, feel*, appear**) are available for examination at nestelmaps.net.

Most key word attestations in the sample were classified as nouns (no fewer than 2,857/3,767; 78.5%; Table 4.2; Figure 4.1). Nouns (*nn*, *nns*) are important to this analysis because they identify concepts emerging within cartography, particularly within the context of reified design, but also provide insight into key words a concept when used without modifiers, e.g., the usage *beauty* belonging to *beauty nn* (noun singular.) Also, because aesthetics is a noun, many aesthetic concepts are readily expressed in nouns.

[18] Not discussed in this chapter: the influence of location on authors' language use (e.g., British English versus American English). However, authors' locations, nationalities and affiliations are sometimes discussed in chapters 6 and 7, when relevant.

[19] Traditionally, aesthetics involves the senses, as "immediate" experiences. One 'tastes' beauty (Shelley 2022, 3-4)., reflecting the origin of the word as 'sensuous perception' from Baumgarten 1750 (Nanay 2009).

Word	POS	Tag	Count	POS -based reason for inclusion or exclusion
style	**noun**	**nn**	**395**	Key noun
styles	**noun**	**nns**	**220**	Key noun
styled	**Past part.**	**vvn**	**3**	Past participles connected less closely with aesthetic concepts and were excluded from further analysis
styling	**gerund participle**	**vvg**	**2**	Gerund participles connected less closely with aesthetic concepts and were excluded from further analysis
aesthetic	**noun**	**nn**	**49**	Key noun
aesthetics	**noun**	**nns**	**12**	Key noun
aesthetically	**adverb**	**rb**	**21**	Adds conceptual description to verb
esthetic	**noun**	**nn**	**2**	Key noun, alternate spelling
esthetics	**noun**	**nns**	**3**	Key noun, alternate spelling
esthetically	**adverb**	**rb**	**2**	Adds conceptual description to verb
art	**noun**	**nn**	**293**	Key noun
arts	**noun**	**nns**	**46**	Key noun
artistry	**noun**	**nn**	**4**	Key noun
artistic	**adjective**	**jj**	**126**	adjectival forms create noun phrases
artful	**adjective**	**jj**	**2**	adjectival forms create noun phrases
artistically	**adverb**	**rb**	**12**	Adds conceptual description to verb
design	**noun**	**nn**	**1633**	Key noun
designs	noun	nns	129	Excluded due to redundancy with singular form
design	verb	vv	101	Verbs beyond scope of analysis, worthy of follow-up study
designs	verb	vvz	2	Verbs beyond scope of analysis, worthy of follow-up study
designed	past part.	vvn	447	Past participles connected less closely with aesthetic concepts and were excluded from further analysis, worthy of follow-up study
designed	preterite	vvd	14	Verbs beyond scope of analysis, worthy of follow-up study
designing	Gerund participle	vvg	102	Gerund participles connected less closely with aesthetic concepts and were excluded from further analysis, worthy of follow study
beauty	**noun**	**nn**	**45**	Key noun
beautiful	**adjective**	**jj**	**53**	Adjectival forms create noun phrases
beautifully	**adverb**	**rb**	**21**	Adds conceptual description to verb
taste	**noun**	**nn**	**25**	Key noun
tastes	**noun**	**nns**	**1**	Key noun
tasteful	**adjective**	**jj**	**2**	Adjectival forms create noun phrases

Table 4.2. Total concordances retrieved.

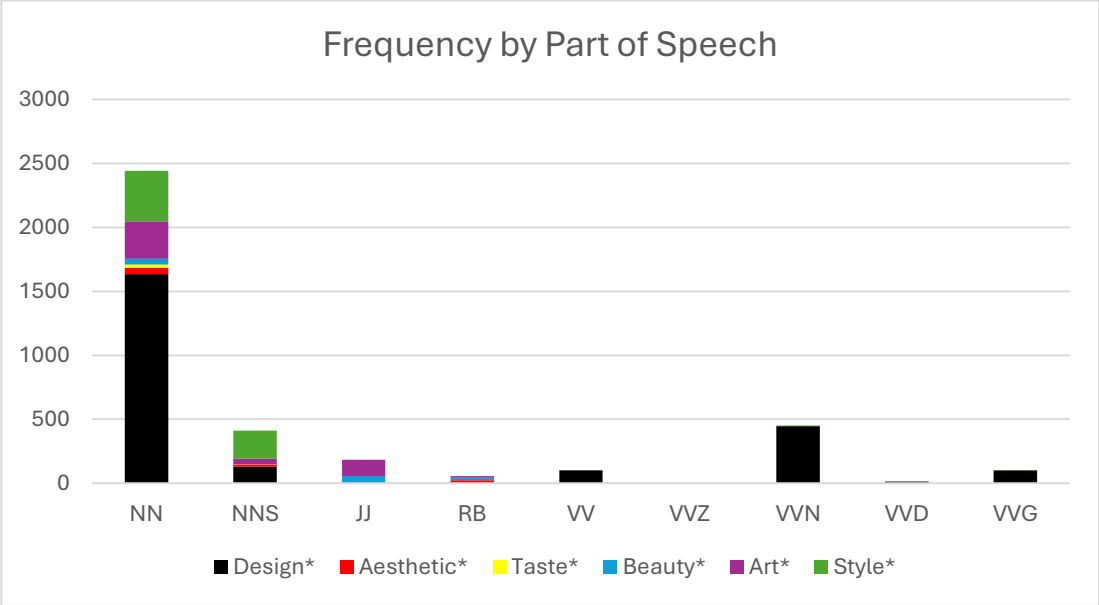


Figure 4.1. Frequency of key words by Part of Speech: **NN** (noun, singular); **NNS** (noun, plural); **JJ** (adjective), **RB** (adverb), **VV** (verb, base form), **VVZ** (verb, present 3rd person singular), **VVN** (verb, past participle), **VVD** (verb, past tense), **VVG** (verb, gerund participle)

In practice, nouns and adjectives often were used to create noun adjunct phrases that carried a specific or reified meaning (e.g., *design process*, *graphic design*, *Old Style*) within cartographic epistemology, expanding cartography's disciplinary terminology, particularly theoretical terminology. This pattern was most important with *design nn* (1,059/1,633; 64.8%), the POS containing the important noun phrase *design process*, which I discuss in Chapter 5. A hallmark was *design** appearing first in a noun adjunct phrase (e.g., *design* appears first in the noun adjunct phrase *design process*; 564/1,633; 34.5%); thus, if *design nn* appeared first in the noun adjunct phrase, the noun adjunct phrase *always* carried a specific or reified meaning.

This pattern also appeared in *style nn* (199/395; 50.4%). Repeated attestations of noun adjunct phrases suggest concepts becoming reified within cartography. In turn, these noun adjunct phrases connect to cartographic and aesthetic concepts, which I examine in Chapter 5.

However, not all nouns formed reified conceptual phrases. Many usages were more generalized, particularly nouns with degree or intensity adjectives attached (e.g., *best design*).

These usages tended to be axiological, relating to aesthetic value, but also related to aesthetic judgment in that the usages were trying to train cartography students' aesthetic judgment. Thus, even though the nouns did not form reified conceptual phrases, the noun phrases are still important components of cartography's developing design-based aesthetic epistemology. I examine noun phrases in Chapters 5 and 6.

Sometimes entire key words lacked conceptual specificity, such as *aesthetic nn,* which used the term aesthetic inconsistently when appearing with a modifier (e.g., *aesthetic design*), resulting in *aesthetic nn* noun phrases in which *aesthetic nn* functioned more as a generalized adjective. This pattern of decreasing clarity of use of *aesthetic nn* increased across the eras of the corpus, paradoxically coinciding with an increased usage of *aesthetic nn,* a pattern investigated in Chapter 6.

Generally, adjectives (*jj*) that did *not* form reified noun adjunct phrases were those that were most closely associated with aesthetics, such as *artistic jj*, *artful jj*, *beautiful jj,* and *tasteful jj*, together forming 83/3,727(4.9%) concordances. While these adjectives retained their general meaning—they did not become a reified concept in cartography—the adjectival phrases formed by these adjectives are revealing about attitudes towards the conceptual meaning of the key word, which often was more subjective or contested within cartography. Chapter 6 takes this approach towards examining adjectival meaning in the unclear usages of *aesthetic nn* and other vague and inconsistent key word usages.

Nouns were mostly singular (*nn*; 2,446/2,857; 85.6%) rather than plural (*nns*; 411/2,857; 14.4%). Plural nouns are an important part of the overall statistics, however, when used in the key word *design**, they tend to repeat the same patterns as singular nouns as described above. Thus, I excluded them from the analysis in Chapter 5, but they appear in the analysis of *aesthetic**, *taste**,

*beauty**, *art**, and *style**, as these plural usages often differ from singular usages, and are thus informative.

Participles (*vvn*) were extremely common among *design** and comprised 447/3,767 (11.9%) of concordances. Participles modify nouns (i.e., *map designed for reduction*). As such, they reveal the objects of design. Past participles can reveal the increased prevalence of design as it affects cartographic objects (e.g., maps, map elements, and things associated with cartographic design). Past participles were frequently coupled with to-infinitives to show purpose (169/447; 37.8%), such as *designed to serve*, and past participles also frequently appeared in prepositional phrases, which revealed purpose or information about the designer. These prepositional phrases include *designed for* (130/447; 29.1%), *designed by* (16/447; 3.6%), *designed with* (8/447; 1.8%), *designed in* (7/447; 1.6%), *designed as* (5/447; 1.1%), and *designed from* (5/447; 1.1%).

Overall, the usages of participles connected less closely to traditional aesthetic concepts than other parts of speech, providing more information about cartographic epistemology, the cartographer, and the ends of cartographic design. Past participles were *purposeful* usages. Thus, past participles were not selected for further analysis in this text beyond the summary given here.

Verbs (*vv*, *vvd*, *vvz*) were uncommon in the sample (117/3,767; 3.1%) and only found within *design**. The grammatical features most associated with verbs are modality: the ‘shoulds’, ‘oughts’, and ‘musts’ of design. These usages are helpful for understanding aesthetic value within design. However, these verbs were not selected for further analysis, due to the focus on emerging general design concepts, rather than the kinds of actions permissible to the designer. However, this topic is worthy of follow-up study in a future analysis.

Gerund participles (*vvg*) were uncommon in the sample (104/3,737; 2.8%), appearing only in the POS *styling* and *designing*. Gerund participles function like verbal nouns. As such, their usage is revealing, because their usage allows the verb design to be discussed like a noun (e.g., *in*

designing thematic maps). In general, the closer the gerund participle, the more noun-like the phrase, as *text styling* functions more like a noun adjunct phrase than *problems in designing*. Similar to verbs, gerund participles provide information related to actions that the designer can perform, i.e., *consider designing your own animations* or *in designing maps to portray*. Limited to the six-word key word in context, these actions reveal more about cartography than about aesthetics, which is to say that they relate to general cartographic epistemology but do not reveal as much about aesthetic epistemology. Even the most verb-like aesthetic concepts—aesthetic attention and aesthetic experience—did not figure in these usages. These limitations are part and parcel of the concept of a verb, since the verb itself is not judging or critiquing. It is simply telling someone to do something or specifying a circumstance in which something is done, such as *designing for print*. For that reason, I eliminated gerund participles from analysis.

Lastly, adverbs (*rb*) were the least common parts of speech found in the corpus (56/3,767; 1.5%). However, adverbs were particularly useful for understanding aesthetic experience. Adverbs provided a means to approach verbs in cartography without losing focus on concepts, as the concept was contained within the adverb. Adverbs were important to understanding aesthetic hedonism, as the most common modifier of *aesthetic**, and the most common adverbial phrase in the sample, was *aesthetically pleasing*. This phrase is paradigmatic for vulgar (common) understandings of aesthetics. Thus, adverbs formed a critical part of my later analysis.

4.2 Overview by Lemma

Overall, *design** was the most dominant aesthetic key word in the sample (2,428/3,767; 66.7%) but did *not* emerge as the most dominant key word in the Pre-Robinson Era (1928–1952). In the Pre-Robinson Era, the most dominant key word was *style** (133/452; 29.4%) followed by *design** (116/452; 25.7%). In the Robinson Era (1953-1995) *design** not only overtook *style** as the most dominant key word but was more commonly found than all other key words combined (685/1285;

53.3%). By the Post-Robinson Era (1996–2023), *design** was 4.6 times more commonly found than the other key words combined together (1,627/2,030; 80.1%).

Unexpectedly, *aesthetic** followed the same pattern, increasing in frequency of use throughout the corpus: from two attestations in the Pre-Robinson Era (2/452; 0.4%) to 29 attestations (29/1,285; 2.2%) in the Robinson Era, to 58 attestations (58/2,030; 2.8%) in the Post-Robinson Era. This pattern is perplexing given the contested place of aesthetics within cartographic epistemology due to fears of the subjectivity of aesthetics, as outlined in Chapter 2.

However, from the perspective of aesthetic theory, this pattern reflects the conceptual link between *design** and *aesthetic**. As *design** epistemology within cartography accumulates, *aesthetic** epistemology *also* accumulates because aesthetics is part of design—even if relegated to cartographic aesthetic hedonism, an assumption that aesthetics contributes to the value of a map by producing a hedonic response (typically pleasure). Furthermore, as more aspects of the map can be designed, more awareness of subjectivity within these aspects of map design emerges. Somewhat paradoxically, it is in part this better awareness of subjectivity, for which Robinson himself advocated scientific investigation to manage, that lies behind many of the increased attestations of *aesthetic** in the corpus, as will be explored in Chapter 6.

Subjectivity is only part of the story. To understand more, the other key words provide a more detailed picture of the place of aesthetics in relation to cartography. *Taste** is tied even more closely with subjective concerns than the key word *aesthetic**, particularly in relation to the individual, rather than to a group of people. As a result, *taste** decreases in frequency throughout the corpus until it almost disappears completely in the Post-Robinson Era. An assumption of the functionalist paradigm, and of traditional Kantian aesthetics, is the idea of subjective universals. Aesthetics is experienced subjectively, but aesthetic objects (traditionally art and nature) ought to be universally appreciated by folks with a normally operating sensory apparatus—just as map

design guidelines derived from experimentation are assumed to be generalizable. However, if taste varies by individual, it cannot be generalized, and therefore, it cannot be trustworthy. Furthermore, individuals can have bad taste. Aesthetic appreciation, because it is traditionally conceived as more universal, may have persisted because it can be generalized in the form of simple aesthetic pleasure, thus resulting in the preference for *aesthetic** over *taste**.

*Beauty** decreases in usage throughout the corpus, from 75 attestations in the Pre-Robinson Era (75/452; 16.6%) to 29 attestations in the Robinson Era (29/1,285; 2.2%) to 15 attestations in the Post-Robinson Era (15/2,030; 0.7%). This result is predicted by Chapter 2, as following the publication of *The Look of Maps* (Robinson 1952), beauty is pitted in opposition to functionalism in cartography. In the corpus, beauty is frequently perceived as an attribute of older maps, a pattern true even in the Pre-Robinson Era. In that sense, beauty is 'past tense', a general usage pattern that appears outside of cartography (Sartwell 2006). In the modern era, maps often are thought of as art, because they are considered 'out-of-date' and therefore no longer reliable for reference. Furthermore, when scientific design guidelines are established, galleries of older maps—cartographic tradition—are no longer the means by which textbook writers teach cartographic design.

*Art** is used as a trade and technical term in the Pre-Robinson (108/452; 23.9%) and Robinson Era *art** (260/1,285; 20.2%). However, *art** loses its technical meaning in the Post-Robinson Era—coincidentally, following along with the change from traditional to digital cartography—and its attestations drop off significantly, dropping to 115 (115/2,030; 5.6%). A background in traditional art is no longer as direct of a pathway to becoming a cartographer as it used to be, since manual techniques are no longer used. Instead, a new pathway emerges: digital technology. As a result, the place of art in cartography undergoes a considerable shift, as will be discussed in Chapter 6.

*Style** decreases in frequency of use throughout the corpus, from one hundred and thirty-three usages in the Pre-Robinson Era (133/452; 29.4%) to two hundred and seventy-five usages in the Robinson Era (275/1,285; 21.4%) to two hundred and twelve usages in the Post-Robinson Era (212/2,030; 10.4%). However, *style** shows the most stability in meaning over every other key word, because *style** is used in reference to definitions from lettering and typography, outside bodies of knowledge with long traditions. In that sense, like *art*,* many attestations of *style** can be considered technical terms. However, unlike *art*,* the decline in *style** should be read instead as stability: the knowledge from lettering and typography does not change, and few additional concepts are needed, as discussed in Chapter 7.

In conclusion, the decline in *art*,* coupled with the decline in *taste** and *beauty*,* result in an aesthetic knowledge loss for cartography, which may have been accelerated by the transition from manual to digital cartography. This knowledge loss is observed in increasingly vague usages of *aesthetic**. Thus, *aesthetic** seems to be deployed not only in reference to hedonic concerns (i.e., aesthetically pleasing), but also to describe something that has been lost, which cannot be captured within the existing design epistemology. This pattern is particularly apparent in Dent, Torguson, and Hodler (2009), as will be discussed in Chapter 6.

4.3 Overview by Era

Figure 4.2 presents the overall statistics of aesthetic language use by era. The discussion reports frequency in the corpus, but not frequency based on the total word count of the author (i.e., a prevalence per author or rate of use per author). The reason I reported overall frequency, but not a norm is that modern works are longer than earlier works, reflecting the accumulation of additional cartographic epistemology as new concepts enter cartography. A frequency based on the total word count of the author puts the focus on the percentage of use in the lexicon of each author rather than the entry of new concepts into cartography, which is my primary interest. Normalizing

by word count per author thus interferes with accounting for the absolute number of concepts introduced in each era.

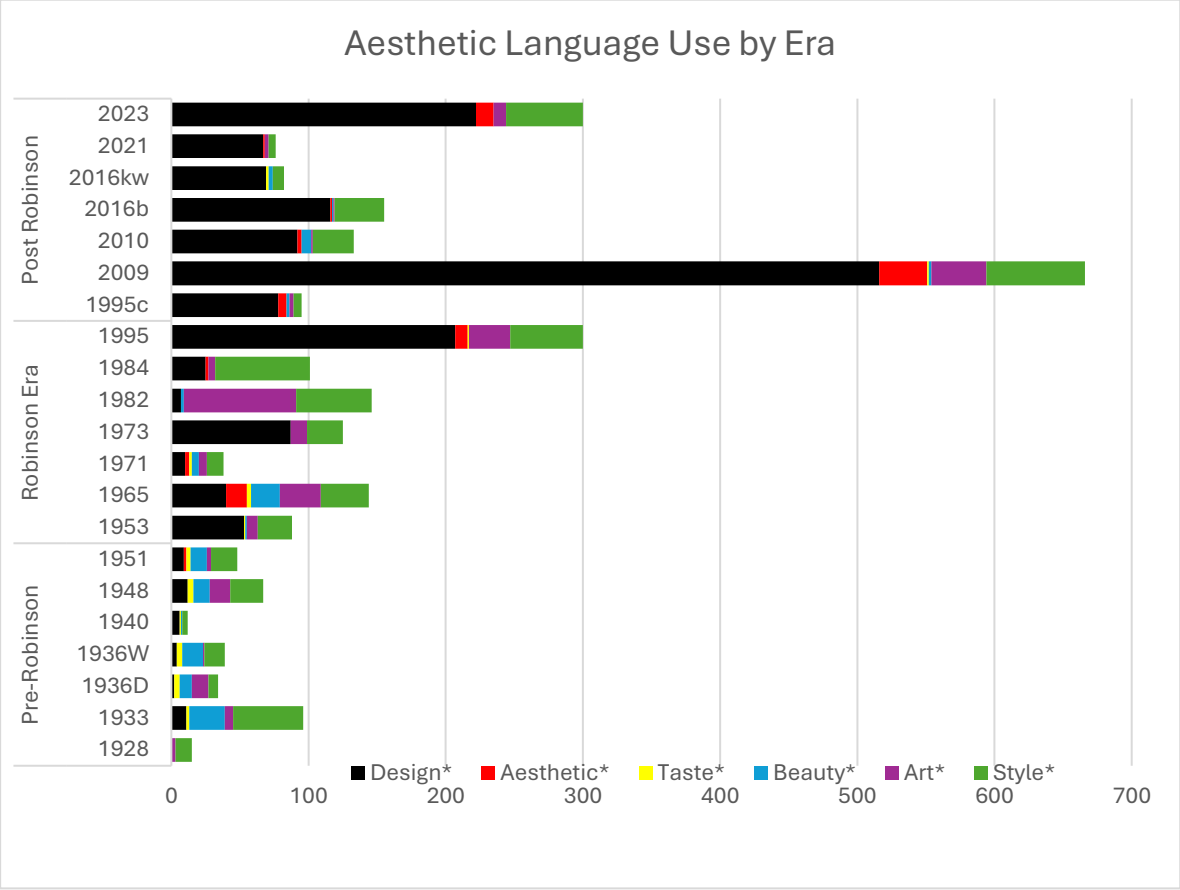
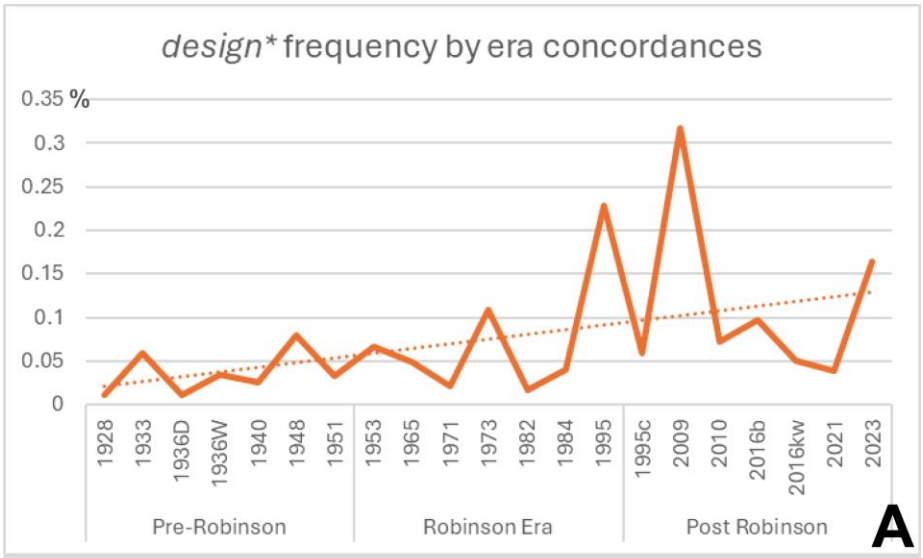
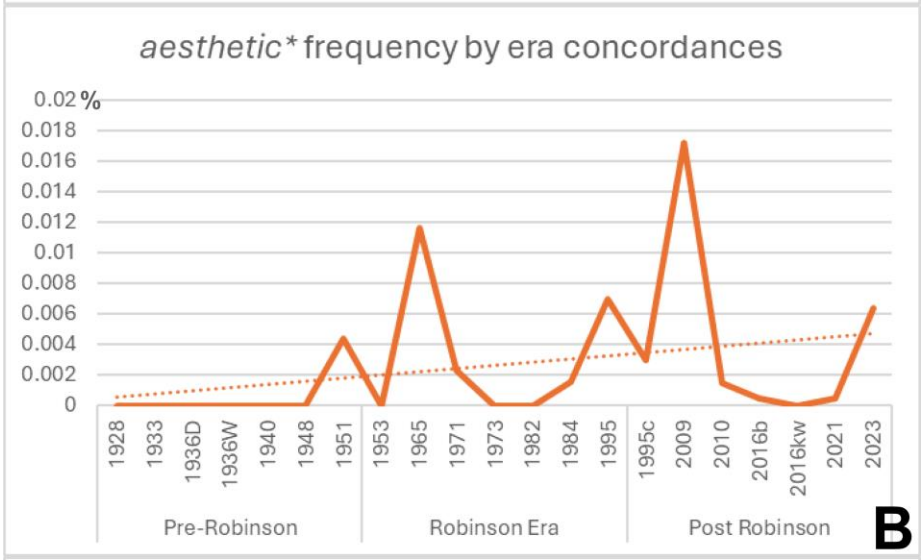
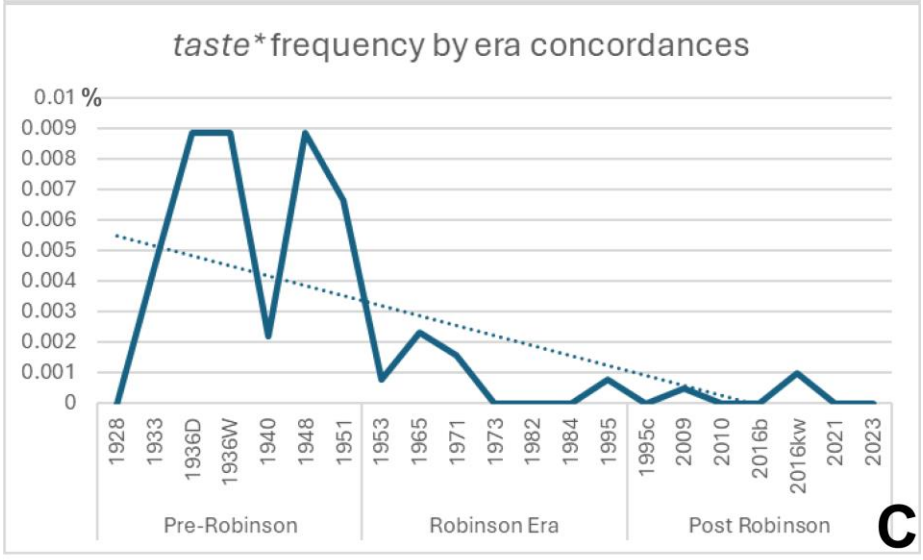


Figure 4.2. Aesthetic Language use by Era.

Figure 4.3 shows small multiples, revealing the overall trends in aesthetic language use across the corpus. *Taste**, *beauty**, *art** and *style** trended downward through the corpus. However, the concordance analysis revealed an unexpected pattern: not only did *design** trend upward through the corpus, but so did *aesthetic**.


*design** frequency by era concordances
0.35 %
0.3
0.25
0.2
0.15
0.1
0.05
0
1928 1933 1936D 1936W 1940 1948 1951 1953 1965 1971 1973 1982 1984 1995 1995c 2009 2010 2016b 2016kw 2021 2023
Pre-Robinson
Robinson Era
Post Robinson
A


*aesthetic** frequency by era concordances
0.02 %
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
1928 1933 1936D 1936W 1940 1948 1951 1953 1965 1971 1973 1982 1984 1995 1995c 2009 2010 2016b 2016kw 2021 2023
Pre-Robinson
Robinson Era
Post Robinson
B


*taste** frequency by era concordances
0.01 %
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
1928 1933 1936D 1936W 1940 1948 1951 1953 1965 1971 1973 1982 1984 1995 1995c 2009 2010 2016b 2016kw 2021 2023
Pre-Robinson
Robinson Era
Post Robinson
C

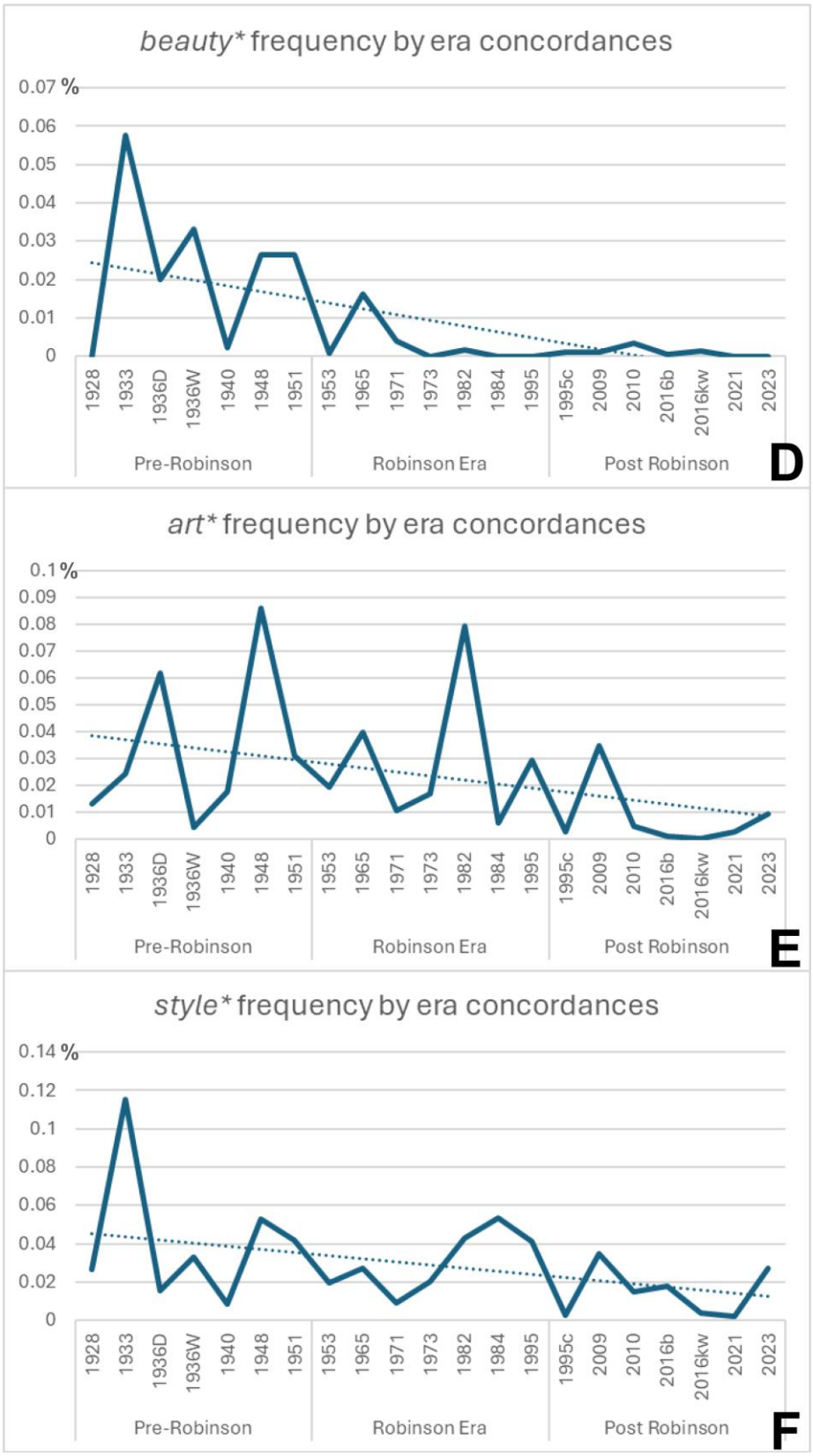


Figure 4.3 *design*, aesthetic*, taste,* beauty* and style** frequency normalized by the number of era concordances per era.

4.3.1 Pre-Robinson Era

The Pre-Robinson Era had 452 concordances, 12.9% percent of all concordances. The most dominant key word in the Pre-Robinson Era was *style** (133/452; 29.4%), followed by *design** (116/452; 25.7%), *art** (108/452; 23.9%), *beauty** (75/452; 16.6%), *taste** (18/452; 4.0%), and *aesthetic** (2/452; 0.4%).

The most common POS for each key word were *style nn* (115/133; 86.5%), *art nn* (67/108; 62.0%), *designed vvn* (53/116; 45.7%), *beautiful jj* (35/75; 46.7%), *taste nn* (17/17; 100.0%), and *aesthetic nn* (2/2; 100.0%). These POS are either nouns (*nn*, singular noun) or modifiers of nouns (*vvn*, past participle; *jj*, adjective), suggesting a focus on concepts (noun and adjective phrases) as well as the objects of design (i.e., past participles; note that I still include verbs in this first-pass overview, but remove in Chapters 5 and 6) . Below, I outline the general usage patterns found in the Pre-Robinson Era for the most commonly occurring POS.

Style nn most frequently appeared by itself, without a modifier (78/115; 67.8%). Modifiers that did appear always were found on the left (37/115; 32.2%), with the most common modifiers including *same style* (5/115; 4.3%), *usual style* (2/115; 1.7%), *expensive style* (2/115; 1.7%), *portolan style* (1.7%; 2/115; 1.7%), *new style* (1.7%; 2/115; 1.7%), *old style* (1.7%; 2/115; 1.7%), and *best style* (1.7%; 2/115; 1.7%). One modifier also was found on the right, forming the phrase *old style forms* (0.9%; 1/115; 0.9%). These modifiers added aesthetic properties and referred to aesthetic judgment. Most usages of style were historic (28/37; 75.7%), applied to describe older maps used as didactic examples. The age of example maps used to teach cartography was less important in the Pre-Robinson Era than today. Using historic maps to teach cartography is less common today because technological changes can make an older map's style look dated, and therefore render the map not sufficient quality for teaching use. In the Pre-Robinson Era, the opposite was true—the quality of older maps was considered difficult for current cartographers to

match because of technological changes in cartographic production which prioritized efficiency. Thus, the Pre-Robinson Era cartographers, especially those cartographers writing during the 1930s, an era of depression in the US and UK, had an anti-progressive, or perhaps Pre-Modern attitude towards aesthetics, in which the past was believed to be inevitably superior to the present, as I will discuss in Chapter 8.

Overall, 25 attestations of *style nn* in the Pre-Robinson Era (25/115; 21.7%) were in reference to lettering or typography. Four usages with the preposition 'of' to the left of *style nn* contained referred to *unity of style* (3/4; 75.0%) or *uniformity of style* (1/4; 25.0%), referencing a common conception of aesthetic experience (one of unity) and relating to later definitions of aesthetics in cartography (e.g., aesthetics as the 'clarity' of the map, Imus 2012; derived from Imhof (1982 [1965]), but concepts first attested in Deetz 1936.).

All Pre-Robinson Era authors referred to *style nn*. *Style nn* was most frequently found in Hinks (1933; 45/115; 39.1%), Raisz (1948; 24/115; 20.9%) and Greenhood (1951; 16/115; 13.9%) and these authors accounted for 29/37 (78.4%) of all usages with modifiers. Greenhood (1951), unique to all other authors, did not use *style nn* in reference to lettering or typography. Winterbotham (1936; 14/115; 12.2%), Beaman (1928; 6/115; 5.2%), Deetz (1936; 6/115; 5.2%), and Debenham (1940; 4/115; 5.2%) used *style nn* less frequently.

Like *style nn*, *art nn* most frequently appeared without a modifier (48/67; 71.6%), and *art nn* modifiers always appeared on the left. The most common modifiers included *science and art* (3/67; 4.4%), *cartographic art* (2/67; 2.9%), *decorative art* (2/67; 2.9%), and *whole art* (2/67; 2.9%). Many *art nn* phrases contained prepositions, importantly *in* (3/67; 4.5%) and especially *of* (22/67; 32.8%), forming phrases such as *art of lettering maps* and *art of cartographic expression*. These usages commonly were deployed in reference to aesthetic judgment, and in turn, aesthetic value. These

usages relate to the 'doing' of cartography and imply the development of skill or technique, foreshadowing the emergence of technical terms using *art nn* during the Robinson Era.

All authors from the Pre-Robinson Era referred to *art nn*. Most usages were from Raisz (1948; 23/67; 34.3%), Deetz (1936; 16/67; 23.9%), and Greenhood (1951; 11/67; 16.4%), and these authors formed the bulk of the prepositional phrases expressing aesthetic judgment and value (22/25; 88.0%). Debenham (1940; 8/67; 11.9%), Hinks (1933; 5/67; 7.5%), Beaman (1928; 3/67; 4.5%), and Winterbotham (1936; 1/67; 1.5%) used *art nn* less frequently.

Designed vvn most frequently appeared without a close noun or adjective modifier (28/53; 52.8%), and modifiers were generally on the left (20/53; 37.7%) rather than the right (9.4%; 5/53). The most common left modifier was *specially designed* (6/53; 11.3%). Seven other singular usages of left modifiers (1/53; 1.9%) referred to objects: *instrument designed, projection designed, stereoscope designed, titles designed, alphabets designed, apparatus designed,* and *Bonne projection designed*. All other left modifiers were unique. Right modifiers included *designed more particularly*, *designed especially*, *designed primarily*, *designed only*, and *designed exactly,* reflecting a concern for precision and accuracy in maps and in instrumentation, which has long been part of cartographic epistemology, given the view that map accuracy is a moral good (Edney 2019).

Many usages contained infinitives (19/53; 35.8%). These infinitives contained the verbs *designed to serve* (3/19; 15.8%) and *designed to measure* (2/19; 10.5%). Other usages included *designed to conform*, *designed to constitute*, *designed to examine*, *designed to be used*, *designed to fill*, *designed to give*, *designed to portray*, *designed to show*, and *designed to supply* (1/19; 5.3%). All of these usages emphasize the purposeful usage of *designed vvn*. Prepositions also contained purposeful usages, particularly *for* (15/53; 28.3%), creating phrases such as *designed for use*, *designed for drafting-room use*, and *designed for military use* (6/15; 6.6%). All of these usages

reflect future concerns for functionalism in cartographic design. Thus, they are precursors to the Robinson Era, even though the authors have not yet thought about how to measure interpretational accuracy. This follows, because measuring interpretational accuracy becomes easier when design is used as a reified concept—expressed in cartography as the noun, *design nn*. Nevertheless, these usages show that there is a consideration of *how* maps are designed, that is, how they should be. Thus, they reflect cartographic aesthetics even if these usages alone do not yet amount to cartographic scientific aesthetics, as described in Chapter 2.

However, *designed vvn* does contain one noteworthy outlier. The six-word key word in context, which provides three words to the right and to the left of the key word, misses one important usage of *designed vvn* in the Pre-Robinson Era: *designed to be quietly decorative* (Hinks 1933), in reference to the Ordinance survey alphabet. This usage emphasizes the avoidance of ornate lettering in cartography, an aesthetic norm in cartography described by cartographic convention (Guidero 2017).

All authors from the Pre-Robinson Era used *designed vvn*, with the frequency Raisz (1948; 16/53; 30.2%), Winterbotham (1936; 11/53; 20.7%), Hinks (1933; 10/53; 18.9%), Debenham (1940; 6/53; 11.3%), Beaman (1928; 5/53; 9.4%), Deetz (1936; 3/53; 5.7%), and Greenhood (1951; 2/53; 3.8%). Raisz' usage of *designed vvn* is interesting because before Robinson (1953), Raisz was the leading cartographic textbook. The larger number of usages of *designed vvn* (and for that matter, *design**) in Raisz foreshadow the utility of *design** to organize cartographic epistemology and teach cartography.

Beautiful jj only appeared with modifiers (100.0%; 35/35; 100.0%) as necessitated because 'beautiful' is an adjective, requiring a noun counterpart which it modifies, i.e., *beautiful map*. Modifiers generally were on the right (28/35; 80.0%) rather than on the left (11/35; 31.4%), but sometimes appeared on the left and the right (7/35; 20.0%). The most common left modifier was

more beautiful (3/35; 8.6%) followed by *very beautiful* (2/35; 5.7%). The most common right modifiers were *beautiful maps* (2/35; 5.7%), *beautiful example* (2/35; 5.7%), and *beautiful sheet* (2/35; 5.7%). With modifiers on the left, usages tended to be focused more on aesthetic value than aesthetic judgment, but the distinction between aesthetic value and aesthetic judgment was not always clear in the absence of comparative words (e.g., *more*, *most*, *outstandingly*, etc).

Even in the Pre-Robinson Era, *beauty** was largely referred to in the past-tense. The large majority of usages (30/35; 85.7%) were in reference to already existing or historic maps, rather than general usages describing characteristics of beautiful maps. The past-tense usage reflects the sense in the Pre-Robinson Era that the era of the most beautiful maps had ended because of changes in map production technology, as I will explain in Chapter 6.

Not all authors from the Pre-Robinson Era used *beautiful jj*. Authors referring to *beautiful jj* included Hinks (1933; 19/35; 54.3%), Winterbotham (1936; 8/35; 22.9%), Raisz (1948; 4/35; 11.4%), Deetz (1936; 2/25; 5.7%), and Greenhood (1951; 2/35; 5.7%). Beaman (1928) and Debenham (1940) did not use this part of speech. Beaman did not refer to *beauty** whatsoever. Debenham's only use of *beauty** is *beautifully rb,* forming the phrase *beautifully prominent*. This attestation of *beauty** is used in reference to telephone poles on a map, is hedonically charged, and will be discussed in Chapter 6.

Taste nn most commonly appeared without a modifier (9/17; 53.0%). All modifiers were on the left. The most common left modifiers were *individual taste* (3/17; 17.6%), and *personal taste* (2/17; 11.8%). Authors referring to *taste nn* included Winterbotham (1936; 4/17; 23.5%), Deetz (1936; 4/17; 23.5%), Raisz (1948; 4/17; 23.5%), Hinks (1933; 2/17; 11.8%), Greenhood (1951; 2/17; 11.8%), and Debenham (1940; 1/17; 5.9%). The usages of taste emphasize the subjectivity of taste, especially *personal taste*. Taste seems to be distinguished from functional concerns, as even maps produced to professional quality can still fall short of an author's taste (e.g., Raisz 1948). In that

sense, taste is more 'modest' than other considerations. Taste seems to provide reasons for inconsequential decisions, such as how to cut and mount a map (e.g., Winterbotham 1936).

Aesthetic nn appeared only in Greenhood (1951; 1/1; 100.0%) and was used solely in the context of describing aesthetic experience (1/1; 100.0%). However, this usage held a unique meaning that will be examined in Chapter 6.

In summary, the Pre-Robinson Era shows the beginnings of the scientific vocabulary that subsequently developed during the Robinson Era. Deetz (1936) is an important precursor to Robinson. However, 'design' has not emerged as a reified concept applied to the creation of maps, as will be discussed in Chapter 5.

Beauty's retrospective usage makes the marginalization of *beauty* in the Robinson Era almost a natural progression because *beauty** is closely associated with art. As will be discussed in Chapter 6, the 'new' scientific cartography begins to restrict the place of art to the production process. However, neither beauty nor art are truly 'lost' in the Robinson Era, since the manual techniques used to make maps share similar skillsets with artists. The Pre-Robinson Era is friendly to art, viewing art as a vocation not only parallel to science, but one in which many scientists also develop significant skills, to the benefit of both fields. Thus, Winterbotham (1936) can proclaim that "the public have a right to expect that the national map shall be a triumph of art as well as of science" (Winterbotham 1936, 100).

The acceptance of art in cartography in the Pre-Robinson Era, and the tendency towards using a gallery-based approach to teaching map design, may be a reason for the extensive discussion of *style** outside of the context of lettering and typography, which tends towards specific, historic usages (e.g., *portolan style*) and uses relating to map type (e.g., *choropleth style*). Frequently, the subjects are part of a preposition phrase, typically with 'of', such as *style of lettering*. In future eras, style noun adjunct phrases rarely refer to anything outside of typography.

4.3.2 Robinson Era

The Robinson Era had 1,285 concordances, 34.2% percent of all concordances. The most dominant key word in the Robinson Era is *design** (685/1,285; 53.3%), followed by *style** (275/1,285; 21.4%), *art** (260/1,285; 20.2%), *beauty** (29/1,285; 2.2%), *aesthetic** (29/1,285; 2.2%), and *taste** (7/1,285; 0.5%). Notably, *design** now accounts for more than all other aesthetic terms combined, suggesting that there has been a shift in cartographic epistemology. That shift, the introduction of *design**, and particularly *design nn*, provides a means to organize cartographic epistemology, and the start of objectification of cartographic design. Comparing the title of the previous leading textbook—Raisz's (1948) *General Cartography* to Robinson's (1953) *Elements of Cartography*—even reflects this shift, as the individual map elements can be investigated scientifically while more general or holistic dimensions of mapmaking are more subjective falling into the domain of artisan craft.

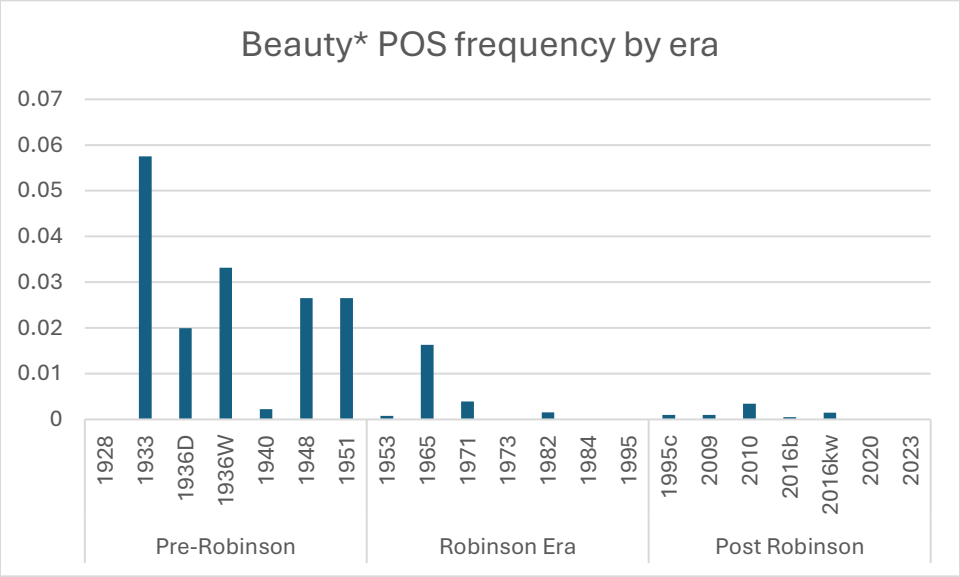


Figure 4.4. *beauty** relative frequency.

Most other aesthetic terms have shown a drop off in relative frequency, with the strongest drop off belonging to *beauty** (16.6%→2.2%, a decrease of 14.2%; Figure 4.4). Here, it is important to note an idiosyncrasy in the corpus that influenced results. By publication year, Imhof (1982

[1965]) is grouped with the Robinson Era textbooks. Although informal translations of *Cartographic Relief Presentation* had been available privately within certain US agencies, the English translation of Imhof's work was not publicly available until 1982. Furthermore, before the English publication, the text had had been edited by multiple authors: Mr. Michael Wood, Dr. Reiner Rummel, Dr. Romin Koebel, and Dr. Harry Steward. At the very least, these edits added content about computer cartography that may not have been part of the original German text (Imhof 1982 [1965], viii-x; 209-212). Despite these modern additions—perhaps added to make the book appear timelier, given the technological change that had taken place in the nearly two decades since original publication—the bulk of *Cartographic Relief Presentation* is more similar to works in Pre-Robinson Era. By the time Imhof's work was available in English, the transition to computer cartography was already well in progress. Because it was out-of-date, it would not have been adopted as an English-speaking textbook in 1982 or afterward. Furthermore, the English translation was both expensive, and difficult to find (Imhof 1982 [1965]; back cover). Thus, *Cartographic Relief Presentation* is an anachronism, a retrospection of techniques used during the Pre-Robinson and early Robinson Eras.

Because of Imhof's status as belonging to both the Pre-Robinson era by content and Robinson Era by date of publication, the drop off in *beauty** after 1953 is even sharper than the graph in Figure 4.4 suggests. This drop-off continues into the Post-Robinson Era. This finding is expected, as beauty is not considered a desideratum of maps in Robinsonian cartography.

However, one aesthetic key word increased in frequency of use: *aesthetic** (0.4%→2.2%; 1 to 29 +1.8%). This increase was unexpected, and it cannot be accounted for by acknowledging that Imhof (1982 [1965]) is an outlier, as Monkhouse and Wilkinson (1971), Cuff and Mattson (1984), and Robinson, Morrison, Muehrcke, and others (1995) all refer to *aesthetic**. Even though the attestations from Monkhouse and Wilkinson (1971), Cuff and Mattson (1984), and Robinson,

Morrison, Muehrcke and others (1995) are an overall minority of aesthetic language usage in the time period (Figure 4.5), I argue that they signal a shift in cartographic aesthetic epistemology.

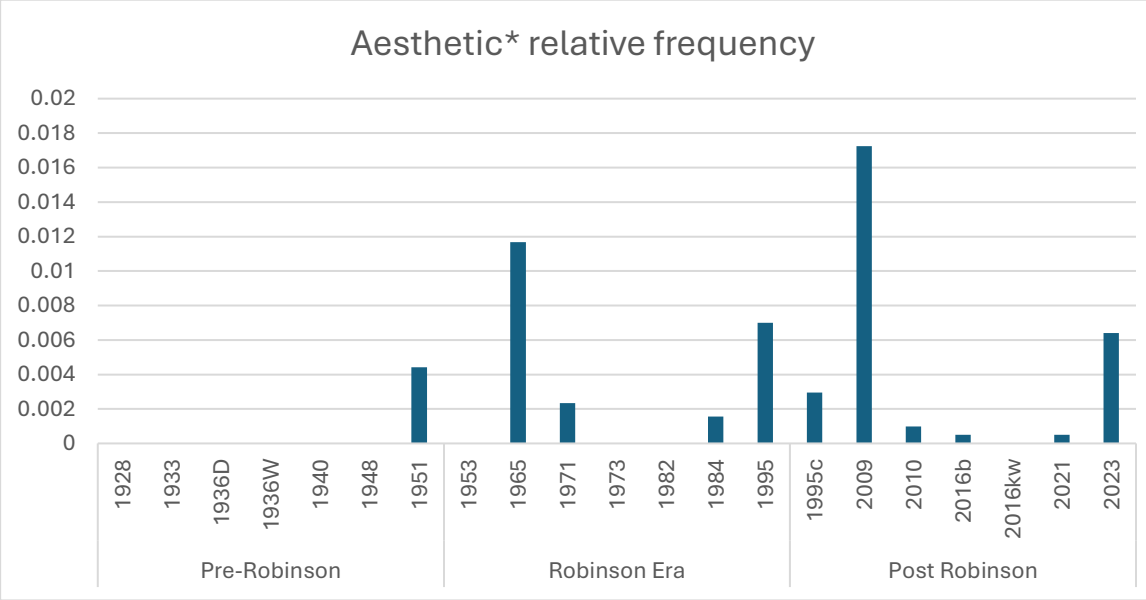


Figure 4.5. *aesthetic** relative frequency.

I theorize that the drop off in *taste*, beauty*, art** and *style** occurs because *design nn* takes the place of prescriptive and evaluative language, which characterized cartographic aesthetic judgment and aesthetic value, that had formerly appeared in vulgar aesthetic synonyms and aesthetically associated words. These words, vulgar aesthetic synonyms and words closely associated with aesthetics, are subjective. They no longer fit with the scientific design paradigm that emerged in the Robinson Era.

However, the attestations of *aesthetic** do not fit this pattern, as except for Imhof (1982 [1965]), *aesthetic** was not previously used in a prescriptive or evaluative sense. Instead, paradoxically, it may be that the increasing usage of *aesthetic** captures the subjective dimensions that were (apparently) being lost as usages of *design** and especially objectified *design nn** increased.

In the Robinson Era, the most common POS for each key word were *design nn* (429/1,285; 33.3%), *art nn* (165/1,285; 12.8%), *style nn* (140/1,285; 10.9%), and *aesthetic nn* (19/1,285; 1.5%). *Beauty nn* and *beauty jj* had the same number of concordances (13/1,285; 1.0%). The only POS of *taste** was *taste nn* (7/1,285; 0.5%).

Design nn most commonly appeared with a modifier (297/429; 69.2%). The most commonly occurring left modifiers included *map design* (69/429; 16.1%), *graphic design* (20/429; 4.7%), and *good design* (12/429; 2.8%). The most common right modifiers included *design problem* or *design problems* (8/429; 1.9%), *design principles* (7/429; 1.6%), and *design process* (4/429; 0.9%).

The bulk of new design terminology was introduced by *Elements of Cartography 1E* and *Elements of Cartography 6E* (Robinson 1953; Robinson, Morrison, Muehrcke and others 1995), a result predicted by the literature review. Authors using *design nn* included Robinson, Morrison, Muehrcke and others (1995; 207/429; 48.3%), Keates (1973; 87/429; 20.3%), Robinson (1953; (53/429; 12.4%), Imhof (1965; 40/429; 9.3%), Campbell (1984; 25/429; 5.8%), Monkhouse and Wilkinson (1971; 20/429; 2.3%), and Cuff and Mattson (1982; 7/429; 1.6%). The paucity of design language in Cuff and Mattson (1982) is curious, especially because they also have the highest number of usages of *style** and *art**. However, the influence of design can be seen in the title of the book itself: introduction to *Thematic Maps: Their Design and Production*, and the preface to the book explains that it is meant to only cover thematic maps, rather than to provide the in-depth overview of other works like *Elements of Cartography*.

Furthermore, Cuff and Mattson's (1982) usage of *style nn* is like usages of *design nn*. The usages almost always concern typography or cartographic epistemology. While not quite synonymous, the usage patterns are similar to how later authors might refer to *design choice*, *design option*, or 'map type'.

Style nn was used equally with (70/140; 50%) and without (70/140; 50%) a modifier. Modifiers appeared more commonly on the left (66/140; 47.1%) than on the right (10/140; 7.1%) but sometimes appeared on both sides (6/140; 4.3%). The most common left modifiers were *type style* (14/140; 10.0%), *same style* (4/140; 2.8%), *graphic style* (4/140; 2.8%), *old style* (2.1%; 3/140; 2.1%), *particular style* (3/140; 2.1%), and *classic style* (3/140; 2.1%). The most common right modifier was *style variations* (2/140; 1.4%) with no other repeated right modifiers. The large majority of uses of *style nn* referred to lettering or typography (97/140; 69.3%).

Authors referring to *style nn* included Cuff and Mattson (1982; 34/140; 24.3%), Imhof (1965; 29/140; 20.7%), Robinson, Morrison, Muehrcke and others (1995; 29/140; 20.7%). Campbell (1984; 21/140; 15.0%), Keates (1973; 12/140; 8.6%), Robinson (1953; 10/140; 7.1%), and Monkhouse and Wilkinson (1971; 5/140; 3.6%), for most of these authors, the number of usages corresponds to the length of their discussion of typography.

Most authors referred to *style nn* predominantly in the context of typography and lettering, including Robinson (1953; 10/10; 100.0%), Campbell (1984; 21/21; 100.0%), Robinson, Morrison, Muehrcke and others (1995; 28/29; 96.5%), Keates (1973; 9/12; 75.0%), and Monkhouse and Wilkinson (1971; 3/5; 60.0%). Authors who did not use *style nn* for type include Cuff and Mattson (1982; 17/34; 50.0%), whose usage of *style nn* already was elaborated above, as well as Imhof (1965; 9/29; 31.0%). I discuss these usages by Cuff and Mattson (1982) and Imhof (1982 [1965]) in Chapter 7.

Aesthetic nn was used only with modifiers (19/19; 100.0%). Modifiers always appeared on the right (19/19; 100.0%) and sometimes also appeared on the left (5/19; 26.3%). There were no repeated left modifiers. The most common right modifiers included *aesthetic sensitivity* (4/19; 21.0%), *aesthetic grounds* (2/19; 10.5%), and *aesthetic judgment* (2/19; 10.5%).

Only 57.1% (4/7) authors used *aesthetic nn*, and most usages were from Imhof (1982 [1965]; 13/19; 68.4%). Imhof is a work in translation, and there may be differences in culture of language between English and Swiss German. *Aesthetic* is an adjective in German (*ästhetisches*). Just as in English, aesthetic can be used to create noun phrases. In German, noun phrases typically appear in compound nouns, e.g., *Geländedarstellung is* the noun phrase *Terrain Representation*. Because of limitations in time and space, I am unable to work on Imhof in original Swiss German at present, therefore, translation difference is unaccounted for in this analysis.

Robinson, Morrison, Muehrcke and others (1995; 3/19; 15.8%), Campbell (10.5%; 2/19; 10.5%), and Monkhouse and Wilkinson (1971; 1/19; 5.3%) also used *aesthetic nn*. In English, the assignment of POS is more difficult, as *aesthetic judgment* forms a noun adjunct phrase in which aesthetic functions as a noun. The other non-Imhof usages from this era—*aesthetic terms, aesthetic considerations, aesthetic art form, aesthetic arts*, and *aesthetic sensitivity*—are somewhat ambiguous as to whether aesthetic is being used to form a noun adjunct phrase, forming a reified concept, or whether aesthetic is more adjectival. In general, usages trend more towards adjectival, which contrasts Greenhood's (1951) use of *aesthetic experience*, which is reified in the sense that aesthetic cannot be substituted for another word. Furthermore, this usage meets the criteria of the term as introduced in the literature review: aesthetics describes special experiences that 'really matter'.

Most attestations of *beauty** came from Imhof (72.4%; 21/29). Most of Imhof's usages relate to clarity, to the Swiss landscape, and to some aspect of the map as a whole, particularly the use of color. These usages are closer to usages in the Pre-Robinson Era.

The other authors using *beauty nn* included Robinson (1953; 1/13; 7.7%), Monkhouse and Wilkinson (1971; 1/13; 7.7%), and Cuff and Mattson (1982; 1/13; 7.7%). All three authors require more than a six-word key word in context to understand their usage. Monkhouse and Wilkinson

refer to *beauty nn* in the sense of functionalism with the phrase *beauty of the net reproduction rate*. Cuff and Mattson's usage of *beauty nn* is in the context of a discussion of composition, with the collocate clarity near beauty: "the all-important *contrasts* that lend clarity as well as beauty to a cartographic work" (Cuff and Mattson 1982, 71). These usages both emphasize functional beauty. Robinson's usage of *beauty nn* is critical, warning that a map viewer "will be stimulated first by its beauty and will fail to see the concept." (Robinson 1953, 13; "it" in this usage refers to the map).

Beauty jj almost always was used with a modifier (10/13; 76.9%) and modifiers were predominantly on the right (9/13; 69.2%) than the left (4/13; 30.8%). There were no repeated modifiers on the left or the right, however, two modifiers on the right referred to color: *beautiful colored area patterns* and *beautiful blue green*. Only two authors used *beautiful jj*, Imhof (1965; 11/13; 84.6%), discussed above, and Monkhouse and Wilkinson (1971; 2/13; 15.4%). Monkhouse and Wilkinson's usages included *beautiful work* and *beautiful illustrations*, referring to a work on landscape drawing and block diagrams respectively.

The paucity of usages of *beauty nn* and *beauty jj*, aside from the outlier Imhof, demonstrates the decline in beauty in the Robinson Era, as well as a new way of teaching cartography, which will be discussed in Chapter 6.

Taste nn was mostly used without modifiers (4/7; 57.1%). Modifiers appeared predominantly on the left (3/7; 42.8%) rather than the right (1/7; 14.3%). The most common left modifier was *good taste* (2/7; 28.6%). The only right modifier was *judgment and taste needed*, a similar usage to the Pre-Robinson Era in its emphasis on individual subjectivity, however, the number of references decreased significantly. Authors using *taste nn* included Imhof (1965; 3/7; 42.9%), Monkhouse and Wilkinson (1971; 2/7; 28.5%), Robinson (1953; 1/7; 14.3%) and Robinson, Morrison, Muehrcke and others (1995; 1/7; 14.3%).

Art nn modifiers appeared primarily on the right (99/168; 59.0%) rather than on the left (57/168; 33.9%), but also appeared without any modifiers (45/168; 26.8%). The most common right modifier was *art work* (82/168; 48.8%) followed by *art supply* (6/168; 3.6%), *art form* (3/168; 1.8%), and *art paper* (2/168; 1.2%). The most common left modifiers were *camera ready art* (8/168; 4.8%), *positive art* (7/168; 4.1%), and *fine art* (6/168; 3.6%).

The large number of usages of *art nn* in this era is somewhat misleading. The increase does represent an increase in epistemology associated with art, which was an unexpected finding. Many prepositional usages of art reflect this increase in epistemology. However, the large number of modifiers reflects the usage of art as a technical or trade term defining objects used in manual cartographic production processes (e.g., *glossy art paper*). A very large number of usages of *art work* appear in Cuff and Mattson, who offer this explanation for the use of the term:

> The trade term art work (or simply "the art" is applied to the piece or pieces that leave the drafting table and go to photography, or possibly to plate making without need for a photographic negative. The term, camera-ready, is not ideal for the purpose, because the art work used for separations is also ready for the camera. (Cuff and Mattson 1982, 132)

Thus, the noun phrase *art work* and related modifiers (e.g., *negative art work*, or a photographic negative) are technical terms relating to layers in the manual map production process. This usage as a technical or trade term is similar to current use of "art board" in Adobe Illustrator. The use of *work* in this sense reflects usages found in technical fields outside of cartography, such as electrical engineering (e.g., Khandpur 2006).

Regardless of the etymology of the turn, the pragmatic effect of tying art to technical processes and literal objects is the creation of an objective basis on which to base decisions, because these objects are measurable. This provides a counterweight to subjectivity in art. Cuff and Mattson's (1982) usage accounted for 79 of the 168 attestations of *art nn* from this time (47.0%), and Cuff and Mattson overall account for the majority of usages of *art nn* (99/168; 58.9%). However, even with this term eliminated and all of Cuff and Mattson's technical and trade usages of

art nn excluded, *art nn* remains the most common POS of *art** in the Robinson Era because art nn also refers to the production process, such as the art of drawing maps (Monkhouse and Wilkinson 1971), including trade terms from other authors, such as Robinson, Morrison, Muehrcke and others explaining a reproduction process using map reflections: "you can use reflection art to produce tangible copies" (Robinson, Morrison, Muehrcke and others 1995, 571).

Imhof's (1982 [1965]) usages mirror the aesthetic judgment usages in earlier eras, accounting for 21 additional usages, the next most common author to use *art nn* (21/168; 12.5%). As discussed previously, Imhof is an outlier across all key words in the Robinson Era.

Aside from Imhof (1982 [1965]), the remaining usages mostly refer to disciplinary art, especially Robinson (1953; 17/168; 10.1%), who elaborates at length on the place of art in cartography, as do Keates (1973; 12/168; 7.1%), Robinson, Morrison, Muehrcke and others (1995; 8/168; 4.8%), Monkhouse and Wilkinson (1971; 8/168; 4.8%), and Campbell (1984; 3/168; 1.8%). I discuss the focus on disciplinary art in the Robinson Era in Chapter 6.

The decline of *beauty** during this era reflects the new, objective Robinsonian cartography. Something is lost as beauty is lost, but cartographic epistemology continues to grow as Cartography debates the place of art within the discipline and reacts to changing technology. Style becomes narrower, leaning more into epistemology from typography and lettering, and authors begin discussing aesthetics. By the end of the era, design epistemology explodes, as Robinson, Morrison, Muerhrcke and others (1995) introduce large numbers of new *design nn* terms.

4.3.3 Post-Robinson Era

The Post-Robinson Era had 2,030 concordances, 53.9% percent of all concordances. The most dominant word in the Post-Robinson Era is *design** (1,627/2,030; 80.1%), followed by *style** (212/2,030; 10.4%), *aesthetic** (58/2,030; 2.8%), *art** (115/2,030; 5.6%), *beauty** (15/2,030; 0.7%), and *taste** (3/2,030; 0.1%). *Design** is now 4.7 times all other aesthetic key words combined. All

other key words save *aesthetic** have shown large decreases in relative usage from the Robinson Era: *style** decreases from 20.1% to 10.4%; *art** decreases from 20.2% to 5.6%; *beauty** decreases from 2.2% to 0.7%, and *taste** decreases from 0.5% to 0.1%. The only key word showing increased frequency in this era is *aesthetic**, which increases by another 0.6% over the Robinson Era. The explosion in design comes from Robinson's influence. Although Raisz (1948) begins using the term design, the first author who truly reified *design nn* was Robinson (1953), and by the Post-Robinson Era, all authors speak Robinson's design language, as I discuss in Chapter 5.

The most common POS for each word were *design nn* (1,160/2,030; 57.1%), *style nn* (140/2,030; 6.9%), *art nn* (58/2,030; 2.9%), *aesthetic nn* (30/2,030; 1.5%), *beauty nn* (9/2,030; 0.4%), and *tasteful jj* (2/2,030; 0.1%). Once again, the most consistently used key word was design as a singular noun. Nouns create objects for epistemology. The dramatic expansion of design as a singular noun shows a large increase in reference to design epistemology in cartography.

Design nn was used predominantly with left modifiers (659/1,160; 56.8%) but also frequently with a right modifier (449/1,160; 38.7%), occasionally with modifiers on the left and the right (208/1,160; 17.9%), and occasionally without any modifiers (260/1,160; 22.4%). The most common left modifiers include *map design* (209/1,160; 18.0%), *cartographic design* (83/1,160; 7.2%), and *legend design* (41/1,160; 3.5%). The most common right modifiers include *design process* (77/1,160; 6.6%), *design software* (25/1,160; 2.1%), and *design principles* (23/1,160; 2.0%). The large number of usages of *design process* is very important, as this noun phrase only emerged in 1995 but is an early indicator of a turn towards post-representation and processual mapping in the 21st century. Likewise, *design software* reflects technological change in cartography away from manual production methods. For this reason, as will be discussed, *art nn* has a sharp decrease in frequency in the Post-Robinson Era.

All Robinson-Era authors used *design nn*: Dent, Torguson, and Hodler (2009; 516/1,160; 44.5%), Slocum, McMaster, Kessler and others (2023; 222/1,160; 19.1%), Brewer (2016; 116/1,160; 10.0%), Tyner (2010; 92/1,160; 7.9%), Clarke (1995; 78/1,160; 6.7%), Krygier and Wood (2016; 69/1,160; 5.9%), and Kraak and Ormeling (2021; 67/1,160; 5.8%).

Style nn most commonly was found with a modifier, but sometimes appeared without one (48/ 140; 34.3%). Modifiers appeared more frequently on the left (87/140; 62.1%) than the right (10/140; 7.1%) and sometimes appeared with modifiers on the left and the right (5/140; 3.6%). The most common left modifiers were *type style* (29/140; 20.7%), *continuous style* (7/140; 5.0%), and *noncontinuous style* (5/140; 3.6%). The most common right modifier was *style difference* (2/140; 1.4%), with no other repeating right modifiers. The majority of usages of *style nn* referred to typography (95/140; 67.8%), a number almost identical to the Robinson Era. The other usages referred to a design choice or style option available to the cartographer (45/140; 32.1%).

All Post-Robinson Era authors used *style nn*: Dent, Torguson, and Hodler (2009; 54/140; 38.6%), Slocum, McMaster, Kessler and others (2023; 42/140; 30.0%), Brewer (2016; 18/140; 12.8%), Tyner (2010; 15/140; 10.7%), Clarke (1995; 5/140; 3.6%), Krygier and Wood (2016; 4/140; 2.9%), Kraak and Ormeling (2021; 1.4%; 2/140). However, Clarke's (1995) usages are unique because despite the work focusing on computer cartography, not a single usage of style refers to typography. Instead, Clarke's usages refer to attribute styles that can be assigned through programming, an application of *style nn* different from all other usages in the corpus.

Art nn was used predominantly without modifiers (43/58; 74.1%). Modifiers appeared more frequently on the left (12/58; 20.7%) than on the right (5/58; 8.6%). No right modifiers were repeated. The most common left modifier was *clip art* (6/58; 10.3%). Overall, there are very few, to almost no technical or trade usages of *art nn*. Most references to aesthetic judgment have also fallen away, but several still remain. The most common prepositional usages are *art of cartography*

(2/58; 3.4%) and *art in cartography* (2/58; 3.4%). Authors using *art nn* included Dent, Torguson, and Hodler (2009; 31/58; 53.4%), Slocum, McMaster, Kessler and others (2023; 10/58; 17.2%), Tyner (2010; 9/58; 15.6%), Kraak and Ormeling (2021; 3/58; 5.2%), Clarke (1995; 3/58; 5.2%), Brewer (2016; 1/58; 1.7%), and Krygier and Wood (2016; 1/58; 1.7%).

Aesthetic nn almost always was used only with modifiers (29/30; 96.7%). Modifiers appeared on the right (29/30; 96.7%) and sometimes appeared on the left (6/30; 20.0%). The most common left modifier, improved, formed the noun phrase *improved aesthetic look* (2/30; 6.7%). No other left modifiers repeated. The most common right modifiers included *aesthetic quality* (3/30; 10.0%), *aesthetic aspects* (3/30; 10.0%), *aesthetic look* (2/30; 6.7%), *aesthetic quality(ies)*(3/30; 10.0%), and *aesthetic sense* (2/30; 6.7%).

Five Post-Robinson Era authors used *aesthetic nn,* including Dent, Torguson, and Hodler (2009; 24/30; 80.0%), Slocum, McMaster, Kessler and others (2023; 3/30; 10.0%), Clarke (1995; 1/30; 3.3%), Tyner (2010; 1/30; 3.3%), and Kraak and Ormeling (2021; 1/30; 3.3%). While Dent, Torguson, and Hodler had the most usages, these usages were also the most confused and contradictory, as will be explored in Chapter 6. In general, while usages of *aesthetic nn* significantly increase, the clarity of usage decreases, whether losing specificity in aesthetic concept, or aesthetic judgment (i.e., for the term *aesthetic aspects*, if the aesthetic aspects can be inferred or understood through the text).

Like earlier periods, *beauty nn* was never used with modifiers (0/9; 0.0%). Authors using *beauty nn* include Tyner (2010; 6/9; 66.7%), Clarke (1995; 1/9; 11.1%), Dent, Torguson, and Hodler (2009; 1/9; 11.9%), and Krygier and Wood (2016; 1/9; 11.1%). Interestingly, although *beauty* was not used by many authors, only one of the usages was past tense. All others referred to *beauty* as an aesthetic property of maps, as will be discussed in Chapter 6.

Tasteful jj was used only by Krygier and Wood (2016; 1/1, 100.0%). As an adjective, *tasteful* appeared only with a noun on the right side (100.0%; 2/2). The two right modifiers were *tasteful layouts* and *tasteful coloring*, and both usages were pejorative historic quotes, as will also be discussed in Chapter 6. The pejorative usages in Krygier and Wood is expected because of the iconoclastic style of the authors—Wood (2016) is the same Wood (2003) who called for the end of cartography—but also somewhat ironic given that the design decisions Krygier and Wood playfully lament using these tongue-in-cheek quotes are exactly what traditional cartographic aesthetic norms also malign. In other words, Krygier and Wood's (2016) usage of *tasteful jj* conforms with cartography's core aesthetic norms.

4.4 Conclusions

The statistical analysis of key word phrases revealed four important overall results for further investigation during the qualitative analysis to follow in Chapters 5, 6 and 7. The first result to be investigated is the sudden dramatic of *design** starting in 1995, and the sudden appearance of the third most common *design* noun phrase in the Post-Robinson Era, *design process*, which had only emerged at the end of the Robinson Era, with four attestations in Robinson, Morrison, Muehrcke and others (1995). I examine this result in Chapter 5.

The second unexpected result was the increase in the use of *aesthetic** throughout the corpus. This result appears paradoxical given the marginalization of aesthetics following WWII, especially because other aesthetic synonym terms did follow expectations, decreasing in use throughout the corpus. A semantic examination of *aesthetic** and aesthetic synonym terms may help understand the increased usage of *aesthetic** and the decreased usage of aesthetic synonym terms. I examine this result in Chapter 6.

Third, the use of *art* as a technical term referring to materials in the production process is a confounding factor which is revisited in Chapter 6 and returned to in Chapter 8. The subsequent

decline of technical terminology relating to *art* makes sense when new technical terms arise relating to computer design. What is left of *art* after trade and technical usages are removed is important for understanding aesthetics in cartographic epistemology, which I examine in Chapter 6. In Chapter 8, I explore the relationship between lost *art* technical terms and the emergence of new design terms related to technology, and how that relationship impacts cartographic aesthetics theory.

The fourth unexpected result was the use of style appearing more frequently when design is used less frequently. *Style** was the most commonly used key word in the Pre-Robinson Era, but these usages had the least stability. In the Robinson Era, the authors who did not use design as the most frequent key word used *style** as the most frequent key word. The relationship of *style* to *design* bears investigation, which I investigate in Chapter 7 and in Chapter 8.

Chapter 5: *design nn* (noun, singular)

5.1 Introduction

*Design** was the most dominant aesthetic key word in the sample (2,428/3,767; 66.7%) but did *not* emerge as the most dominant key word in the Pre-Robinson Era (1928-1952): *style nn* (115/452; 25.4%) *art nn* (67 / 452; 14.8%), and *designed vvn* (53/452; 11.7%) were found more frequently. By the Robinson Era, *design** is the most common key word (685/1,285; 53.3%) and *design nn* is found most frequently therein (429/685; 62.6%). The bulk of new design terminology was introduced by *Elements of Cartography 1E* and *Elements of Cartography 6E*. By the Post-Robinson Era, *design** is responsible for more than three quarters of the concordances (1,627/2,030; 80.1%), and most of those uses are *design nn* (1,150/1,627; 70.7%). *Design process* becomes an important noun phrase, as will be explored in this chapter.

Design nn is a slightly left-loaded word, meaning that modifiers appear somewhat more often on the lefthand side of the word than the right. Modifiers appearing on the lefthand side of the word generally provide aesthetic properties (e.g., *clear design*, *good design*, *better design*) as well as types of design or objects that can be designed (e.g., *map design*, *cartographic design*). Modifiers appearing on the righthand side of design generally refer to concepts or tools (e.g., *design software*, *design prototypes*, *design limitations*).

There were 546 noun adjunct phrases associated with *design nn*. *Design* appears more frequently in noun phrases (1,217/1633, 74.5%) than alone (416/1633, 24.5%). The closeness between *design* and its modifiers is an indication of the introduction of new concepts into cartography, as distance between words closes when less explanation is needed as to what those words mean, for example, *design of maps* (Raisz 1948) becomes shortened into a noun adjunct phrase, *map design* (Robinson 1953).

The graph in Figure 5.1 shows the usage of *design** as a standalone word, and *design nn* within a noun adjunct phrase, with the first attestation of *design nn* in the corpus in Hinks (1933). There are three notable points on the graph. First, 1953, marked in red, indicates the publication of Robinson's *Elements of Cartography*, 1E, when reified 'design' enters the lexicon (Nestel 2019). In Robinson's work, *design nn* is used 20 times as a standalone word, and 33 times within 26 unique noun phrases.

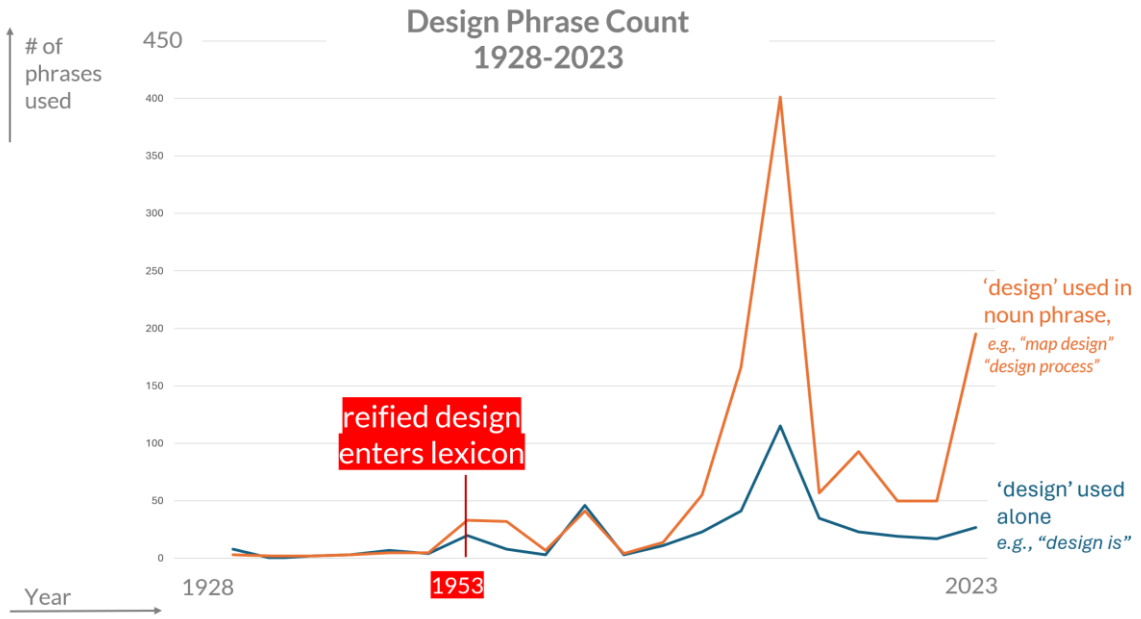


Figure 5.1. *design nn* noun phrase count. This graph shows the raw count of 'design' usage through the sample, compared to design noun phrase usages.

After *Elements of Cartography*, 1E, usage patterns remain somewhat consistent until the period 1995–2010, which includes the publication of *Analytical and Computer Cartography*, 2E (Clarke 1995), *Elements of Cartography*, 6E (Robinson, Morrison, Muehrcke, and others 1995), *Cartography: Thematic Map Design* (Dent, Torguson, and Hodler 2009), and *Principles of Map*

Design, 1E (Tyner 2010). This period marks an explosion of *design nn* noun phrases, many of which had never been used before in cartography.

To investigate why so many new *design nn* noun phrases are first attested 1995–2010, it is useful to reflect on what is happening both within and outside of cartography. Cartography was experiencing two dramatic changes starting in the 1980s: first, the computer revolution in cartography, and second, the rise of geographic information systems (GIS). I discuss each in turn.

The use of computers in cartography was speculated on by cartographers since at least the early 1970s (Peuker 1972; Moellering 1976, Carter 1984), and by 1985 the process had a name: the Electronic Transition. Nevertheless, an understanding of how computers and especially GIS software would relate to cartographic production was yet to come, partially because of the disciplinary separation between computer science research and geographic research (Monmonier 1985). Ten years later, the Electronic Transition was still a major concern, as Robinson, Morrison, Muehrke, and others (1995) comment that the UW-Madison Cartography Lab, one of the leading university cartography labs in the country, had only just transitioned to a digital production process. Thus, *Elements of Cartography 6E* (1995) and *Analytical and Computer Cartography 2E* (1995) still were grappling with describing and teaching the new technology. Even *Cartography: Thematic Map Design* 6E (2009) shows remnants of this language with the large number of terms modified by 'computer': *computer software*, *computer program*, *computer spreadsheets*, *computer programing language*, *computer display devices*, *computer versions of type size*, etc. These objects are already digital, most of them obviously so. Those that are not, such as *spreadsheet*, already are implied to be digital because *Cartography: Thematic Map Design 6E* teaches a digital production process.

Moving to fully computerized workflows involved the introduction of new phrases. Technical terms such as *CADD (computer-assisted design and drafting programs)*, *design loop*, and *database design* enter the lexicon to emphasize these textbook authors teach the new technology. Most

terms are imported directly from CAD and from computer science, and there are discrepancies in the use of terms even within a single work, as both Clarke (1995) and Robinson, Morrison, Muehrcke, and others (1995) use *computer aided design* and *computer assisted design*. At the same time, after 1984, there is a sudden and near-complete loss of attestations of *art*-based trade and technical terms.

Very few of the new technological terms stick around after the period 1995–2010. Only *design software* and (importantly) *design process* continue to see use, the latter of which I discuss later. The rapid appearance and disappearance of computer terms suggests that they are jargon imported from outside of cartography, and ultimately were not conceptually necessary to teach design in cartography. However, the jargon served several purposes: to help understand how technology changes could change cartography and especially cartographic design; to think through cartographic epistemology from a computer science and technology perspective; and, perhaps most importantly, to signpost the currency and relevance of cartography itself by adopting the aesthetics of computer technology.

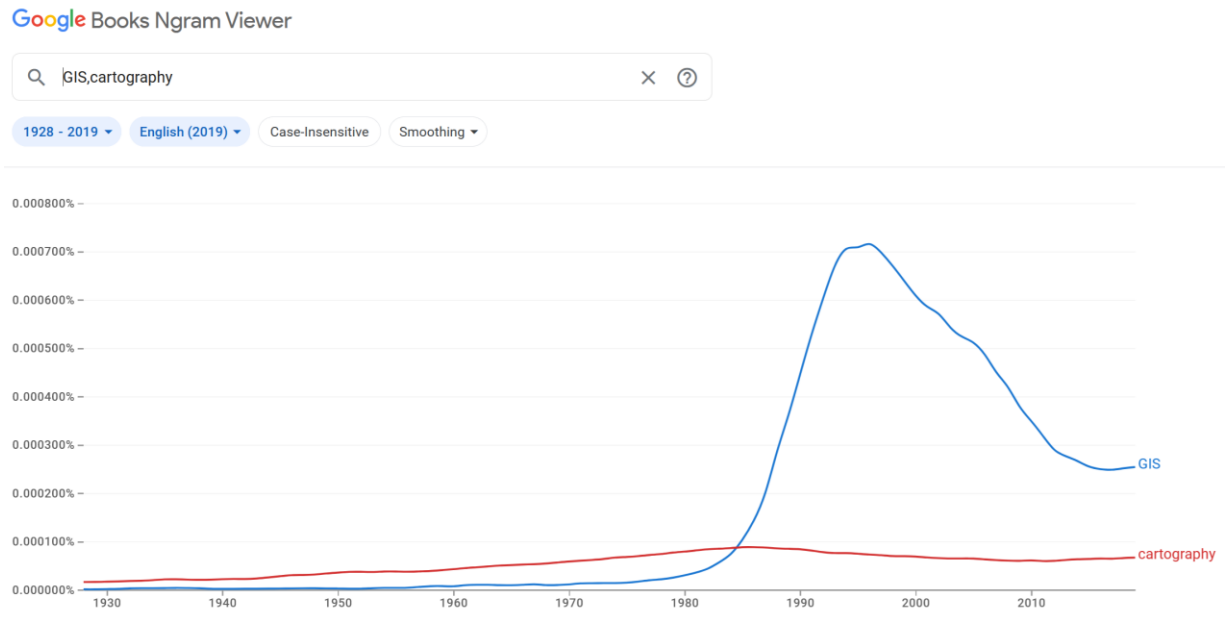


Figure 5.2. Ngram of *GIS* and *cartography* from Google Books Ngram Viewer.

The rise of GIS in the 1980s was viewed as an existential threat to cartography itself, as mapping expertise was claimed outside of cartography (Olson 2003; Goodchild 2000). GIS quickly overtook cartography in discourse (Figure 5.2) and cartographers had to re-evaluate the value and purpose of their discipline. At the same time, influential Marxist and post-structural critiques of cartography questioned whether maps could ever overcome their settler-colonialist history (e.g., Harley 1990). These critiques often were based on aesthetics, attacking maps as images (*cf* Nestel 2024, forthcoming; "A Map is an Image which proclaims its Objective Neutrality," Wood 2003). cartography positioned itself against GIS by asserting what was most core to its identity: design. Whereas GIS focused on analysis, cartography's value lay in design, and so laying out cartography's design epistemology became critical. Design noun phrases delineated *cartographic* design epistemology, and the term *cartographic design* itself, which had previously appeared just once in Robinson (1953), becomes one of the top five noun phrases used in the entire corpus, and features in the titles of half the works during this time:

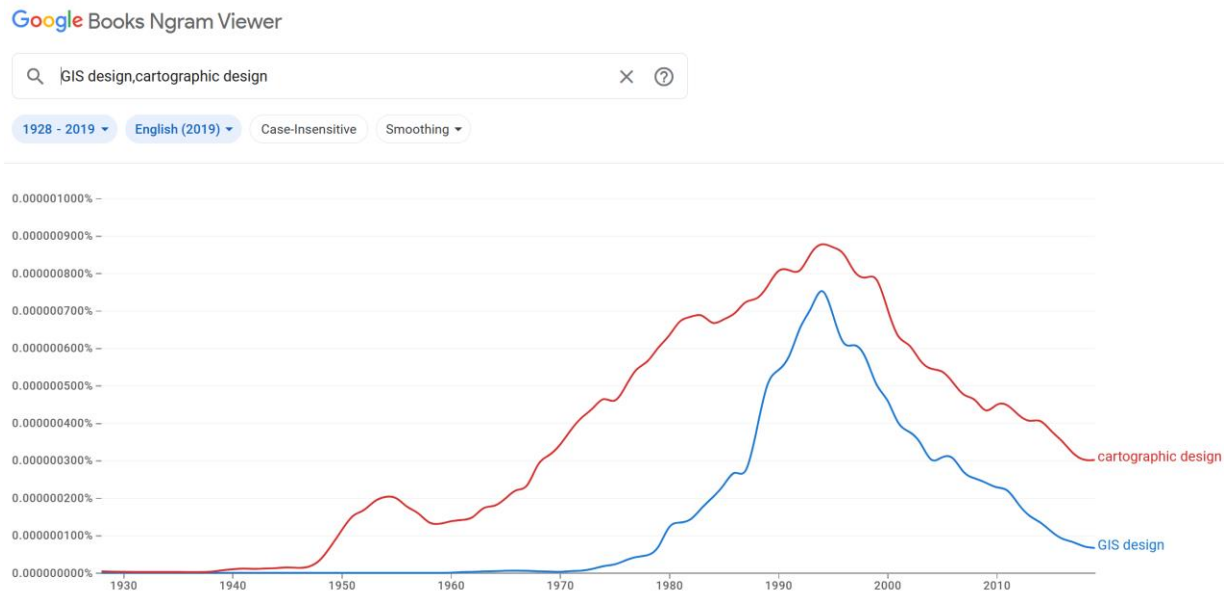


Figure 5.3. Ngram of *GIS design* and *cartographic design* from Google Books Ngram Viewer.

Analytical and Computer Cartography 2E (1995), Clarke
Elements of Cartography, 6E (1995), Robinson, Morrison, Muehrcke, and others
Thematic Map Design, (2009) Dent, Torguson and Hodler
Principles of Map Design, (2010) Tyner

Cartography's claim to *design* seems to have been successful. Although there are many more—and remain many more—attestations of GIS than of cartography, design is much more closely associated with cartography than with GIS within the Google corpus of English language books 1928-2019 (Figure 5.3).

However, one limitation of neglecting aesthetic language is that cartography was not able to fully address iconoclastic critiques because it did not have sufficient language to do so, a paucity explained by cartography's theoretical reliance on semiotics, which tends to elide aesthetics (Guter 2010). The effects of semiotics can be seen in the collocates for *design*, in which aesthetic attitude (attention) and experience have the fewest modifiers. Attitude and experience tend to be hedonic and particularly difficult to conceptualize from semiotic frameworks because these frameworks break down meaning into component parts rather than focusing on wholes. Thus, there is language to argue for value and judgment, as these tend to fit easily with semiotic systems (i.e., a *design decision* is 'good' by reference to the outside world, what objects count as map objects as opposed to art objects, etc.), but do little to counteract claims regarding the source of these judgments and values (i.e., institutional or state knowledge), which is exacerbated further by the need to emphasize both metrics and technology.

5.2 Overview by Aesthetic Concept

In general, aesthetic focus within *design nn* noun phrases has been on judgment, objects, value, experience, and attention, in that order. Aesthetic judgements of design concern potential aesthetic properties, such as *traditional* or *clear design*, as well as perceptual and conceptual qualities, such as *design hypothesis, feedback, technique, approach,* and *evaluations*. The

collocates show the impact of science and technology on cartographer's aesthetic judgment, emphasizing that these skills are part of cartographic epistemology, not just part of the aesthetic "look" but the practice of disciplinary cartography.

5.2.1 Aesthetic Judgment and Value

Within *design nn,* aesthetic judgment and value show considerable intersection, as many aesthetic judgments also are aesthetic value judgments (i.e., *appropriate design*), although some are partially separable (i.e., *better design*); value judgments depend on aesthetic judgment broadly, as aesthetic judgment involves perception. In that sense, cartography's focus on aesthetic judgment dimension of design makes sense, as cartography's value claims as a discipline often are based on psychological or perceptual understandings of map design.

Value judgments begin with *better design* (Hinks 1933), reflect new functional concerns via *design requirements* and *design strength* (Robinson 1953), and then proceed to the hedonic and attitudinal (or attentive) *attractive design* (Keates 1973). Explicitly professionalized terms such as *professional design* (Robinson, Morrison, Muehrcke, and others 1995) and *expert design* (Dent, Torguson, and Hodler 2009) do not appear until much later in the sample, and surprisingly, *design conventions* does not appear until 2016 (Krygier and Wood). Although this elision may be partially explainable to the gap (fourteen years) between books in the sample, once again, the time period showing the emergence of this term (1995–2010) reflects fears that cartography might be trending towards obsolescence. Prior to this time, explicit language regarding professional cartographic design may not have been necessary because cartographers did not need to justify being the 'map design experts'.

5.2.2 Aesthetic Objects

Aesthetic objects are the second most developed cartographic aesthetic concept. An aesthetic object is traditionally regarded as nonfunctional, and therefore in contrast with a functional object. Academic cartographic epistemology establishes maps as functional objects (Nestel 2024 forthcoming). Therefore, this category is something of a 'negative' category from a traditional (Kantian) aesthetic standpoint, since it describes cartographic objects and concepts, and neither objects nor concepts traditionally 'count' as aesthetic. However, modern philosophical aesthetics does not view a distinction between aesthetic objects and functional objects as necessary. Some objects are appreciated because we know their use, and cartographers have made hedonic arguments for functional map design (e.g., Kent 2008).

Aesthetic objects typically form either what is designed (i.e., *map design*) following technological advances, such as *computer-aided design* (Clarke 1995) or provide a conceptual example like *sample design* (Monkhouse and Wilkinson 1971), *design goals* (Cuff and Mattson 1982), or *design ideas* (Imhof (1982 [1965])). Some aesthetic properties associated with judgment also are associated with objects, such as *original design* (Hinks 1933) and *new design* (Winterbotham 1936), reflecting traditional characteristics of aesthetic objects. It is notable that these terms, along with *whole design* (Debenham 1940), are among the earliest attested design noun phrases in the sample, showing that consideration of the map as an aesthetic object of design has a history at least as long as aesthetic value.

A disproportionate share of aesthetic object terms was introduced 1995–2010, many of which show the influence of technological change. Many map type terms also are introduced during this time, terms which used without design as a collocate had long histories within cartography (e.g., choropleth gains a new collocate, *choropleth design*, in Dent, Torguson, and Hodler 2009). The difference between the usage of these terms before and now is that now they are

implicitly objects of *cartographic design* (Robinson 1953), and thus claimed by cartographic ownership.

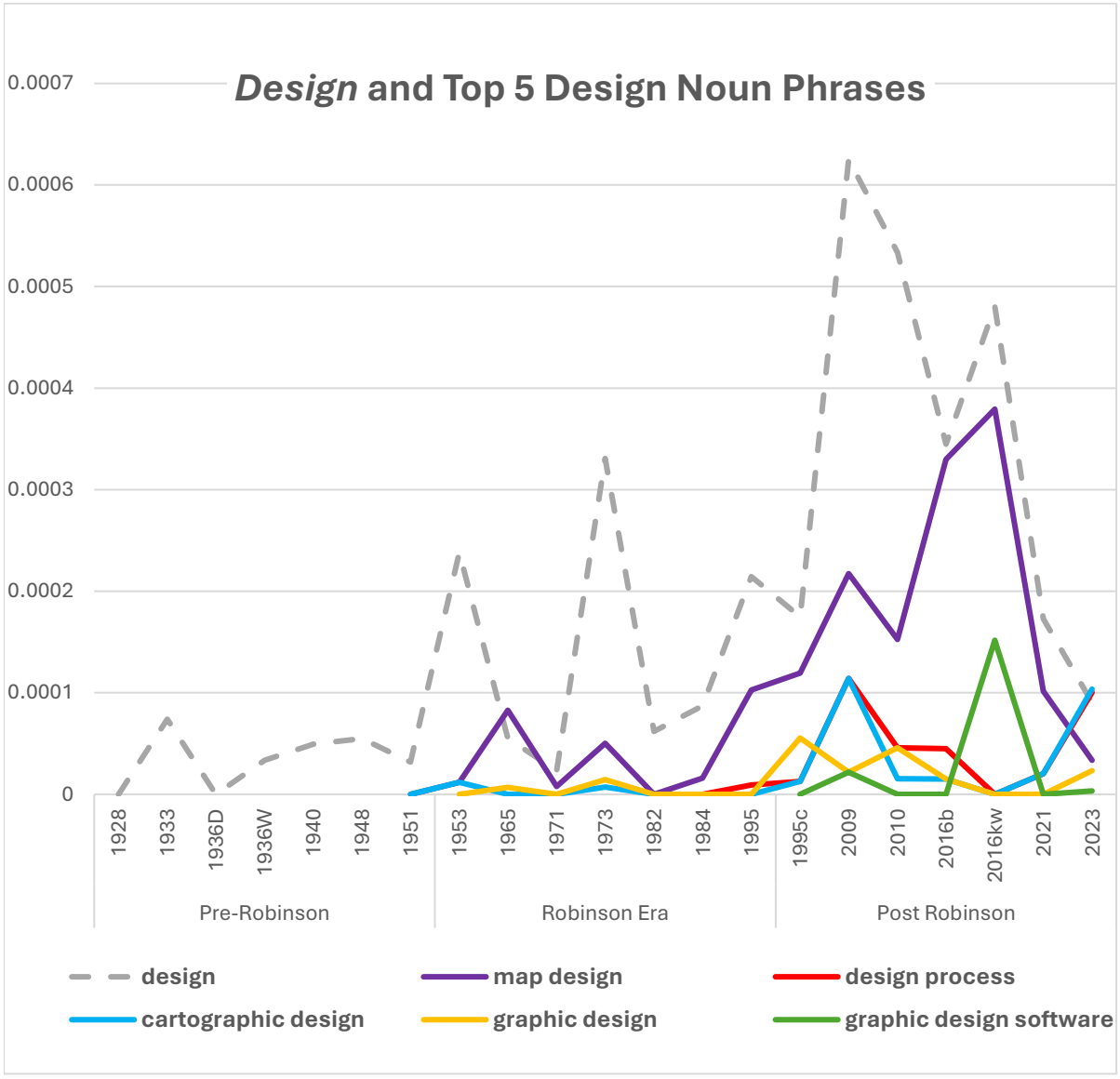


Figure 5.4. Ngram displaying the top five noun phrases associated with *design nn* and *design nn* used without adjective or noun modifiers. Each point on the graph shows the frequency per author, adjusted by word count to account for the increasing length of textbooks.

Four of the top five noun phrases in the sample relate to aesthetic objects, as shown in the Figure 5.4 ngram: *map design* (303/1633, 18.55%), *cartographic design* (93/1633, 5.69%), *graphic*

design (56/1633, 3.42%), and *graphic design software* (12/1633, 0.73%), reflecting the importance of aesthetic objects as a category.

5.2.3 Aesthetic Experience

Although aesthetic experience is the fourth most populous aesthetic concept by number of unique terms, the second most used *design* noun phrase relates to aesthetic experience: *design process* (83/1633, 5.08%; Figure 5.4.) *Design process* is first attested in the sample in *Elements of Cartography 6E* in a generalized sense. That same year, Clarke (1995) adopted the term from a software design standpoint to reflect the steps of thinking through data and code structure to produce a map (Table 5.1). Prior to this usage, the term *cartographic process*, first attested by Robinson (1953), had occasionally been used as a technical term to describe how maps were processed for printing.

Author	Concordance
Robinson (1953)	Processing the negative is one of the more important steps in the cartographic process, for it is in this stage that some results can be obtained better than in the drafting stage. (Robinson 1953, 98).
Cuff and Mattson (1982)	The processes of reproduction constitute a most important aspect of the cartographic process. (Cuff and Mattson 1982, 109).
Robinson, Morrison, Muehrcke, and others (1995)	As we noted earlier, cartographers don't have complete control over the processes of generalization. Generalization is also guided by a number of external forces. These controls are similar to the influences on map design which we explored in Chapter 18. As we explained there, the following factors affect the design process: reality, map purpose, quality and quantity of available data, map scale, audience, conditions of use, and technical limits. These same forces affect cartographic generalization. In the following discussion, we will treat reality, map purpose, and conditions of use as one set of controls, which we call map
Clarke (1995)	Assuming that you have read much of this book, have read about the C programming language, understand cartographic data structures, and have gone through the software de- sign process described above, how do you actually go about writing a computer program to generate a map? During the design process, you have asked yourself what kind of map you wish to produce. You have blocked out a set of modules, which can do any necessary input, structure the data, perform any necessary transformations, and then generate the map. The next and most important step is to write the program.
Dent, Torguson, and Hodler (2009)	map design process is characterized by six stages: problem identification, preliminary ideas, design refinement, analysis, decision, and implementation.

Table 5.1. Noun phrase, first attestations of *design process*.

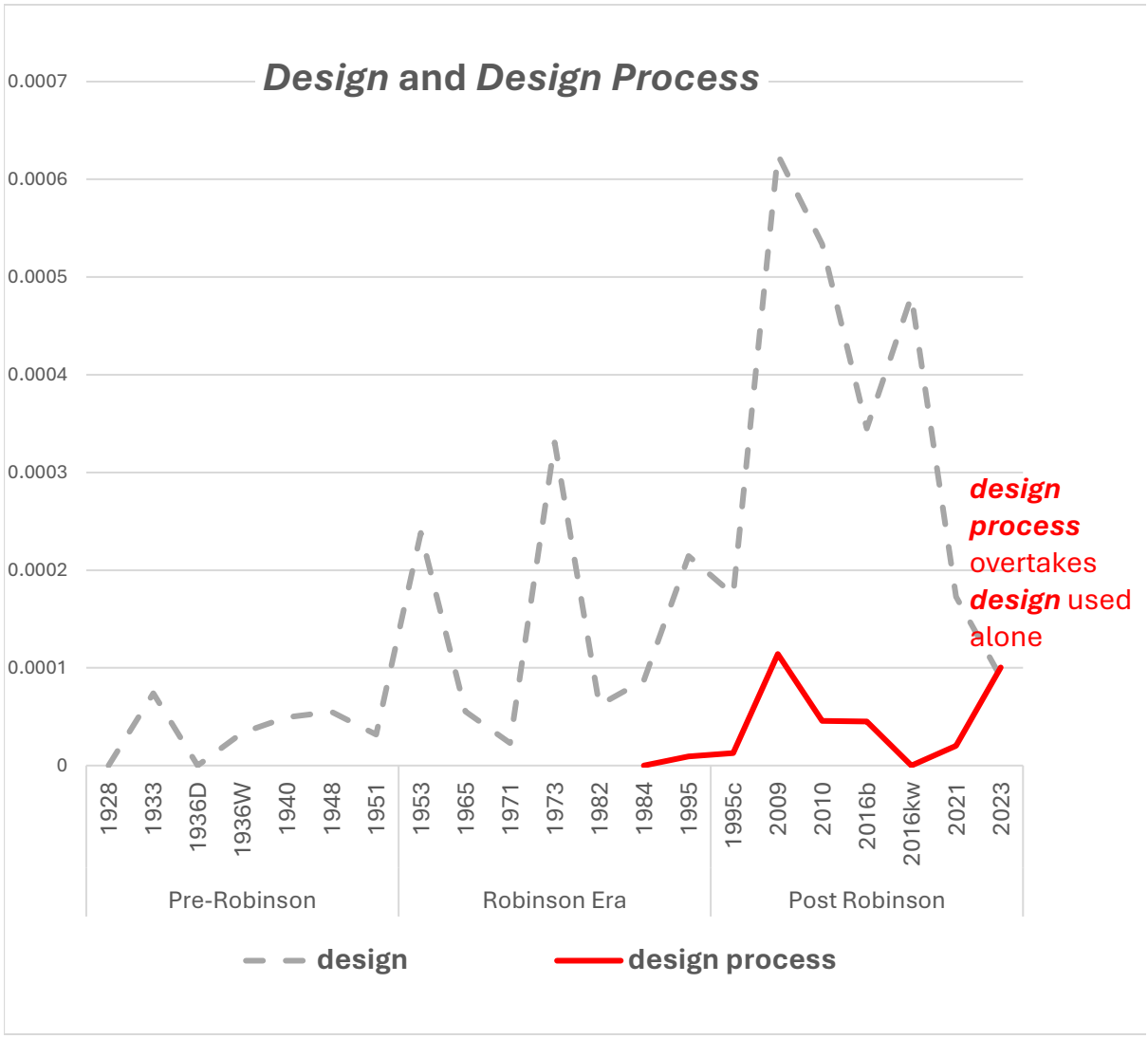


Figure 5.5. Ngram displaying *design process* and *design nn* used without adjective or noun modifiers. Each point on the graph shows the frequency per author, adjusted by word count to account for the increasing length of textbooks.

Although more generalized, Robinson, Morrison, Muehrcke, and others' (1995) discussion lists considerations rather than steps. The first attestation of a formal *map design process* does not appear until Dent, Torguson, and Hodler (2009), showing a complete reification of the design process itself, as something that is undergone. Notably, it also is around this time that processual and post-representational theories of cartography become an increasing part of cartographic theoretical discourse. By 2023, *design process* is more commonly used than *design* itself (Figure

5.5), reflecting both the influence of processual theories, as well as increasing recognition of the *design process* as a key concept in cartographic epistemology.

5.2.4 Aesthetic Attitude and Attention

The aesthetic attitude is traditionally one of disinterest, however, philosophical aesthetics no longer regards disinterest as constitutive for aesthetic experience, and thus aesthetic attitude also may be thought of as aesthetic attention (Nanay 2016). The persistence of traditional attitudes partially may explain why attitude is the least common aesthetic concept found within *design* noun phrases. However, another explanation may be that attitude and attention reflect what one does: attitudinizing or attending. The verb simply may not mix well with the noun design. Furthermore, like aesthetic experience, aesthetic attitude is more difficult to conceptualize through semiotic frameworks, as distance closes between the viewer and the object, resulting in a whole, rather than discrete parts. For instance, part-whole models might include the triadic models present in cartography, such the familiar sign vehicle, referent, interpretant from Peirce and later Morris (Nöth 1994); classically, in aesthetic attention and experience, these parts would be collapsed into one.)

Nevertheless, some noun phrases intersect aesthetic attitude, namely, *attractive design* (Keates 1973), *interesting design* (Dent, Torguson, and Hodler 2009), and *aesthetic design* (Dent, Torguson, and Hodler 2009). These describe the stance or attention that one takes towards an object. Some noun adjunct phrases mirror these phrases as a negative example, such as *unattractive design* (Keates 1973) or *monotonous design* (Slocum, McMaster, Kessler, and others 2023). Others indicate directing attention, such as *design emphasis* (Cuff and Mattson 1982), an important example because it reflects how not all attention must be hedonic, in the sense of being pleasure-based.

Designing for attention is not a new avenue for cartographic design epistemology or research, reflecting the limitation of the term *design* as an entry point to aesthetic theory in cartography. Generalization operators such as selection, simplification, and exaggeration all relate to attention (Roth, Stryker and Brewer 2011), even if they do not do so in the traditional sense of the aesthetic attitude. Nevertheless, attention represents future growth for cartography, both in relation to broader design trends and concerns, such as the attention economy, as well as design for emotion.

Debates in cartography have concerned designing for trust, such as IMIA's webinar in Trust in Mapping (April 24th, 2024), which considered the role of design to help viewers distinguish between 'fake' and 'nonfake' information and the extent to which a map can be designed to indicate it is deserving of trust in the mapmaker's expertise. With the unprecedented power and rapid expansion of generative AI, the spread of cartographic mis- and disinformation will be amplified, and thus finding some means through design to keep up with technological developments is even more important.

These debates in cartography reflect debates within aesthetics on the attitude and attention of viewers, particularly in relation to critiques on the power of images to overwhelm viewers with a feeling of psychic 'rightness' (Eagleton 1990). Psychologically, this feeling can be described by 'click-whirr' effect, which describes the tendency for people to find evidence of trustworthiness and stop evaluating critically the material that they are working with, instead accepting arguments at face value (Cialdini 2006).

Studying the means by which maps set the attitude of the viewer by 'designing for trust'—or perhaps, by designing in ways that promote data, information, and geographic literacy—are future directions which implicitly involve aesthetic considerations and aesthetic debates, from the role of design decisions on aesthetic judgment of the cartographer and the viewer, to the co-creation of

space through processual theories of cartography and cartographic design. Further integration of explicitly aesthetic vocabulary and considerations of debates within aesthetic theory holds great promise to enrich cartographic design.

5.3 Overview by Era

5.3.1 Pre-Robinson Era

In the Pre-Robinson Era, *design nn* is the second most common POS of *design** (the most common POS of design is *designed vvn*). *Design nn* has 44 usages (44/1,633), the fewest usages of any era. Six authors refer to *design nn* with the following frequency: Raisz (1948; 12/44, 27.3%), Hinks (1933; 11/44, 25.0%), Greenhood (1951; 9/44, 20.4%), Debenham (1940; 6/44, 13.6%), Winterbotham (1936; 4/44, 9.1%), and Deetz (1936; 2/44, 4.5%). Raisz has more usages than any other author, and Raisz is the first author to start closing the distance between *map* and *design* (Table 5.2).

Author	Concordance
Raisz (1948)	Reading photographs is also a great inspiration to the map maker as the true pattern of the earth will guide him in the design of his maps, with better, truer, and more beautiful cartography as a result
Greenhood (1951)	This gives us two kinds of axis to keep in mind: the axis of the earth (which is a study in symmetry, too!) and the axis upon which turns the design of a map.
Greenhood (1951)	He doesn't own the facts. All he owns is the means of communicating these facts: his particular design of map, with its more or less generalized interpretation of relief and shoreline, its expression of detail, the special symbols of his own invention, etc.

Table 5.2. Distance between design and map. Aesthetic language has been underlined.

Outside of these three usages, *design* does manage to close the distance between object and modifier in three additional usages, unrelated to maps. These usages also come from Raisz (1948) and Greenhood (1951): *poster design* (Raisz 1948), *cover design* (Greenhood 1951), and *world-interrupted design* (Greenhood 1951). In that sense, it is unexpected that *map design* does not emerge.

Modifiers of design appear solely on the left. The most common modifiers of design are *careful design* (2/44; 4.5%), both usages from Deetz (1936), and *general design* (2/44; 4.5%), with one usage by Raisz (1948) and one usage by Greenhood (1951). Other left modifiers include *better, original, fuller, new, whole, best, sound, complete, geometric, symmetrical, main,* and *particular*. Several of the modifiers relate to aesthetic value: *better, best,* and *sound; whole* seems to relate to aesthetic experience, however, the in-line usage "*the whole design being cut into the wood or stone of posts, buildings, &"* is rather weakly charged for this association.

The most common usages of *design* are nonspecific to mapping, that is, generalized to a concept that is not specific to cartography, as shown in the examples in Table 5.3. *Design* is an outside concept applied to maps, rather than an epistemology from within cartography, as explained by Raisz (1948): "The term "cartogram" for such design is more correct than map" (Raisz 1948, 222).

Even though *design nn* is used as a general concept, these usages show cartographic aesthetic epistemology. We learn that good design in cartography takes functional concerns into account, such as simplicity, legibility, and economy, that maps are successful if they serve their purpose, but that maps can serve their purpose better if they are attractive and connect hedonically with their audience (i.e., interest them), so long as the pictures on the map do not take attention away from the map itself. The cartographer's job is to direct attention, and directing attention well can make a map more enjoyable. These connect to aesthetic attitude through attention concerns, aesthetic experience in how the map feels—both to use and to make—and aesthetic value in design choices.

Thus, the epistemology surrounding these general usages shows the relationship of aesthetics to design. By Greenhood (1951), we can see this relationship to aesthetics hinting at one

of the two modern definitions of design as a noun that are listed in the GIS&T Body of Knowledge:

design nn as the "look and feel" of the map product (Nestel 2019, no page number).

Author	Concordance
Hinks (1933)	To which of course the reformers replied that the new alphabets submitted were as simple and legible as could be made; that the subtleties of design are introduced to get legibility; that a letter written in a single stroke is at any rate simpler besides much quicker to make; and that, if not for the Ordnance survey at least for everyone else, the ruling consideration is economy.
Deetz (1936)	As in musical composition we may obtain, by the employment of dissonance, a desired effect or clash, such effect is after all accomplished only through the careful design by the artist composer. In color selection likewise, when departure from consonance is desired for special reasons, the needed contrast should be effected from careful design and avoidance of results that are amateurish.
Winterbotham (1936)	During the earlier years of the popular there was a natural reaction against the puritanical simplicity of the unsupported contour. Experiments in a fuller design were still caried on, therefore, and took the shape of the various "tourist" maps.
Debenham (1940)	With a large demand, makers have been able to install special machines to turn out accurate parts in quantity and so reduce the price. This cannot happen to any marked extent with survey instruments, but while the manufacturers can encourage the market by sound design and by making large numbers, they must in the end depend also on an increased demand by amateurs.
Raisz (1948)	It is also customary to show in large scale the region served by the company and compress the rest of the map. The term "cartogram" for such design is more correct than map. Although these totally utilitarian maps serve their purpose well, it is somewhat unfortunate that a great educational opportunity is neglected. Attractive railroad maps showing the nature of the country, its geology, products and interesting features, would awaken interest in travel (Raisz 1948: 222).
Greenhood (1951)	A map is not to be smothered like a florist's wire frame; it is not a support for the exhibitionism of somebody who likes to draw pictures. It is itself the picture. Being that, it should have design. The uneasy feeling we get from some "decorated" maps is usually caused by jumbled arrangement, which crazes a map, making it seem more crowded than it is. [This can be largely avoided by the rudimentary principles of composition an artist uses in organizing the detail of his picture—subordination of certain elements to lead the eye along main lines. The idea is to steady the attention of whoever looks at the map. Make it enjoyable.] (Greenhood 1951, 171).

Table 5.3. Design applied to maps. Text in brackets is added to provide additional context beyond the 101-word concordance. Aesthetic epistemology is underlined.

Despite the connection to modern usages of design, during the Pre-Robinson Era there is not much emphasis of scientific epistemology in relationship to design. In that sense, design is not much different from other concepts from art, such as harmony, balance, or composition, and at

times *design nn i*s explicitly associated with art, such as in Deetz (1936). In the Robinson Era, that relationship begins to change.

5.3.2 Robinson Era

In the Robinson Era, the most common key word and POS combination was *design nn* (429/1,285, 33.3%). *Design nn* increases from 20 uses in Greenhood (1951) to 53 usages in Robinson (1953), where *Map Design* forms an entire chapter. Furthermore, Robinson's (1953) usages are reified: it is not possible swap out another word for design such as style or appearance and retain the same or similar meaning, as was possible in the Pre-Robinson Era, which can be seen by comparing the three concordances from Robinson (1953) in Table 5.4 with the concordances in Table 5.3, above:

Design nn Concordances from Robinson 1953
The possibilities of varying balance relationships to suit the purpose of the map are legion. The cartographer will do well to analyze every visual presentation he sees, from posters to advertisements, in order to become more versatile and competent in working with this important factor of map design. (Robinson 1953, 136)
As is so often the case in matters involving design and execution, the ultimate appearance of a map depends more upon its design than upon its drafting excellence (Robinson 1953, 80)
Many maps that appear correct in these aspects in copy form appear crowded and heavy, or the opposite, light and weak, when reduced and printed. This may be a result of poor design, treated elsewhere in this book, or the result of a lighter printing ink on an absorbent paper or some other similar circumstance. (Robinson 1953, 93)
Table 5.4, *design nn* concordances from Robinson 1953, *Elements of Cartography* 1E

Through the combination of Robinson's (1953) usages, design continues progressing towards the first modern meaning of the word—the 'look and feel' of the map—as well as the second meaning, the internal organization of the map.

Echoing his (1952) monograph *The Look of Maps*, Robinson (1953) understands maps as having two components: an "intellectual connotation" and "visual meaning" (Robinson 1953, 123). Although visual meaning cannot be separated wholly from intellectual connotation, Robinson's aim is to isolate visual meaning to derive objectivity, a practice for which he was inspired from art:

> Artists turn their works upside down; advertising layout men "rough in" outlines, and even basic lettering, as design units without "spelling anything out", and because the intellectual connotation cannot always be predicted, cartographers will obtain better design if they do likewise.
> (Robinson 1953, 123)

The large number of *design* noun phrases that Robinson uses, including repetition of noun phrases, associates *design* in cartography with concepts and objects, creating something like a set of independent variables. In this way, Robinson creates the map as an object of study, and thus objectified, it can be evaluated. Furthermore, by breaking cartographic epistemology into objects, the *design* noun phrases introduced by Robinson create a new way to talk about design in cartography, enabling clearer and more specific discussion about how to make maps—essential for a cartographic textbook. Robinson's *design* provides *method*, or how to design; *properties,* or aspects of design (Robinson's example is "repeating pattern of lines"); *object of* design, such as a map or lettering; *object as*, or design as an object; and *evaluation*, which provides a means of assessing design (Table 5.5).

Design Noun Phrases Introduced by Robinson (1953)				
Mod L		**Mod R**	**Classification**	**Term appears in Post-Robinson Era**
	design	"strength"	evaluation	
	design	plan	method	yes: 2009
	design	planning	method	yes: 2009
	design	**problem**	evaluation	yes: 2009, 2010, 2016kw, 2020, 2023
	design	quality	property	
	design	sense	evaluation	
	design	units	object as	
	design	variations	type	yes: 2016kw
alphabet	design		object	
better	design		evaluation	yes: 1995c, 2009, 2020
cartographic	**design**		object	yes: 2009,
good	**design**		evaluation	yes: 1995c, 2009, 2010, 2016b, 2023
good execution and	design		method / evaluation	no, but "poorly executed design" appears in 2010
letter	design		object	yes: 2009
letter formation and	design		method	
lettering	design		object	yes: 2009
line	design		object	
map	**design**		object	yes: all authors
poor	**design**		evaluation	yes: 1995c, 2009, 2010

simple	design		evaluation / property	yes: 2009, 2016b
total	design		object	yes: 2009
visual	design		object	yes: 1995c, 2009, 2023
well-balanced	design		evaluation	yes; 2023
whole	design		object	

Table 5.5. *Design* noun phrases introduced in Robinson (1953). Terminology changes over time, but the concepts and objects created by Robinson's *design* noun phrases endure. Terms highlighted in yellow are used by Robinson-Era authors after Robinson (see Table 5.5) and also are found among the largest number of authors in the Post-Robinson Era (green highlight).

Although Robinson's (1953) objectification of cartographic design is not based on semiotics, and he does not use a formal typology, the idea of breaking *design* up into parts anticipates the arrival of semiotics in cartography within the 1960s, particularly the visual variables, as introduced by Bertin (1967).

Every other author in the Robinson Era adopts at least one of Robinson's *design* noun phrases, and many adopt multiple, or a variation more appropriate to changing technology (e.g., *type design* instead of Robinson's *letter design*), as shown in Table 5.6. By the sixth edition of *Elements of Cartography* (1995), the new *design* epistemology has been well-established, though the exact terms are still being worked out. For instance, redundancies remain, such as *type design* and *lettering design*, both appearing in Table 5.6, along with many other design noun phrases with only one attestation in the Robinson Era.

The concepts and objects of *design nn* introduced by Robinson (1953) are further broken up as design epistemology develops. Much of this design epistemology comes from Robinson himself, and likely appears in previous editions of *Elements of Cartography,* which ran throughout the era (again, intermediary editions were not included in the sample).

Even though Robinson states that "the basic elements of good design lend themselves to systematic analysis" (Robinson 1953, 107) difficulties remain. For one, even though an objectified *design* can be put in objective terms, it is difficult to put *good design* into metric terms. Every usage

of *good* in a *design* noun phrase during the Robinson Era contains subjectivity and/or hedonic language (16/16, 100.0%). By 1995, Robinson, Morrison, Muehrcke, and others address the issue directly, acknowledging the problem of subjectivity and hedonism while emphasizing that evaluating a map should be done logically:

> Our problem is that critical thinking with respect to map design is strongly intuitive and not easy to describe in words. Good design simply "looks right." It is simple (clear and uncomplicated.) Good design is also elegant, and does not look contrived. A map should be aesthetically pleasing, thought-provoking, and communicative. In evaluating a map, you should focus on the logical as well as the visual aspect of design**. (**Robinson, Morrison, Muehrcke, and others 1995, 318; formatting added for emphasis)

Thus, design, especially good design, in cartography is acknowledged as related to aesthetics, but the subjectivity of design remains a problem to be managed.

In contrast, *poor design* is much easier to define in metric terms. *Poor design* occurs when cartographers disregard "the powerful forces associated with [cartographic] traditions and conventions [which] would inconvenience map users," (Robinson, Morrison, Muehrcke, and others 1995, 445) providing two criteria by which poor design can be measured: violating the aesthetic norms of cartography and failing to be useful. Later, Robinson provides a third criterion for a negative evaluation, based on communicative failure: "poor design can block the map's message from reaching the user" (Robinson, Morrison, Muehrcke, and others 1995, 478), and then a fourth based on functional concerns, but also aesthetic attention: "[ornate lettering] is an example of poor communication design because it is hard to read and calls undue attention to itself" (Robinson, Morrison, Muehrcke, and others 1995, 405).

Design Noun Phrase			Stats		Attestations in Robinson Era						
Mod L		Mod R	#	%	1953	1965	1971	1973	1982	1984	1995
map	**design**		69	16.1	1	14	1	8		2	43
graphic	**design**		20	4.7		2		2			16
good	**design**		12	2.8	1	1					10
type	**design**		12	2.8			1	8			3
cartographic	**design**		8	1.9	1	2		1			4
	design	problem(s)	8	1.9	1	4		1			2
	design	principles	7							1	6
general	**design**		5	1.6				1		1	3
letter	**design**		5	1.6	5						
basic	**design**		4	0.9				4			
color	**design**		4	0.9		4					
	design	process	4	0.9							4
	design	strategy(ies)	4	0.9							4
computer-aided	**design**		3	0.7							3
layout and	**design**		3	0.7					1	1	1
lettering	**design**		3	0.7	2						1
poor	**design**		3	0.7	1						2
same	**design**		3	0.7				2		1	
symbol	**design**		3	0.7				2		1	
visual	**design**		3	0.7	3						
	design	alternatives	3	0.7							3
	design	character-istic(s)	3	0.7		1		1			1
	design	plan	3	0.7	1						2
	design	rule(s)	3	0.7							3
	design	variation(s)	3	0.7	1						2
	design	work	3	0.7						1	2

Table 5.6. Most common noun and adjective modifiers of *design nn* and the number of attestations per author. Terms highlighted in yellow originated from Robinson 1953, with no changes.

The buildup of epistemology around *map design*, the most common noun phrase in the Robinson Era, is significant. Twenty-one unique noun phrases occur with *map design*. Imhof (1982 [1965]) introduces three phrases: s*olving map design problems, poor map design,* and *terrain map design*. Keates (1973) introduces one phrase: *whole map design*. Seventeen other phrases are introduced by Robinson, Morrison, Muehrcke, and others by 1995 (Table 5.7).

Map Design Noun Phrase			Attestations in Robinson Era						
Mod L		Mod R	1953	1965	1971	1973	1982	1984	1995
solving	**map design**	problems		1					
poor	**map design**			1					
terrain	**map design**			1					
whole	**map design**					1			
color	**map design**								2
mono-chrome	**map design**								1
good	**map design**								2
deceptive	**map design**								1
improve	**map design**								1
graphic	**map design**								1
common	**map design**	strategy							1
	map design	choices							1
considerable	**map design**	effort							1
good	**map design**	examples							1
	map design	guidelines							1
	map design	options							1
	map design	principles							1
	map design	process							1
	map design	software							1
best	**map design**	tools							1

Table 5.7. Noun phrases produced by map design.

The modifiers introduced to *map design* intensify references to aesthetic concepts: aesthetic value in adjectives such as *poor, good,* and *best,* and aesthetic judgment in nouns such as *principles, guidelines, examples, strategy*, and *choices*, aesthetic properties in *color* and *monochrome*, and aesthetic experience in *whole* and *process*. Functional objects such as tools and software are in opposition to aesthetic objects. Similar patterns exist for cartographic design.

Design nn Concordances from *Elements of Cartography* 6E
Given the potential difficulties that segmented symbols pose for map users, it is best that their design be kept as simple as possible. Elaborate multicomponent symbols may turn out to be more confusing than useful, resulting in a communication failure in spite of considerable map design effort (Robinson, Morrison, Muehrcke, and others 1995, 551).
The principle of good contour finds many applications in cartography. In Figure 18.6D, for example, the graticule appears to be continuous beneath the land, thus raising the land area and helping it to become figure. This differentiation of land and water is a common map design strategy. Another example of good contour is the breaking of a line for lettering or other map components. This practice is possible because visual logic will continue the line where it is not actually shown. (Robinson, Morrison, Muehrcke, and others 1995, 327).
Nevertheless, at present "color appearance" systems based entirely on human judgments of hue, chroma, and value currently are the best map design tools. Several such systems have been developed and two, the Munsell and Natural Color System, are well suited to cartography. (Robinson, Morrison, Muehrcke, and others 1995, 351).
The issue of deceptive map design falls in the realm of cartographic ethics. Although distortion is fundamental to all forms of representation, the cartographer has a professional responsibility to keep distortion to a minimum or, at least, to provide map users with tools to assess the distortion inherent in a map's design. (Robinson, Morrison, Muehrcke, and others 1995, 431).
Separation of the visual field into figure and ground is automatic. It is not a conscious operation. It is a natural and fundamental characteristic of visual perception and is therefore a primary consideration in graphic map design. Map users must be able to tell land from water and to recognize outlines of towns, islands, and harbors. They should be able to focus immediately on the cartographer's objectives without struggling to decide what they are supposed to see. (Robinson, Morrison, Muehrcke, and others 1995, 326).
This suggests our green-red and yellow-blue visual coding system is based on these four visually unique "primary" hues, with all other colors being mixtures of two non-opponent primary hues, as illustrated in Figure 19.6. We shall see that color modeling systems and map design guidelines have been developed around these opponent process primary hues and their mixtures. (Robinson, Morrison, Muehrcke, and others 1995, 346).
Table 5.8. Robinsonian perceptual map design epistemology appearing in concordances from Elements of Cartography 6E

By 1995, Robinson, writing with Morrison, Muehrcke and others, provides explicit language emphasizing a scientific, logical, or technological map design epistemology, primarily derived from psychological experiments in perception with an emphasis on communication. Examples of this language are listed in Table 5.8, with collocates relating to psychological and technological epistemology underlined. These usages associate design with objectivity and an attempt to manage or minimize inevitable subjectivity.

5.3.3 Post-Robinson Era

In the Post-Robinson Era, *design nn* undergoes a dramatic increase of usages, from 33.3% (429/1,285) of era concordances in the Robinson Era to 57.1% (1,160/2,030) of concordances retrieved from the Post-Robinson Era, an increase of 270.4%.

Most textbooks from the Post-Robinson Era do not offer definitions of any terms (3/7; 42.9%), but all three of the textbooks which do offer definitions, provide a definition of *design* or a *design* noun phrase (Table 5.9). *Process* is important to two of the three definitions, and d*esign process* is the third most common *design* noun phrase in the Post-Robinson Era (Table 5.10).

Design nn Concordances	
Dent, Torguson, and Hodler (2009)	**map design** is the aggregate of all the thought processes that cartographers go through during the abstraction phase of the cartographic process. It "involves all major decision-making having to do with specification of scale, projection, symbology, typography, color and so on" (Robinson and Petchenik 1976, 19) (Dent, Torguson, and Hodler 2009, 19)
Tyner (2010)	**Design.** (1) The process of creating a map. (2) A plan of execution. (3) The appearance of a map. (Tyner 2010, 236)
Slocum, McMaster, Kessler and others (2023)	**map design research:** research focusing on which mapping techniques are most effective and why. (Slocum, McMaster, Kessler and others 2023, 561)
Table 5.9. Explicit definitions of *design* and noun phrases containing *design* in the Post-Robinson Era.	

Design retains its metric associations established in the Robinson Era. There is an expansion as processual uses also are embedded in many usages of *design* as a single word, which comment on the design process or steps in design. Not only does the Post-Robinson Era show more *design nn* language use, but also shows more consistent use of the same *design nn* noun phrases. *Design* is now entrenched in cartographic epistemology.

Design Noun Phrase			Stats		Attestations in Post-Robinson Era						
Mod L		Mod R	#	%	1995 c	2009	2010	2016 b	2016 kw	2020	2023
map	**design**		209	18	**14**	**68**	**15**	**36**	**23**	**16**	**39**
cartographic	**design**		83	7.2		**29**	**1**	**3**		**6**	**45**
	design	process(es)	79	6.8	**1**	**27**	**3**	**6**		**3**	**37**
legend	**design**		41	3.5		**24**	**1**	**1**			**15**
graphic	**design**		36	3.1		**11**	**4**	**2**	**6**		**13**
	design	software	25	2.1	**1**	**10**		**4**	**6**	**2**	**2**
	design	principle(s)	24	2.1	**1**	**13**	**2**	**2**	**1**		**5**
	design	decision(s)	20	1.7	**1**	**8**	**3**	**2**	**1**		**5**
	design	element(s)	20	1.7		**14**	**4**	**2**			
	design	problem(s)	17	1.5		**10**	**2**		**1**	**1**	**3**
	design	strategy(ies)	15	1.3		**10**		**1**	**1**		**3**
good	**design**		14	1.2	**3**	**7**	**2**	**1**			**1**
thematic map	**design**		13	1.1		**13**					
activity	**design**		13	1.1		**13**					
	design	loop	12	1.0	**12**						
	design	research	11	0.9							**11**
type	**design**		10	0.9		**7**		**2**			**1**
	design	consider-ations	10	0.9		**4**	**1**	**1**			**1**
	design	option(s)	9	0.8		**4**		**1**		**1**	**3**
overall	**design**		8	0.7		**8**					
	design	solution(s)	8	0.7		**8**					**3**
	design	aspect(s)	7	0.6		**4**	**1**	**1**			**1**
	design	issues	7	0.6		**4**	**1**				**2**
major	**design**		7	0.6		**5**	**1**				**1**
important	**design**		6	0.5		**6**					
	design	approach-(es)	6	0.5		**3**				**2**	**1**
	design	goal(s)	6	0.5		**5**		**1**			
	design	task(s)	6	0.5		**6**					
layout	**design**		6	0.5	**2**	**2**		**2**			
symbol	**design**		6	0.5		**2**	**2**	**2**			

Table 5.10. Most common noun and adjective modifiers of *design nn* and the number of attestations per author. Terms highlighted in yellow were first attested in Robinson 1953 or Robinson, Morrison, Muehrcke, and others (1995). Additional terms on this list may have originated from editions of *Elements of Cartography* not part of the corpus.

Twelve of the 30 most common design noun phrases from this era are first attested from Robinson, either from *Elements of Cartography 1E* or *Elements of Cartography 6E*. It is possible that

even more terms originated from intermediary editions of *Elements of Cartography* than are attested here.

Technology change impacts design phrases, especially in Clarke (1995), who, as we have seen, introduces many *design* terms related to computer science at the beginning of the era. Clarke refers to *design loop* (Table 5.9) twelve times, making *design loop* one of the thirty most used *design* noun phrases in the Post-Robinson Era. However, these computer science-based terms are not used after Clarke (1995). Instead, they are replaced by terms that are related to the software itself.

Design decisions and *design options* are both much easier to make—and, critically for digital cartography, *remake*—when working on a computer, versus working on paper. Likewise, *graphic design*—a body of knowledge that Robinson (1952) referenced in his dissertation, and which was undergoing its own digital transition—had barely been referenced before 1995, but is referenced 13 times in Robinson, Morrison, Muehrcke, and others (1995) and then appears in almost all textbooks in the Post-Robinson Era, which contain instruction and best practices for using *design software*. With such software, there are many more *design options* than ever before, and new kinds of subjectivity that cartographers must manage because of the new software and technology, particularly combining GIS with cartographic design.

The number of modifiers of *map design* increase to 27 unique right modifiers and 31 unique left modifiers which are combined to produce new *map design* noun phrases, the most common of which have been reproduced in Table 5.11.

Map Design Noun Phrase			Attestations in Robinson Era						
Mod L		Mod R	1995 c	2009	2010	2016 b	2016 kw	2020	2023
	map design	research							**11**
	map design	process		**4**		**3**			**2**
	map design	principles		**1**		**2**	**1**		
	map design	course(s)				**3**	**1**		
good	**map design**			**2**		**2**			
overall	**map design**								**4**
virtual	**map design**			**4**					
	map design	specif-ications					**1**		**2**
	map design	issues		**2**					**1**
	map design	problem		**2**					**1**
	map design	decision			**1**				**1**
	map design	strategy		**1**		**1**			
color	**map design**			**2**					
efficient	**map design**					**1**			**1**
evolving	**map design**								**2**
final	**map design**		**1**						**1**
general	**map design**			**1**					**1**
given	**map design**			**2**					
total	**map design**			**2**					
maps and	**map design**			**1**			**1**		

Table 5.11. Noun phrases produced by map design in the Post-Robinson Era. Phrases highlighted in yellow originated with Robinson, Morrison, Muehrcke, and others (1995).

Map design research is an interesting outlier, present in just Slocum, McMaster, Kessler, and others (2023). The term is revealing because more than any other work in the Post-Robinson Era, *Thematic Cartography and Geovisualization 4E* attempts to provide research-based references for its design recommendations, a practice that was started by Robinson (1953) *1E*. Prior to Raisz (1948), no work in the corpus provided formal references regarding its design recommendations. *Map design research* emphasizes that the design recommendations within are not subjective.

The increasing number of modifiers of map design in 2023 demonstrates the continued growth of cartographic design epistemology. Many of the previous references to aesthetic concepts continue, including aesthetic value in the adjective good and efficient, but also aesthetic

experience in adjectives such as *final, total, overall*, and *process*. Aesthetic judgment appears in *problem, decision, issues, specifications, principles*, and *courses*. These terms are useful for demarcating areas of subjectivity to then frame for research.

5.4 Conclusions

In this chapter, I explore the relationship of *design nn* with aesthetic concepts and the evolution of *design nn* into a container for cartographic epistemology, especially cartographic aesthetic epistemology, following Robinson (1953).

Aesthetic epistemology in *design nn* focuses on aesthetic value and aesthetic judgment, however, aesthetic objects, aesthetic experience, and aesthetic attention also are referenced within it. Aesthetic value and judgment are primary considerations because these considerations shape the values of the discipline and the value of cartography and maps produced by trained cartographers, and they are reproduced through cartographic education. Aesthetic objects in the traditional sense typically form a negative category. Modifiers relating to aesthetic attention and experience are the least common aesthetic modifiers in *design nn*, although these types of modifiers seem to be increasing in the Post-Robinson Era, partially thanks to the ability to run eye tracking and other attention experiments.

Cartography's *design* epistemology expands in times of disciplinary crisis and technological change and has been deployed to establish cartography as more closely associated with design than GIS. After *map design*, the noun phrase *design process* becomes extremely important to cartography's disciplinary identity. The rapid expansion of the *design process* in and after 1995 may also relate to technological changes in cartography and the influence of process in the computer-science aspect of the term. However, *design process* is also an evolution of an earlier term from Robinson's (1953), *cartographic process*, referring to the routine technical steps followed to create a map (much like manual photographic processing). Lastly, the switch from *cartographic process* to

design process as the preferred term may reflect the influence of processual and post-representational theories and philosophy on cartography, though it is difficult to assess their influence upon a textbook.

The largest share of noun phrases relating to design epistemology first are attested in Robinson, whether Robinson (1953) or Robinson, Morrison, Muehrcke, and others (1995). Though it is possible that some design noun phrases may originate elsewhere, it is also possible that more design noun phrases than what appear here come from Robinson, given that four editions of *Elements of Cartography* are not included in this sample. Robinson's design epistemology enabled 'good' maps to be objectified, providing a way to discuss design evaluation, design methods, design properties, design as an object, objects of design, and types of design. This approach made it easier to develop experiments to derive scientific design recommendations and to teach cartography. Robinson's approach was resilient to changes in technology that introduced new design noun phrases, which arguably further reified design into the Post-Robinson Era. Though some of the emphasis on science was lost in design noun phrases in the Post-Robinson Era, that only was occurring because design was responding to awareness of new subjectivities in cartography that resulted from changing technology and an overall increase in cartographic epistemology. The language itself was and is still being deployed to manage subjectivity in design, if not through scientific design recommendations, then through signposting moments of subjectivity so that subjectivity can at least be managed through awareness.

The Post-Robinson Era is still ongoing. The influence of new technologies in Slocum, McMaster, Kessler, and others (2023) is yet to be fully realized, as patterns are in place now that will not be fully apparent until the next series of cartographic textbooks are published.

Chapter 6: *aesthetic*, taste*, beauty**, and *art**

6.1 Introduction

Chapter 6 addresses two key findings in Chapter 4. The first key finding relates to the increased usage of *aesthetic** throughout the corpus, which corresponds with a decline in the usage of *taste**, *beauty**, *art**, and *style**. I examine this unexpected result through studying aesthetic and aesthetic synonym terms. In general, *aesthetic** appears to have increased in use because of the conceptual link between *design* and *aesthetic*. The meaning of *aesthetic** gets pulled by *design** to take the place of concepts that reified cartographic 'design' does not explain well, or that which "is strongly intuitive and not easy to describe in words" because it simply "looks right" (Robinson, Morrison, Muehrcke, and others 1995, 318). In that sense, *aesthetic** represents what has been lost from the focus on scientific design epistemology. Usages of *aesthetic** focused on hedonism. Generally, the more hedonic the statement, the more specificity *aesthetic** has. These usages give aesthetic reasons to make design choices, such as selecting a projection. Others simply reference aesthetic evaluation.

The second key finding relates to the loss of *art** and 'art'-related technical terms, which occurs after the end of the Robinson Era. Cartography was friendly towards 'art' at the start of the Pre-Robinson Era, and many cartographers had a background in art. During the Robinson Era, cartographic textbooks transitioned away from a gallery-based teaching style to a teaching style based on design guidelines derived from research. The antagonism between *art** and cartography becomes apparent by the end of the Robinson Era. By the conclusion of the Post-Robinson Era, the place of art in cartography moves from the production process—which had emphasized *art** through its use of technical terms—to a small set of decisions made at the end of the cartographic design process.

6.2 *Aesthetic/Esthetic**

*Aesthetic/esthetic** was the second to least common key word in the sample, with 89 attestations across three POSs: *aesthetic/ esthetic nn* (51/89; 56.7%), *aesthetic/esthetics nns* (15/89; 17.8%), and *aesthetically/esthetically rb* (23/89; 25.5%). An unexpected finding in the concordance analysis was the increasing use of *aesthetic**, from two attestations in the Pre-Robinson Era (2/452; 0.4%) to 29 attestations (29/1,285; 2.2%) in the Robinson Era, to 58 attestations (58/2,030; 2.8%) in the Post-Robinson Era. Thus, *aesthetic* trends towards increased usage throughout the corpus (Figure 6.1).

Aesthetics, as a word and concept, is historically associated with the arts. The authors with a formal or known background in the arts included Winterbotham (1936), Debenham (1940), Raisz (1948), Greenhood (1951), Robinson (1953 | 1995), Keates (1973), Robinson (1995), and Brewer (2016), comprising 8/21, or 38.1% of authors. Nevertheless, it is a misconception to assume that because an author had a background in art, the author had an interest or knowledge of aesthetic theory. The abstract painter Barnett Neuman famously quipped that aesthetic philosophy "aesthetics is to artists what ornithology is to birds" (Neuman 1952). Accordingly, half of the authors who had a background in the arts did not refer to *aesthetic/esthetic** at all: Winterbotham (1936), Debenham (1940), Raisz (1948), and Keates (1973). Likewise, Dent, Torguson, and Hodler (2009), who had the most extensive discussion of *aesthetic/esthetic** and introduced the largest number of new *aesthetic/esthetic** phrases to cartography (Table 6.1), did not have a recognized background in art.

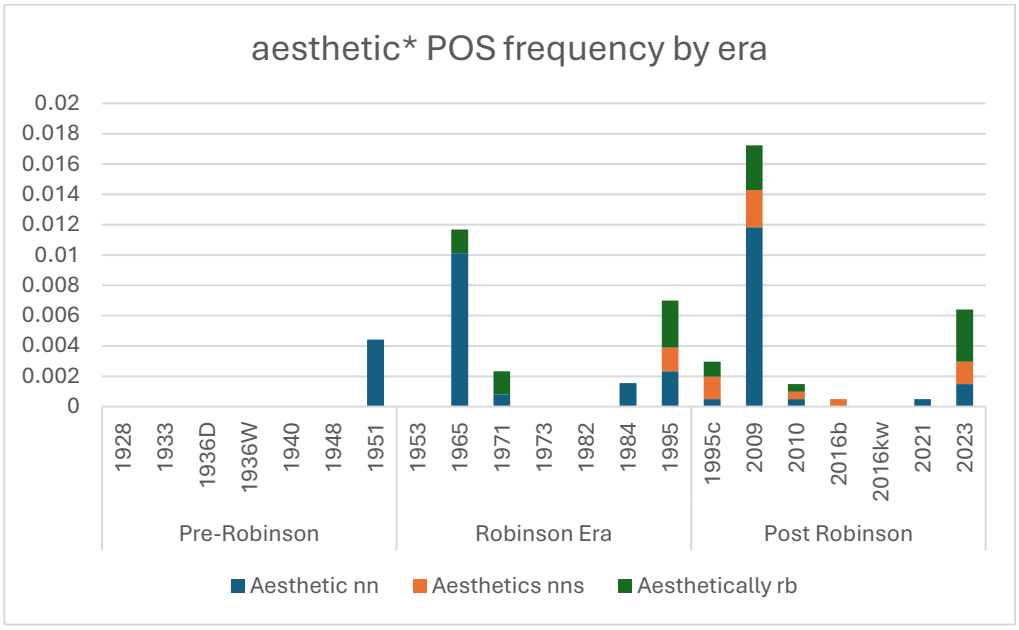


Figure 6.1 *aesthetic** POS frequency by era.

These patterns reflect that identification as an artist is not a requirement for engaging with aesthetic theory, because aesthetic philosophy is broader than the philosophy of art. Aesthetics concerns evocation, which is very much a concern of artists (Nanay 2019), just as creating a map that stimulates an appropriate response was a major concern for Robinson (1953)[20].

Furthermore, just because an author did not refer to aesthetics by name, did not mean that the author did not discuss or understand aesthetic concerns. Instead, it appears that *aesthetic/esthetic** and its verb-line synonym *taste** are marginalized terms during the Pre-Robinson and much of the Robinson Eras, with the notable exception of Imhof (1982 [1965]).

Paradoxically, the more that cartography wished to associate itself with science and to reject subjectivity in the design process, the more that authors began referencing aesthetics within the text. The increased usage of *aesthetic/esthetic** coincided with a steep decline in the usage of

[20] The skills or techniques of the cartographer are based upon the findings of many scientists. These skills generally fall into two categories, intellectual or visual, depending upon whether their main function is to stimulate the reason or the visual sense of the map reader (Robinson 1953, 11).

the key words *taste** and *beauty** and an overall decline in *art** and *style**. It may be that the slipperiness of *aesthetic/esthetic** enabled its usage, but *taste**, *art** and *style** were harder to use in acceptable ways because their meanings were less abstract and therefore less pliable.

Tables 6.1 and 6.2 classify noun phrases formed by *aesthetic**. Some uses of aesthetics refer to ***objects***, generally to separate the functional map object from aesthetic objects, or to ***nature***, a traditional subject of aesthetics. Other uses are categorized as ***hedonic***, meaning, they refer to pleasure.

Greenhood (1951) uses aesthetics differently from every other author. His uses of *aesthetic** are ***internal***, meaning that they refer to the internal experience of the mapmaker during map creation. All other authors use *aesthetic** only in reference to the experience of the map as an object.

The two most common uses of *aesthetic** noun phrases are classified as aesthetic evaluation and aesthetic reasons. ***Evaluative*** uses describe an aesthetic verdict. The aesthetic evaluation is something like input, meaning that the map or design scenario creates the aesthetic evaluation (Lopes 2018, 106). An example aesthetic evaluation is provided by Tyner (2010): "Standards of beauty change, but readers still react to the aesthetics of maps." The reaction that Tyner describes is an aesthetic evaluation.

In contrast, an aesthetic ***reason*** is a reason that a cartographer should act aesthetically. Aesthetic reasons are the outputs of an aesthetic evaluation (Lopes 2018, 106). An example is provided by Slocum, McMaster, Kessler, and others 2023, who note that while squares are easier for people to accurately compare than circles, "A potential disadvantage of using squares is that squares are not as aesthetically pleasing as circles" (Slocum, McMaster, Kessler, and others 2023, 369). Thus, this usage provides an aesthetic evaluation—not hedonically pleasing, which provides a reason for a cartographer to act aesthetically, i.e., to choose circles for proportional symbols rather

than squares.

Lastly, several usages are ***functional***, meaning that they integrate aesthetics with map function, rather than listing aesthetics as a separate concern from map function.

Although authors with a background in the arts clustered in the Pre-Robinson Era (4/7; 57.1%), authors used all other aesthetic key words more frequently than *aesthetic**. Instead, authors preferred *style** (133/452; 29.4%), *design** (116/452; 25.7%), *art** (108/452; 23.9%), *beauty** (75/452; 16.6%), and *taste** (18/452; 4.0%) over *aesthetic** (2/452; 0.4%).

The only author to mention *aesthetic/esthetic** was Greenhood (1951). Greenhood was the last author in the Pre-Robinson Era, who, in addition to being a cartographer, was a writer and a poet. His usages referred to the internal aesthetic experience of the mapmaker, emphasizing its hedonic qualities (Table 6.2).

In the Robinson Era, the most used aesthetic terms include *aesthetic sensitivity* (4/29; 13.8%), *aesthetic grounds* (Imhof 1982 [1965], 4/29; 13.8%), and *aesthetically pleasing* (Robinson, Morrison, Muehrcke and others 1995, 4/29; 13.8%). Two additional terms appear that also are used in the Post-Robinson Era: *aesthetic considerations* (2/29; 6.9%) and *aesthetic qualities* (1/29; 3.4%).

Noun Phrase			Class.	Attestations in Pre-Robinson Era						
Mod L	Form	Mod R		1928	1933	1936d	1936w	1940	1948	1951
	aesthetic	experience	Hedonic / Internal							1
	esthetic	responsive-ness	Hedonic / Internal							1
				Attestations in Robinson Era						
				1953	1965	1971	1973	1982	1984	1995
	aesthetic	sensitivity	Hedonic / Eval		3					1
	aesthetic	[grounds]	Hedonic / Eval		4					
	aesthetic	judgment	Reason		1				1	
	aesthetic	consider-ations	Reason		1				1	
	aesthetic	art form	Object							1
	aesthetic	arts	Object							1
certain	**aesthetic**	qualities	Properties		1					
visual	**aesthetic**	rules	Eval / Reason		1					
	aesthetic	terms	Eval			1				
more	**aesthetic**	and more naturalistic appearance	Hedonic / Nature / Eval		1					
	aesthetic	and technical nature	Function / Eval		1					
	aesthetics		Hedonic							1
map	**aesthetics**		Hedonic / Function							1
	aesthetically	pleasing	Hedonic / Eval							4
	aesthetically	satisfying	Hedonic / function / eval		2					
most	**aesthetically**	attractive	Hedonic / Eval			1				
	aesthetically	acceptable	Hedonic			1				

Table 6.1 *aesthetic** noun phrases in the Pre-Robinson and Robinson Eras.

***Aesthetic* in Greenhood (1951)**
By dint of some unshowy beauty within himself the mapper often expresses some of that in the terrain outside. This same aesthetic responsiveness in him is what enlivens his technical abilities. (Greenhood 1951, 212).
And you'll begin to suspect that they are aching to tell you more than they'd better: about how it feels to be out on a lone reconnaissance at night time, cooking one's own chow while others hasten down distant highways homeward to warm suppers; how after a day of plane-tabling it feels to go on working so as to be on top of the next day's job; and how there's an aesthetic experience in watching a map "grow under one's hand" from a welter and a fracas of data and a white desert of paper into a valid article, as trim and pretty as a prize flower yet as precise and strong as a fine rifle. Greenhood 1951, 232).
Table 6.2. *aesthetic** : Hedonic and Internal usages.

Aesthetic sensitivity is used by Imhof (1982 [1965]) (3/4, 75.0%) and by Robinson, Morrison, Muehrcke, and others 1995 (Robinson, Morrison, Muehrcke 1/4, 25.0%) quoting Imhof (1982 [1965]). Therefore, all usages of aesthetic sensitivity in the corpus derive from Imhof (Table 6.3).

Author	Concordance
Imhof (1982 [1965])	Objective considerations alone have not always been the deciding factors. Tradition, partiality and whim, preconceived opinions, aesthetic sensitivity or barbarity of taste often play leading roles in the selection of colors. There are "brown supporters," "green fans," "blue enthusiasts," "yellow admirers," and "red worshippers." Many mapmakers and map users do not like change and stick by their first loves (Imhof 1982[1965], 300).
Imhof (1982 [1965])	Machines, equipment, electronic brains possess neither geographical judgment nor graphic aesthetic sensitivity. Thus, the content and graphic creation remain essentially reserved for the critical work of the compiler and drawer of a map. (Imhof 1982[1965], 357-358).
Imhof (1982 [1965])	Artistic talent, aesthetic sensitivity, sense of proportion, harmony, form and color, and graphical interplay are indispensable to the creation of a beautiful map and thus to a clear, expressive map (Imhof 1982[1965], 359).
Robinson, Morrison, Muehrcke, and others (1995)	Tradition, partiality and whim, preconceived opinions, aesthetic sensitivity or barbarity of taste often play leading roles in the selection of colors. There are "brown supporters," "green fans," "blue enthusiasts," "yellow admirers," and "red worshippers." Many map makers and map users do not like to change and stick by their first loves. (Robinson, Morrison, Muehrcke, and others 1995, 383; quoting Imhof 1982[1965]).
Table 6.3 *aesthetic sensitivity*.	

These usages characterize aesthetic sensitivity as hedonic. *Aesthetic sensitivity* implies the capacity to make an evaluative judgment, especially in the second concordance in Table 6.3, which emphasizes the inability of "machines, equipment [and] electronic brains" to possess such judgment (Imhof 1982 [1965], 367-368). The third quotation in Table 6.3 also provides cartographic

aesthetic values, or what it is that a cartographer skilled in the aesthetic practice of mapmaking can achieve: “a clear, expressive map” (Imhof 1982 [1965], 359).

Concordance four—Robinson, Morrison, Muehrcke, and others’ (1995, 383) quotation of Imhof (1982[1965]) on “aesthetic sensitivity or barbarity of taste”—was in the context of a discussion of color standards. Imhof’s words are used as a warning that color standards may not be chosen with the objective values of cartography in mind. Therefore, cartographers must evaluate standards *cartographically*—that is, according to the values of cartography—to ensure that the standards chosen will produce a cartographically good map:

> Color standards have been established in many ways. Some are based on the properties and theories of color vision, some on design principles borrowed from other fields, and others on special map user requirements. We should always look into the rationale behind any existing standard before adopting it ourselves (Robinson, Morrison, Muehrcke, and others 1995, 383)

Aesthetic grounds is used solely by Imhof (1982 [1965]). Such usages of *aesthetic grounds* provide evaluations (Table 6.4). The evaluations take on a playfully moral tone for Imhof, who uses the verb *condemn* to be humorous, but the choice of that word reminds us that these matters are taken quite seriously, which is why the joke is funny. These evaluations provide reasons to act aesthetically, including refraining from certain acts for aesthetic reasons.

***Aesthetic grounds* in Imhof (1982[1965])**
The shadow toning of level areas was also condemned on aesthetic grounds. It was maintained that the resultant maps would appear gloomy. In fact the contrary can be proved; that a light gray tone on the level areas increases the beauty of the map (Imhof 1982[1965]), 171).
We must free ourselves from the traditional concept that a map is always a sheet of white paper, covered with symbols. Today colored and gray paper finds all kinds of uses in printing, with aesthetic grounds being the prime reason for their selection. Aerial photographs contain gray tones in horizontal terrain, and they are never condemned on aesthetic or any other grounds (Imhof 1982[1965]), 171).
On aesthetic and economic grounds, the same light blue printing color should be used for the ocean and lake areas and as a component of the green tones of the dry land areas. If a different blue is used for water areas and part of the adjacent green of the land, color clashes may occur. Many atlases suffer from this failing (Imhof 1982[1965], 311).
Table 6.4 *aesthetic grounds*. The second and third concordances are combined because the sentences immediately follow one another.

Imhof's *aesthetic grounds* contain an aesthetic evaluation, which then provides reasons to act aesthetically in certain circumstances: when making a map with oblique hillshading and when creating color zones in bathymetry. Notably, all of the reasons Imhof provides have to do with color and tone: the first, second, and third concordances instruct when to use gray. The fourth concordance instructs how to use light blue. Following these instructions enables the cartographer to produce a good map in the design scenarios Imhof describes. Additionally, in the first usage, we can see hedonic concerns—the map would appear "gloomy" —but also aesthetic disagreement, and the fallibility of aesthetic evaluation. Sometimes mapmakers get it wrong.

*Aesthetic considerations (*2) appears in Imhof (1982 [1965]) and Campbell (1984). Both usages provide aesthetic reasons, though both are negative, explaining what a cartographer should *not* do. Once again, Imhof's (1982 [1965], 192) aesthetic reasons have to do with choice of color—the "desire for good contrast." He explains that "weak colors, with little power to delineate objects, or pure bright hues such as yellow, pink, red and red violet, all lack the ability to bring out form." For Campbell (1984, 313), these *aesthetic considerations* are "constraints not easily defined [. . .] but there is no doubt that the use of differing hues for different categories can quickly result in a garish, patchwork appearance".

Aesthetic reasons and functional reasons can go together, not just coincidentally, but causally. An example is given to us by Robinson, Morrison, Muehrcke, and others (1995) attestation of *map aesthetics*. The reasons given for this importance are entirely hedonic, because pleasantness improves visual efficiency. The cartographer is given an aesthetic evaluation of a design scenario (a gray or other low chroma background) and a reason to act aesthetically (to use high chroma colors).

> For cartography, the most important result of these studies is that pleasant colors are those which stand out from their background by being significantly lighter or darker. Pleasantness, then, appears largely a matter of high visual efficiency. Given a constant value level, high chroma colors on gray or other low-chroma backgrounds are also pleasing combinations. Hence, it appears that visual acuity,

> figure-ground development, and map aesthetics are all tied to good visual efficiency and chroma contrast (Robinson, Morrison, Muehrcke, and others 1995: 400).

Like Imhof (1982[1965])'s use of *aesthetic grounds*, Robinson, Morrison, Muehrcke, and others' (1995) usage of *map aesthetics* describes color, but the language used is completely different: it is perceptual and scientific.

The last usage I discuss from the Robinson Era is *aesthetically pleasing* (4). All usages of *aesthetically pleasing* are from Robinson, Morrison, Muehrcke, and others (1995). Their usages describe aesthetic evaluation, and they are hedonic. However, they do not give reasons to act. In fact, they explain the difficulty in providing aesthetic reasons, because *good design* has a certain undefinable quality:

> Our problem is that critical thinking with respect to map design is strongly intuitive and not easy to describe in words. Good design simply "looks" right. It is simple (clear and uncomplicated). Good design is also elegant and does not look contrived. A map should be aesthetically pleasing, thought provoking, and communicative. (Robinson, Morrison, Muehrcke, and others 1995, 318)

Cartographic design, however, provides many reasons to act. As we have seen in Chapter 5, by the time of Robinson, Morrison, Muehrcke, and others (1995), there had been a very large increase in the number of new design noun phrases entering cartography that could be used to describe cartographic evaluation and that provide reasons for cartographers to make different choices when making maps. This epistemology describes the "design decisions required to make the final map look right[21]" (Robinson, Morrison, Muehrcke, and others 1995, 436).

By the Post-Robinson Era, most uses of *aesthetic** do not provide reasons to act, instead describing general aesthetic evaluation (Table 6.5). Some of the uses that provide reasons to act would have belonged to other keywords, such as taste, beauty, art, and style. The most commonly

[21] *Looking right*, of course, was a design concern for the Robinson projection, which had initially been named the orthophanic (right-appearing) projection. Contrast with Robinson's objection to the Gall-Peters projection, described in Chapter 2.

used phrases include *aesthetically pleasing* (11/58; 19.0%), *map aesthetics* (5/58; 8.6%), *aesthetic quality* as properties (3/58; 5.1%), *aesthetic quality* as aesthetic evaluation (3/58; 5.1%), and *aesthetic look* (3/58; 5.1%).

Aesthetically pleasing (11) was the most used phrase in the Post-Robinson Era. Five uses were from Dent, Torguson, and Hodler (2009) and six usages were from Slocum, McMaster, Kessler, and others (2023). Most uses from Dent, Torguson, and Hodler did not provide reasons to act (3/5; 60.0%, Table 6.6, first concordance). Aesthetic concerns have not only been separated from functional concerns but placed in opposition to them. They are a 'challenge' to manage in map creation. Aesthetically pleasing has been used, but *beauty** could have been used here, and, as we will see in the section on *beauty**, was used in the past for such evaluations.

In contrast, all the usages of *aesthetically pleasing* from Slocum, McMaster, Kessler, and others provided reasons to act aesthetically (concordances 2-5 in Table 6.6). These reasons had to do with spacing (second concordance) and shape (third through fifth concordances), with a preference for circles and geometric symbols over squares and rectangular point symbols over crosshatching. These aesthetic reasons are hedonic. They are matters of preference, rather than function, as functional concerns have been separated, although they are not necessarily in conflict.

				Attestations in Post Robinson Era						
				1995	2009	2010	2016 b	2016 kw	2021	2023
	aesthetic	quality*	Properties						1	2
	aesthetic	quality**	Eval		2					1
	aesthetic	aspects	Properties		3					
	aesthetic* **	look	Eval / Reason	1	2					
	aesthetic	sense	Prop/ Eval		1	1				
	aesthetic	appeal	Hedonic		1					
	aesthetic	approach	Reason		1					
	aesthetic	concern	Reason		1					
	aesthetic	consider-ations	Reason		1					
	aesthetic	design	Eval		1					
	aesthetic	differences	Eval		1					
more	**aesthetic**	expressions	Eval / Nat.		1					
	aesthetic	map	Eval		1					
	aesthetic	matter	Eval		1					
	aesthetic	object	Object		1					
	aesthetic	preference	Eval		1					
	aesthetic	realm	Hed /Eval		1					
	aesthetic	reasons	Reason		1					
reason-ably	**aesthetic**	shape	Eval		1					
	aesthetic	world	Eval /Reas.		1					
	aesthetic	and less dated appearance	Eval		1					
map	**aesthetics*** **		Hed / Eval	1	4					
color	**aesthetics**		Eval/ Reas.				1			1
	aesthetics	of [colors]	Eval/ Reas.		1					1
	aesthetics* **	of [maps]	Eval	1		1				
good design and	**esthetics**		Func / Eval							
terms of	**aesthetics**		Reason							1
	aesthetically	pleasing	Hed/ Reas. / Eval		5					6
	esthetically	attractive	Hed./ Eval / Reason	1						
superior	**esthetically**		Eval	1						
	aesthetically	poor	Eval /Reas.		1					
	aesthetically	acceptable result	Eval /Reas.							1

Table 6.5 aesthetic* noun phrases in the Post Robinson Era.

*quality as perceptual (i.e., *perceivable quality*) **quality as evaluation (e.g., *quality work*)
***includes alternate spelling *esthetic**

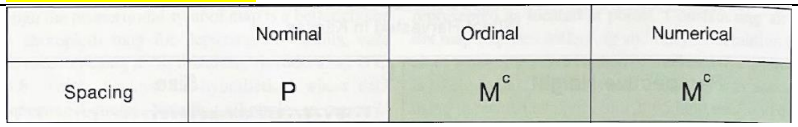
Author	Concordance
Dent, Torguson, and Hodler (2023).	Design decisions regarding the map's elements should be made on the basis of how each element is to function in the communication. The challenge is to make the map aesthetically pleasing as well as functional (Dent, Torguson, and Hodler 2009, 207).
Slocum, McMaster, Kessler and others (2023)	 [c] Not aesthetically pleasing (Slocum, McMaster, Kessler and others 2023, 76). First , note that we have given spacing only a moderate rating for ordinal information because, in our opinion, the symbols are not aesthetically pleasing (Figure 4.11C), and there is the implication that low data values are qualitatively different form high data values (Slocum, McMaster, Kessler and others 2023, 77).
Slocum, McMaster, Kessler and others (2023)	A study by Slocum and colleagues (2004) revealed that squares were not aesthetically pleasing (when compared with several geometric and pictographic symbols) and that bars were difficult to associate with a point location (Slocum, McMaster, Kessler and others 2023, 334).
Slocum, McMaster, Kessler and others (2023)	A potential disadvantage of using squares is that squares are not as aesthetically pleasing as circles (see Section 18.4) (Slocum, McMaster, Kessler and others 2023, 369).
Slocum, McMaster, Kessler and others (2023)	Circles are, however, more aesthetically pleasing, which possibly has been part of the explanation for the widespread use of the Dorling cartogram (Slocum, McMaster, Kessler and others 2023, 374).
Slocum, McMaster, Kessler and others (2023)	Hartnett argued that examining rectangular point symbols is much easier than inspecting the small boxes formed by cross-hatched lines and that the resulting map is more aesthetically pleasing (Slocum, McMaster, Kessler and others 2023, 400).

Table 6.6 *aesthetically pleasing* in the Post-Robinson Era.

The noun phrase *aesthetic quality* appears in two senses: the first sense refers to an evaluation of the map while the second sense of aesthetic quality refers to aesthetic properties. However, these usages mostly name general concepts rather than provide reasons to act. Sample usages of *aesthetic quality* by each sense are in Table 6.7.

Author	Class	Concordance
Dent, Torguson, and Hodler (2009)	Properties	Although the designer may be interested in the aesthetic qualities of letters and alphabets, the real concern is readability (Dent, Torguson, and Hodler 2009, 231).
Dent, Torguson, and Hodler (2009)	Properties	Finally, the artist works with aesthetic qualities of color, using information gained from the physiologist and psychologist (Dent, Torguson, and Hodler 2009, 247).
Kraak and Ormeling (2021)	Evaluation	Generalization entails information loss, but one should try to preserve the essence of the contents of the original map. This implies maintaining geometric and attribute accuracy, as well as the aesthetic quality of the map. (Kraak and Ormeling 2021, 112-113).
Slocum, McMaster, Kessler and others (2023)	Evaluation	The conceptual objectives of generalization include reducing complexity, maintaining spatial accuracy, maintaining attribute accuracy, maintaining aesthetic quality, maintaining a logical hierarchy, and consistently applying the rules of generalization (Slocum, McMaster, Kessler and others 2023, 101-102).
Slocum, McMaster, Kessler and others (2023)	Evaluation / Reason	For example, one of our students rated the orientation variable "poor" (even for nominal data) because he felt it lacked aesthetic quality and that it was difficult to discriminate among different orientations (Slocum, McMaster, Kessler and others 2023, 77).
Slocum, McMaster, Kessler and others (2023)	Properties	We explored some of the pre-digital flow maps (e.g., Minard's map of Napolean's Russian Campaign of 1812). Unfortunately, early digital efforts (such as Tobler's) did not produce the aesthetic quality of the smooth curves found on many traditional pre-digital flow maps (Slocum, McMaster, Kessler and others 2023, 390).

Table 6.7 *aesthetic quality* in the Post-Robinson Era.

Slocum, McMaster, Kessler and others (2023) provide an evaluative usage of *aesthetic quality* with a reason to act—to avoid use of orientation for nominal data. However, they note that cartographers are "not in complete agreement" regarding the ranking of the visual variables, so it is a weaker reason to act (Slocum, McMaster, Kessler and others 2023, 77). Note the hedonic language in the attestation: one *feels* that aesthetic quality is lacking. Importantly, this is a disagreement that previously could have been described by 'taste'.

Both Kraak and Ormeling (2021) and Slocum, McMaster, Kessler, and others (2023) refer to *aesthetic quality* in an evaluative sense regarding generalization. These uses do not provide information about how to preserve the *aesthetic quality* of the map because *aesthetic quality* has

been separated from other concerns. Thus, it is only a reference to the *concept* of *aesthetic evaluation*.[22]

The other three usages of *aesthetic quality* refer to aesthetic properties. The first two uses from Dent, Torguson, and Hodler (2009) reference the existence of these properties but do not name them within the concordance. The last usage of *aesthetic quality* as aesthetic property, in the sixth concordance of Table 6.7, refers to "smooth curves" found on pre-digital flow maps. This usage, too, seems to faintly suggest unity, and something hedonic: *flows*, as represented in cartography, are paradigmatically smooth, for ease of conception, much like traveling down a smooth, flowing stream. In the past, this usage could have been described by 'style'.

Map aesthetics appears again in the Post-Robinson Era, in Dent, Torguson, and Hodler (2009). This discussion describes aesthetic evaluation but cannot get to aesthetic reasons. In other words, goals have been defined, but actions to take to achieve them are unclear:

> Three elements have been identified as forming the basis for the evaluation of map aesthetics: harmony, composition and clarity (Karssen 1980). *Harmony* is viewed as the relationship between different **map elements** (that is, how do the elements look together?) *Composition* deals with the arrangement of the elements and the emphasis placed on them. In other words, how does the structural balance of emphasis appear? Finally, *clarity* deals with the ease of recognition of the map's elements by the map user. "A map which lacks one or more of these three main elements, lacks beauty" (Dent, Torguson and Hodler 2009, 207; Karssen 1980, 124; highlight and underline added, all other annotation present in original).

The evaluative properties that Dent, Torguson, and Hodler (2009) name are aesthetic properties. The quotation itself is the most detailed definition of *aesthetic** that Dent, Torguson, and Hodler provide in *Thematic Map Design, 6E*. These concepts are part and parcel of basic visual arts education.

The final usage of *aesthetic** I describe in this section is in reference to aesthetic objects. In the Robinson Era, aesthetic objects had been distinguished from map objects with the use of terms such as aesthetic arts and aesthetic art form to separate cartography from aesthetics and from art.

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[22] Also worth noting is the idea of generalization as unity implied within these uses.

This separation continues in the Post-Robinson Era, with Dent, Torguson, and Hodler (2009) referring directly to an *aesthetic object*:

> Because all written language elements (letters and words) are symbols for meaning, they serve the same function on maps. Map lettering should be viewed first as a functional symbol on the map, and only secondarily as an aesthetic object. Nevertheless, map lettering, if not done well, can hinder communication. Therefore, the cartographer should approach the employment of lettering with an appropriate regard for both function and form. (Dent, Torguson, and Hodler 2009, 226)

What is interesting about this usage is that the functional object and the aesthetic object are permitted to coincide, so long as function is prioritized. Furthermore, the second half of the concordance implies that aesthetics is not separate from but is part of function, because "lettering, if not done well, can hinder communication" (Dent, Torguson, and Hodler 2009, 226). In other words, regarding the letter as an *aesthetic object* can improve the quality of the letter as a *functional object*.

In conclusion, although *aesthetic** is discussed more frequently in the Post-Robinson Era, the uses tend to be more general. It is hard to know what to do aesthetically to make a pleasing map. Although Dent, Torguson, and Hodler (2009) provide an extensive quote of Karsson (1980), providing aesthetic properties, they do not actually explain how to implement these properties. Design epistemology took over for these concerns, making these aesthetic properties now part of cartographic design decisions.

The increased use of *aesthetic** across eras suggests an awareness of something that has been lost from cartography, particularly what had been contained in the other keywords, as will be seen in the rest of this Chapter and Chapter 7 on *style**.

What also has been lost is the internal experience of the mapmaker, described by Greenhood (1951) as self-expression through making maps – "by dint of some unshowy beauty within himself the mapper often expresses some of that in the terrain outside " – and as aesthetic experience in map creation – "there's an aesthetic experience in watching a map "grow under one's

hand”” (Greenhood 1951, 212 & 232; Table 6.2). Attending to internal experience of creation is in line with post-representational theory in cartography. The unique nature of aesthetic experience, expressing something within the individual cartographer, also speaks to authorship concerns described by the “View from Nowhere” and the “God’s Eye View. (Nagel 1986; Haraway 1988). Aesthetic experience and authorship concerns are worthy of further consideration as cartography moves into the age of AI.

6.3 *Taste**

The key word *taste** was the least common aesthetic key word in the sample, with only 28 attestations. Most discussions of *taste** occurred during the Pre-Robinson Era (Figure 6.2). Taste declined precipitously during the Robinson Era and appeared only twice in the Post-Robinson Era (Table 6.8).

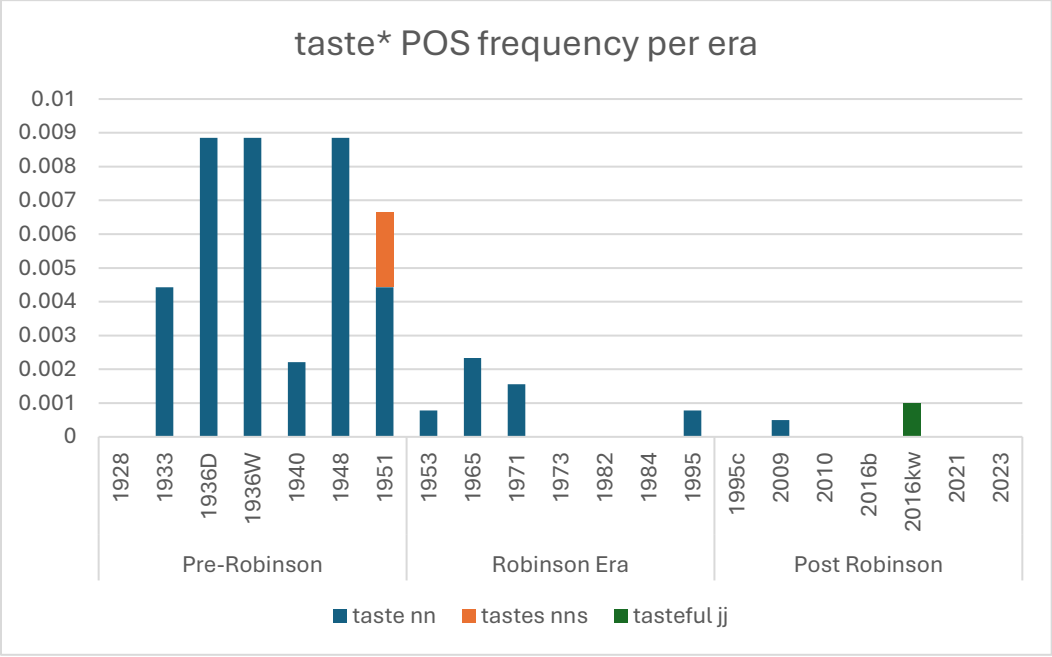


Figure 6.2 *taste** key word frequency by POS. After the emphasis of functionalism in cartography emerging after Robinson 1953, *Elements of Cartography 1E*, there is a drop in the use of *taste.**

From Kant, judgments of taste commonly are understood as hedonic—based on pleasure or displeasure. Thus, judgments of taste are subjective. Paradoxically, these judgments are also considered universal, in the sense that one 'ought' to appreciate beauty and feel displeasure in ugliness (Zangwill 2022). It is this subjective and hedonic quality which leads Robinson to dispense with taste in *The Look of Maps*. Because taste is subjective, taste is no more than what I as a cartographer 'like'. This view is a vulgar (common) relativism regarding subjective taste, following the often quoted saying, *de gustibus non est disputandum* (there is no disputing matters of taste). Therefore, because feelings cannot be wrong, there can be no real 'right' or 'wrong' regarding taste.

However, in practice, and especially in cartographic academic and professional practice, there are right and wrong answers to questions of taste (Zangwill 2022). Some cartographers have better taste than others, and good cartographic education trains cartographers to have good 'taste' even if the word *taste** is no longer used.

Noun Phrase			Charge	Attestations in Pre-Robinson Era						
Mod L	Form	Mod R		1928	1933	1936 d	1936 w	1940	1948	1951
	taste		*		1		3		2	
public	**taste**		normative		1					
personal	**taste**		relative			1				
individual	**taste**		relative/ verdictive			2			2	
	taste	and fancy	relative					1		
logic and	**taste**		normative							1
men of	**taste**		normative				1			
	taste	of good proportions	verdictive			1				
	tastes		relative							1
				Attestations in Robinson Era						
				1953	1965	1971	1973	1982	1984	1995
	taste		*		1					
good	**taste**		verdictive	1						
lack of	**taste**		verdictive		1					
barbarity of	**taste**		verdictive		1					1
individual judgment and	**taste**	needed	normative			1				
canons of	**taste**		normative			1				
				Attestations in Post-Robinson Era						
				1995 c	2009	2010	2016 b	2016 kw	2021	2023
not to your	**taste**		relative		1					
	tasteful	layouts	verdictive					1		
	tasteful	coloring	verdictive					1		

Table 6.8 *taste** noun phrases and charge of phrase.

Within the corpus, *taste** was used in three aspects. The first sense was normative. ***Normative*** uses imply a right and wrong to *taste**, but do not actively judge someone's (or some group's) taste as good or bad. These normative uses describe *taste** as belonging to a group of people, such as *public taste* (Hinks 1933) or *men of taste* (Winterbotham 1936), or a general statement about taste that implies taste is universal, such as *canons of taste,* or *individual judgement and taste needed* (Monkhouse and Wilkinson 1971). Usages that judge taste are ***verdictive***. *Good taste* (Beaman 1928), *lack of taste* (Imhof 1982 [1965]), *barbarity of taste* (Imhof

1982 [1965]), and *tasteful layouts* (Krygier and Wood 2016) are examples of verdictive usages of taste from the corpus. The last sense in which *taste* was used was ***relative***, in which the "right" or "wrong" of taste was left to the perceiver. Thus, relative uses carried weaker obligations regarding matters of taste. Usages such as *taste and fancy* (Debenham 1940), *personal taste* (Deetz 1936), and *not to your taste* (Dent, Torguson, and Hodler 2009) are examples of relative uses of *taste*. In practice, most of the relative uses still contained a verdictive charge (Table 6.9).

These relative uses may seem to describe inconsequential choices, but some choices are simply better than other choices. In Deetz (1936, 50-51), the sinusoidal projection will work—but the parabolic equal area projection is "more pleasing to the eye." Likewise, in Raisz (1948), *any* choice to title the legend is correct—so long as it is one of the four options provided. The patterns in Debenham (1940, 8) can be "varied" to suit the mapmaker, but key, of course, is the caveat within limits. Choices can be wrong, and limits can be exceeded, violating standards of cartographic taste.

'Relative' uses of taste*	
Deetz (1936)	In Elements of Map Projection, Special Publication No. 68, United States Coast and Geodetic Survey, figure 75 shows a Sinusoidal projection of the world in a tripartite arrangement which is probably as good as any, unless the Parabolic equal area projection is preferred. The parabolas of the meridians in the latter are perhaps more pleasing to the eye than sine curves, and the symmetry of the whole is a matter of personal taste. (Deetz 1936, 50-51).
Debenham (1940)	Some dissatisfaction is likely to arise from lack of practice in drawing the irregular shapes and curves of natural features, as well as from lack of familiarity with the conventional signs in common use for map work. And since it is well to become accustomed from the first to these conventions, they are considered in an appendix, together with a pattern, which, of course, can be varied within limits to suit the taste and fancy of the sketcher. (Debenham 1940, 8).
Raisz (1948)	Whether to use the term "Legend," "Key," "Reference," or "Explanation" depends on individual taste. All four are commonly used. (Raisz 1948, 144).
Greenhood (1951)	Every trade to its tastes, but the map user must know the tricks of several if he is to feel at home on any card or chart. The usual practice is to refer azimuths to the south point: measure clockwise from the south meridian. Astronomers, geodetic surveyors, and most landlubbers do so. On sea, though, the north point is preferred for the taking of azimuths. (Greenhood 1951, 56).

Table 6.9 'Relative' uses of taste*. These uses appear relative, but some answers are still better than others. Note the wordplay in Greenhood 1951: a triple pun between the relativity of taste, the relativity of choice of measuring direction, and direction itself.

Individual taste (3/18; 16.7%) is the most common taste noun phrase of the Pre-Robinson Era, and although it can be used in a relative sense, its usage is mostly verdictive, as in the example from Deetz (1936), complaining about the decline in skill in map lettering:

> The lettering of maps is controlled largely by convention which imposes upon the cartographer the necessity of a knowledge of different approved alphabets. Craftmanship in this field, for unaccountable reasons, occasionally suffers from a lapse due to lack of individual taste. Since the early days of printing a revival of knowledge and interest in lettering has taken place periodically by the famous presses, interrupted again by intervals of deplorable decline. (Deetz 1936, 76).

This usage is important, because map lettering was contentious during the 1920s and 1930s in the United States and the UK. Corpus authors took sides in this debate and sought to train their readers on appropriate taste in cartography, as will be described in Chapter 7.

To that end, Hinks (1933, 46) explains that cartographers had shown "a taste for variety" in typography in two different ways during the 19th century. The first way cartographers showed a taste for variety was to seek it out as an end in itself: "*apparently* for its own sake" (italics added for emphasis). To provide an example, Hinks cites the lettering of the Ordnance Survey maps of the era (see Figure 6.3 for an example, not from Hinks).

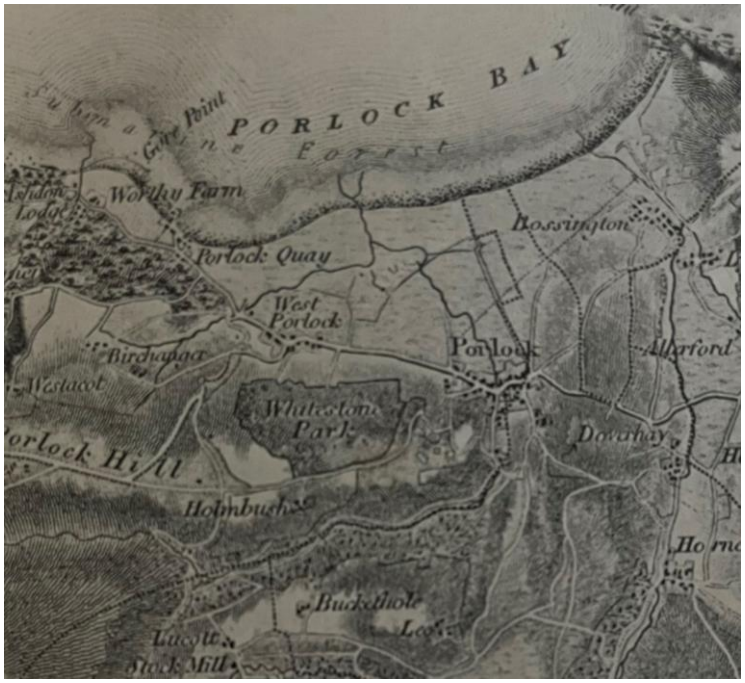


Figure 6.3 Map of Exmoor, Hachuring of 1820. From Winterbotham 1936, who critiques the map as "heavy and none too legible" (Winterbotham 1936, 70).

Hinks provides the following critique of the lettering used on the older Ordnance Survey maps, which provides a list of type characteristics that Hinks finds aesthetic demerits:

> ordinary roman, capitals and lower case; italic capitals; thickened hair-line capitals and lower case, without differences in thickness of the strokes, but with large serifs; the so-called Egyptian or block letters without any serifs at all—the plainest (though far from the most legible) sometimes curiously called "grotesque"; and stump (Hinks 1933, 46).

Hinks' (1933) phrasing is reminiscent of aesthetic disinterest, but in a negative sense. First, maps are supposed to be produced as functional objects, not as a means for cartographers to deploy variety without purpose. Second, as art objects, the lettering on these maps just is not very good. Thus, this is a verdictive usage: the cartographers who deployed lettering in this manner had bad taste.

Hinks' (1933, 46) second example of cartographic *taste of variety*—"variety with intent"—describes cartographic aesthetic judgment shown by mapmakers involved in the

production of the International Map of 1913. The characteristic sheet of the International Map varied type to communicate different meanings. By studying the characteristic sheet with 19 different lettering variations, a student can learn how "very much information can be conveyed by careful variation in the lettering of names" (Figure 6.4). This *taste of variety* "with intent" is not just good taste, it is also provided for the development of good cartographic aesthetic judgment in students of cartography.

Raisz (1948) uses *taste* in a verdictive sense to describe aesthetic disagreements between experts, commenting that Stieler's *Handatlas* possesses "a rich symbol system and fine hachuring" but "the maps look over-crowded for our taste" (Raisz 1948, 218). This usage of *taste* also provides an aesthetic property used to evaluate a map: over-crowded, which is, for Raisz, an aesthetic demerit.

*Taste** in the Robinson Era has fewer uses (7/25; 28.0%), appearing in only four authors: Robinson (1953; 1/7; 14.3%), Imhof (1982 [1965]; 3/7; 42.8%), Monkhouse and Wilkinson (1971; 2/7; 28.6%), and Robinson, Morrison, Muehrcke, and others (1995; 1/7; 14.3%).

Taste in this era is verdictive. Although subjectivity is starting to get pushed out of cartographic textbooks, it remains in the discussion of typography and color. Robinson (1953) comments that Classic or Old Style letters "appear dignified and have about them an air of quality and good taste that they tend to impart to the maps on which they are used" (Robinson 1953, 144). This language is overtly subjective, judging a map positively for its lettering. Old Style letters had been derived from the works of medieval monks, associating quality to reference to the past. This association of aesthetics with the past is important, associated with questions of whether maps and lettering in the future will ever be as good as maps and lettering in the past, a question to which I will return in discussions of *beauty* and *style*.

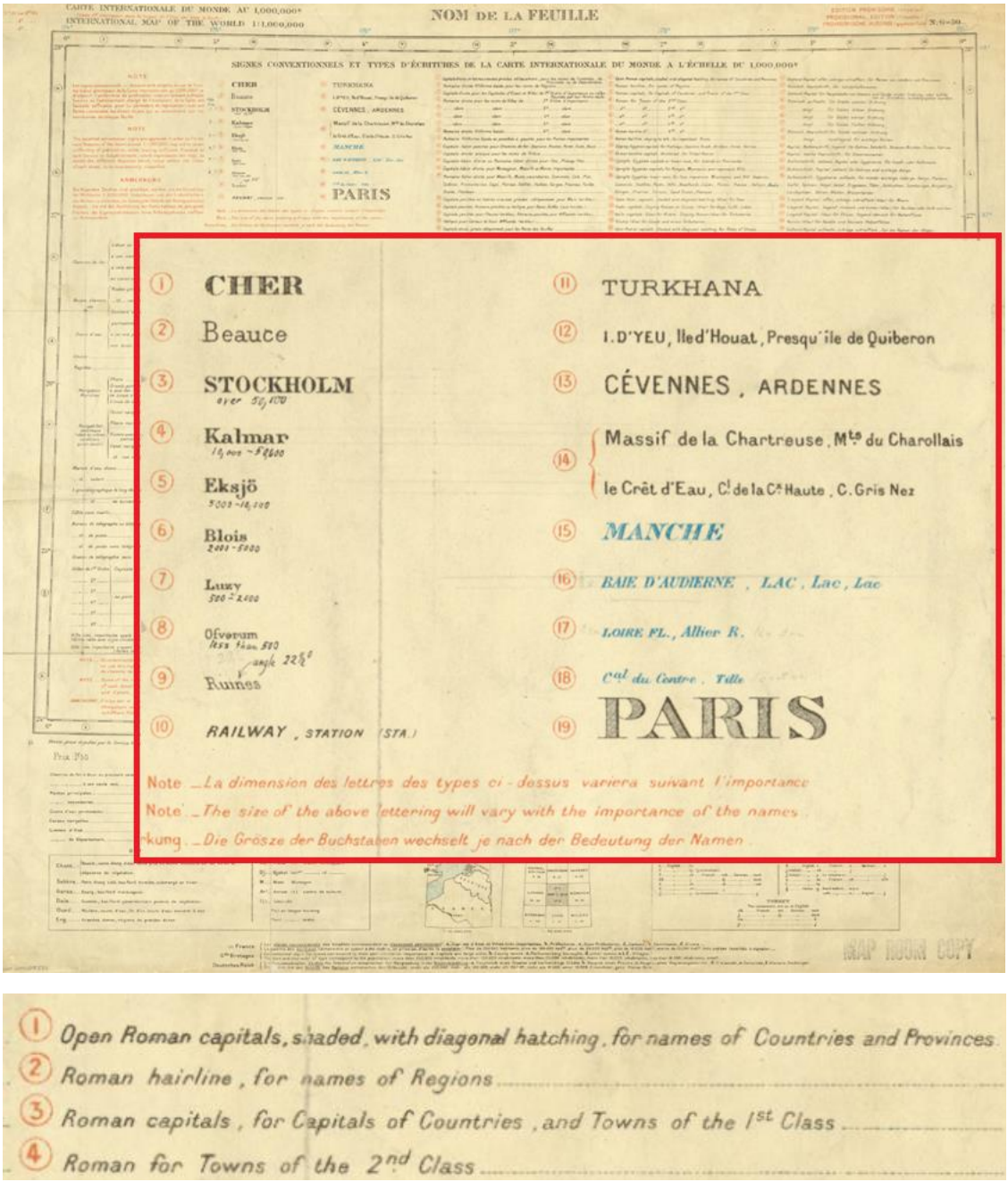


Figure 6.4 Characteristic Sheet, and close-ups of characteristic sheet, from the International Map of the World, 1913. Image Courtesy UW-Milwaukee Map Library

The Imhof (1982 [1965]) quote we saw in the previous section on aesthetics regarding aesthetic sensitivity returns because it is important to our discussion of *taste*. Imhof inveighs against individuals with poor taste in color choices:

> Tradition, partiality and whim, preconceived opinions, aesthetic sensitivity or barbarity of taste often play leading roles in the selection of colors. There are "brown supporters," "green fans," "blue enthusiasts," "yellow admirers," and "red worshippers." Many mapmakers and map users do not like change and stick by their first loves (Imhof (1982 [1965], 300)

Imhof (Imhof 1982 [1965]) is critical of hedonic justifications for design decisions: decisions should not be based on feelings such as a dislike of change or love. Hedonic grounds, by themselves, are insufficient reasons for a choice of colors without consideration of the map and the logistics of the map production process. Overall, though, Imhof is not critical of the concept of *taste* so much as he is of cartographers who produce work in poor taste through failing to consider the design options available to them.

However, when Robinson, Morrison, Muehrcke, and others (1995) quote Imhof (1982[1965]) in the context of color standards, they do so to point out that *taste** cannot be trusted, especially the tastes from fields outside of cartography. *Cartographic* standards require more objective criteria to select color.

In the Post-Robinson Era, references to *taste** have almost wholly disappeared. There are only two attestations, both of which are for *tasteful jj*, appearing in Krygier and Wood (2016; Table 6.10).

***Tasteful* concordances appearing in Krygier and Wood**
Design is not just a matter of tasteful layouts: it has profound public and political dimensions (Krygier and Wood 2016, 139).
When I once complained of this barbarous offensive coloring of maps, the geographer assured me that he would not sell them unless bedaubed in this way; "for," said he, "the greatest number of the large maps are not sold for any purpose of utility, but to ornament the walls of barrooms. My agents write continually to me to color high." This reason was given me by one of the first geographers of the United States, who has himself a perfectly correct idea of the tasteful coloring of maps. *Krygier and Wood 2016, 276; quoting Francis Lieber, "On Hipponomastics: A Letter to Pierce M. Butler," Southern Literary Messenger, 3:5 (1837).
Table 6.10 *tasteful jj* appearing in Krygier and Wood 2016

The first concordance in Table 6.10 is verdictive, however, it nevertheless emphasizes that implications of taste are less consequential than public or political matters. The second

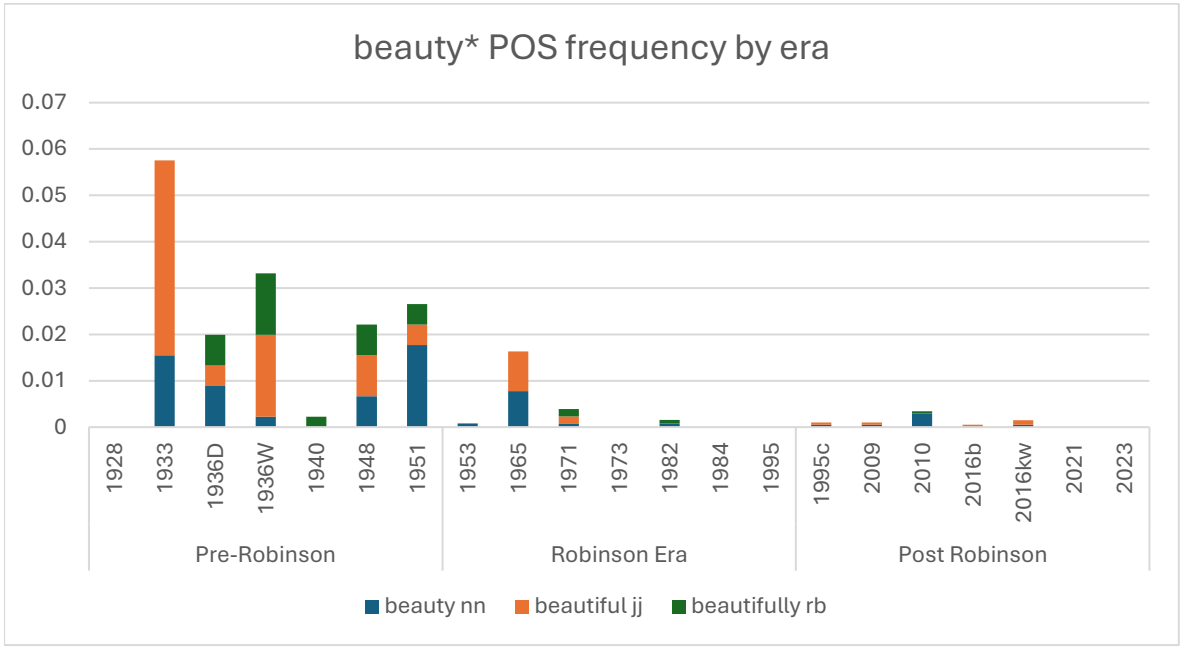
concordance is verdictive and used facetiously to describe bad cartographic taste belonging to an important figure. This bad taste is characterized as "barbarous offensive coloring" not for any functional use, or "purpose of utility" but as an "ornament" (Krygier and Wood 2016, 276). It is this second quote, with an older usage of taste, which captures what has been traditionally considered good cartographic taste: designing for utility and avoiding decoration. These patterns—design for utility, avoiding decoration or ornamentation—have been present in cartography for a long time as merits belonging to a good map, as attested by the age of this quotation, almost one hundred years before the publication of Beaman (1928), the first work in the corpus.

In conclusion, the drop-off of the usage of *taste** reflects how these usages—the relativist use, normative use, and the verdictive use—have found little place in the epistemology of modern cartography, perhaps because of common-sense understandings of taste as subjective, captured in Robinson Era criticisms of the concept. Nevertheless, its absence is not simply an artifact of new and more 'objective' sources on which to base cartographic judgment and value. *Taste** remains, it cannot be removed from cartography because *taste** also is very much objective—there are wrong answers in map design, and within the field of cartography, cartographers do agree a lot, shown by the remarkable stability of cartographic traditions and conventions over time. These terms themselves can be interpreted as simply the preferred means of referring to good cartographic taste.

6.4 *Beauty**

The key word *beauty** was not a common key word in the sample, with only 119 usages (119/3,767; 3.2% of all key words). Like *taste**, most discussions of *beauty** occurred during the Pre-Robinson Era (75/452; 16.6%). *Beauty** declined during the Robinson Era (29/1,285; 2.2%) and

appeared only 15 times in the Post-Robinson Era (15/2,030; 0.7%). Except for Tyner (2010), no work in the Post-Robinson Era mentioned *beauty** more than three times (Figure 6.5).



b

Figure 6.5 *beauty** key word frequency by POS. After the emphasis of functionalism in cartography emerging after Robinson 1953, *Elements of Cartography 1E*, there is a precipitous drop in the use of *beauty.** (Imhof 1965 is an outlier).

*Beauty** does not appear in the first work of the era, *Topographic Mapping*, Volume E of *Topographic Instructions of the USGS* (Beaman 1928). *Topographic Mapping* is different from all other works in the sample. As an instructional manual of how to make topographic maps that conform to the aesthetic profile of USGS, *Topographic Mapping* provides standards for which USGS cartographers are to do their work. Here, 'good' maps conform to standards and 'bad' maps violate standards. Hence the emphasis on 'instruction' in the title of the series: *Topographical Instructions of the USGS*. USGS cartographers must follow instructions to meet standards, and *beauty** does not figure into the standardization of topographic map production.

However, all other works from the Pre-Robinson Era are written more generally. They are not instructions, but 'how-to' guides that assume that mapmakers will make many choices in the map

production process. In other words, these maps can be more unique, and so some other word needs to be introduced to evaluate whether maps are good. Thus, *beauty** first appears in the corpus in 1933, when its use peaks. Afterward, the frequency of use of the key word *beauty** decreases but remains stable until the Robinson Era, when attestations of *beauty** sharply decrease (Figure 6.5). The decline in beauty was expected because of the influence of functionalism on cartography after the publication of *The Look of Maps* (1952).

Thus, in the Pre-Robinson Era, *beauty** was an evaluative word applied to identify the overall quality of a map, or an element of the map, such as lettering. As such, *beauty** was used to indicate whether a combination of techniques or appearances was successful or effective, and therefore, an important example for a student of cartography to study. *Beauty** commonly was used to describe qualities of historic maps, which were assembled into map galleries for students to study. These galleries taught students good cartographic judgment, training their eyes on how to recognize good, beautiful, and ugly maps. By the publication of Raisz (1948) *General Cartography 2E*, such galleries were still used for students to learn cartography through studying historic maps:

> What should be included in a college course in cartography [. . .]? The purpose of such a course is to qualify the student to give a clear and correct graphic expression of his ideas. To do this well he must adhere to certain cartographic principles and traditions, which can best be learned by a historical approach (Raisz 1948, xii)

Maps still were functional objects in the Pre-Robinson Era, and thus, even in the Pre-Robinson Era, *beauty** was sometimes associated with functionalism. In fact, because of changes in map production that occurred during the 1920s and 1930s, some uses of *beauty** reflected fears of cartography becoming a mercenary profession. Hinks (1933), Winterbotham (1936), and Deetz (1936) expressed fears that because of changing technology and the expense involved in producing high quality maps, maps of the future would never be as *beautiful* as the maps of the past.

By Raisz (1948), there is less fretting about lost beauty in cartography. Many references to beauty are simply evaluations of historic maps, without the added that modern maps would fail to retain beauty. In that sense, Raisz (1948) is the first 'progressive' author in the corpus.

Table 6.11 describes the distribution of discussion by author according to these themes. Uses were either ***evaluative***, which use *beauty** to aesthetically evaluate a map, (i.e., to determine whether a map has beauty) similar to the above use in *aesthetic**; ***functional***, using *beauty** to refer to how well a map or other aspect of cartography accomplishes a task, e.g., *beauty of this trick* or *beautiful example*; or to ***lost*** beauty, which refers to fears of losing *beauty**.

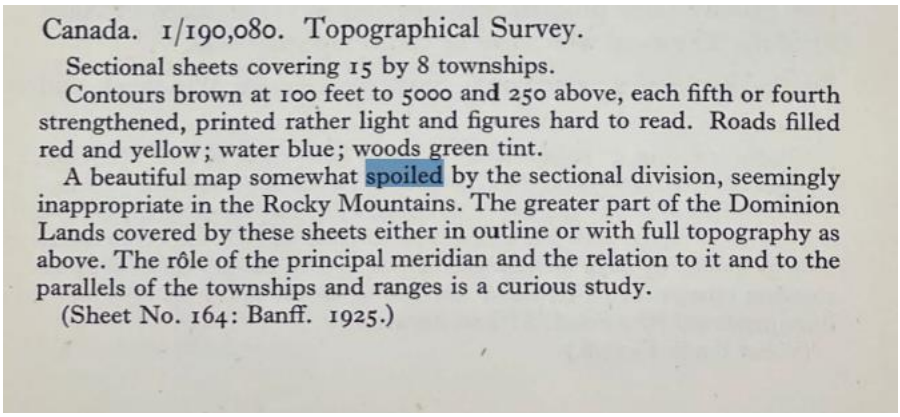
Noun Phrase			Class.	Attestations in Pre-Robinson Era						
Mod L	Form	Mod R		1928	1933	1936 d	1936 w	1940	1948	1951
	beauty	[other/none]	func			2				4
	beauty	of color	eval / lost		1	1				
	beauty	of lettering	eval		1					
	beauty	of the impression	eval / lost		1					
	beauty	of map*	eval / lost		2	1	1		1	
decay of	**beauty**		eval / lost		1					
question of	**beauty**		eval		1					
	beauty	of this trick	func							1
great	**beauty**		eval							1
unshowy	**beauty**		internal							1
	beautiful	[other/none]	eval/func		10	2	1		1	2
	beautiful	map(s)	eval		3		1		1	
	beautiful	example	eval/func		1		1			
	beautiful	sheet	eval		2		1			
more	**beautiful**		eval / lost		2		1		1	
very	**beautiful**		eval		1		1			
quite	**beautiful**		eval				1			
most	**beautiful**		eval						1	
peculiarly	**beautiful**		eval				1			
	beautifully	[other/none]	eval / func			1	1		3	2
	beautifully	engraved	eval				3			
	beautifully	drawn	eval				1		1	
	beautifully	clear	eval				1			
	beautifully	symmetrical	eval			1				
	beautifully	expressed	eval			1				
	beautifully	prominent	func					1		
	beautifully	proportional	eval						1	

Table 6.11 *beauty** noun phrases during the Pre-Robinson Era. Usages highlighted in yellow persist in the Robinson or Post-Robinson Era

Lastly, there is one idiosyncratic usage of beauty from Greenhood (1951), which I call ***internal***, which refers to beauty within the mapmaker expressed through the act of creating a map. This isolated usage does not appear again but is worth briefly mentioning now because it intersects aesthetic ideas regarding art as expressiveness: "by dint of some unshowy beauty within himself, the mapper often represents some of that in the terrain outside" (Greenhood 1951, 232). In addition to presenting cartography as art, *unshowy beauty* also describes the cartographic aesthetic norms to which cartographers aspire.

Evaluative uses of *beauty** help explain whether a map is good. These uses are applied to maps of the past. Many of these usages were in the context of historic maps and map galleries. Here, I examine all uses of *beautiful map(s)* and *beautiful example*.

Beautiful map(s) was used by Hinks (1933), Winterbotham (1936), and Raisz (1948). All usages were historical, mostly in reference to maps produced by state agencies in the form of an imageless map gallery. Thus, these usages require readers to seek out the map to understand the sense in which *beautiful* is used. Many of the descriptions do not provide a lot of information to help the reader interpret why some maps are more beautiful than others (Figure 6.6).



Canada. 1/190,080. Topographical Survey.

Sectional sheets covering 15 by 8 townships.

Contours brown at 100 feet to 5000 and 250 above, each fifth or fourth strengthened, printed rather light and figures hard to read. Roads filled red and yellow; water blue; woods green tint.

A beautiful map somewhat spoiled by the sectional division, seemingly inappropriate in the Rocky Mountains. The greater part of the Dominion Lands covered by these sheets either in outline or with full topography as above. The rôle of the principal meridian and the relation to it and to the parallels of the townships and ranges is a curious study.

(Sheet No. 164: Banff. 1925.)

Figure 6.6 Imageless Map Gallery Critique. (Hinks 1933, 77).

The approach is understandable, as reproducing so many maps within one book is completely impractical. Critiquing the appearance of the original map from a small reproduction is a fruitless task, as the distinguishing features of the original map would have been lost from the change in scale.[23] Raisz (1948) notes the limitations of his own reproduction of *Theatrum Orbis Terrarum*, which gives "but little indication of the beauty of the colorful original" (Raisz 1948, 27).

[23] A point that every author in the Pre-Robinson Era, and many in the Robinson Era make when discussing the problems of changing scale during map reproduction. Robinson (1953) describes the problem thus: "The contemplation of his first reproduced map is likely to be one of the great events in a cartographer's professional life. Sometimes the event generates sorrow. Of certain results it might be said, "Any resemblance between this printed map and the fair drawing is purely coincidental."" (Robinson 1953, 93).

The first usage of *beautiful map* by Hinks (1933) refers to "a beautiful map somewhat spoiled by the sectional division, seemingly inappropriate in the Rocky Mountains." (Hinks 1933, 77; Figure 6.7).

Winterbotham's (1936) usage of *beautiful maps* also is within a map gallery, describing the second edition of the Ordnance Survey 1/M maps, which used a different plate to print hills in brown, forming the first maps in color produced by the Ordnance Survey (Figure 6.8). Winterbotham explains that "these black and brown 1-inch were beautiful maps and covered Great Britain by 1900"(Winterbotham 1936, 73).

Raisz' (1948) usage of *beautiful maps* is within the context of a section on the history of cartography, and it provides slightly more description than Winterbotham (1936). Particularly noteworthy is the association with mural paintings and decoration:

> The charts of the Dieppe school, somewhat in the style of mural paintings, are among the most beautiful maps ever made. Somewhat less decorative are the maps of the "enlumineurs" of the late sixteenth century (Raisz 1948, 28).

The Vallard Atlas demonstrates the decoration to which Raisz (1948, 28) refers (Figure 6.9). Although "decorative" is a criticism in the Robinson Era, for decorative map elements are not functional, Raisz, the leading North American cartographer before Robinson, was known for sometimes including illustrative elements on his maps and atlases, an influence from these historic sources.

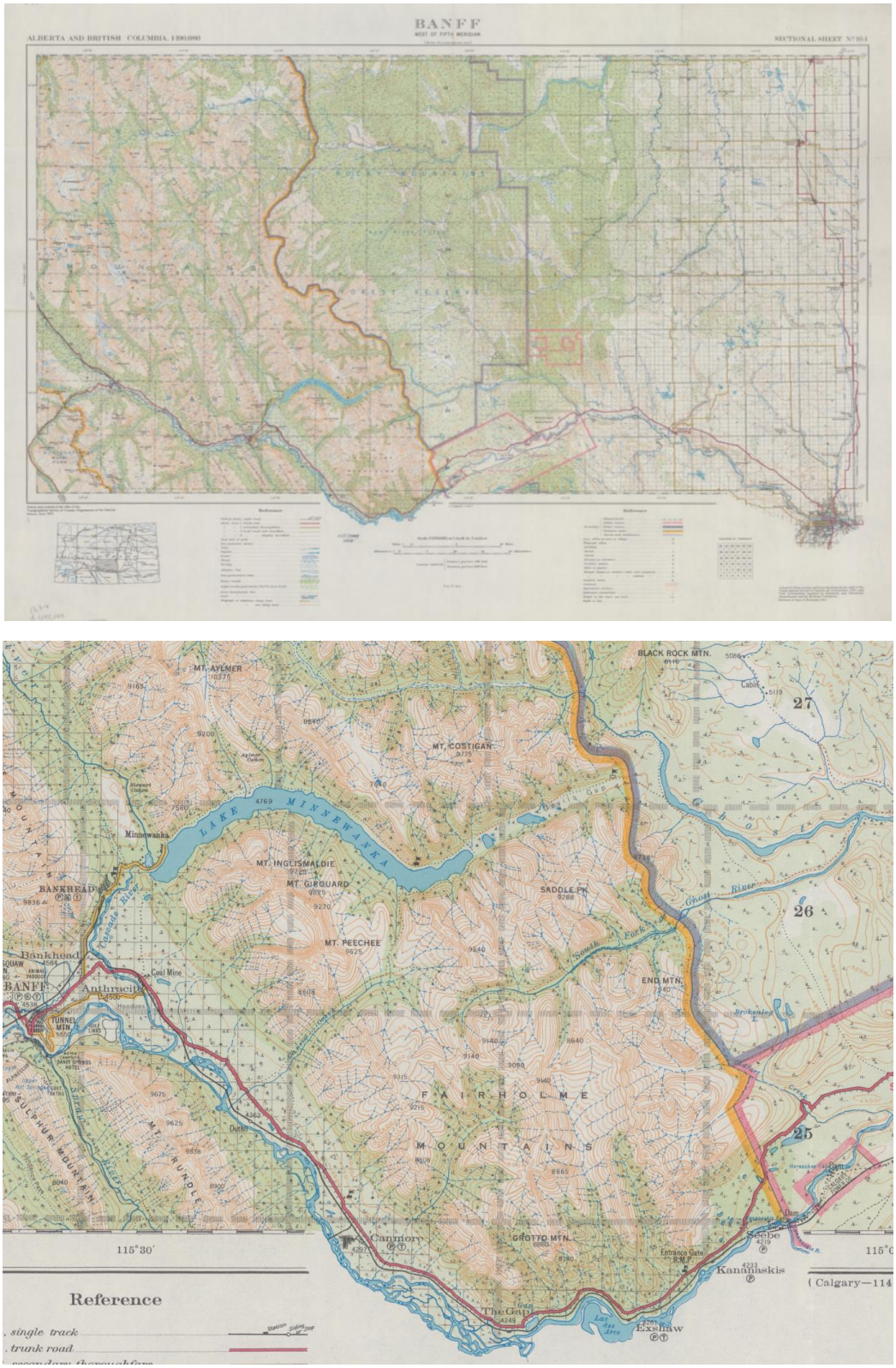


Figure 6.7. *Spoiled beauty* according to Hinks 1933. Banff, 1:190,080. 1925, & close-up. Topographical Survey of Canada, Department of the Interior. Scan courtesy UW-Milwaukee Map Library.

Figure 6.8 Balmoral. Sheet 65. Ordnance Survey of Scotland. 1/M 2E map.1900. 58x71cm. Hachures in brown. Contours in black. Scan by National Library of Scotland.

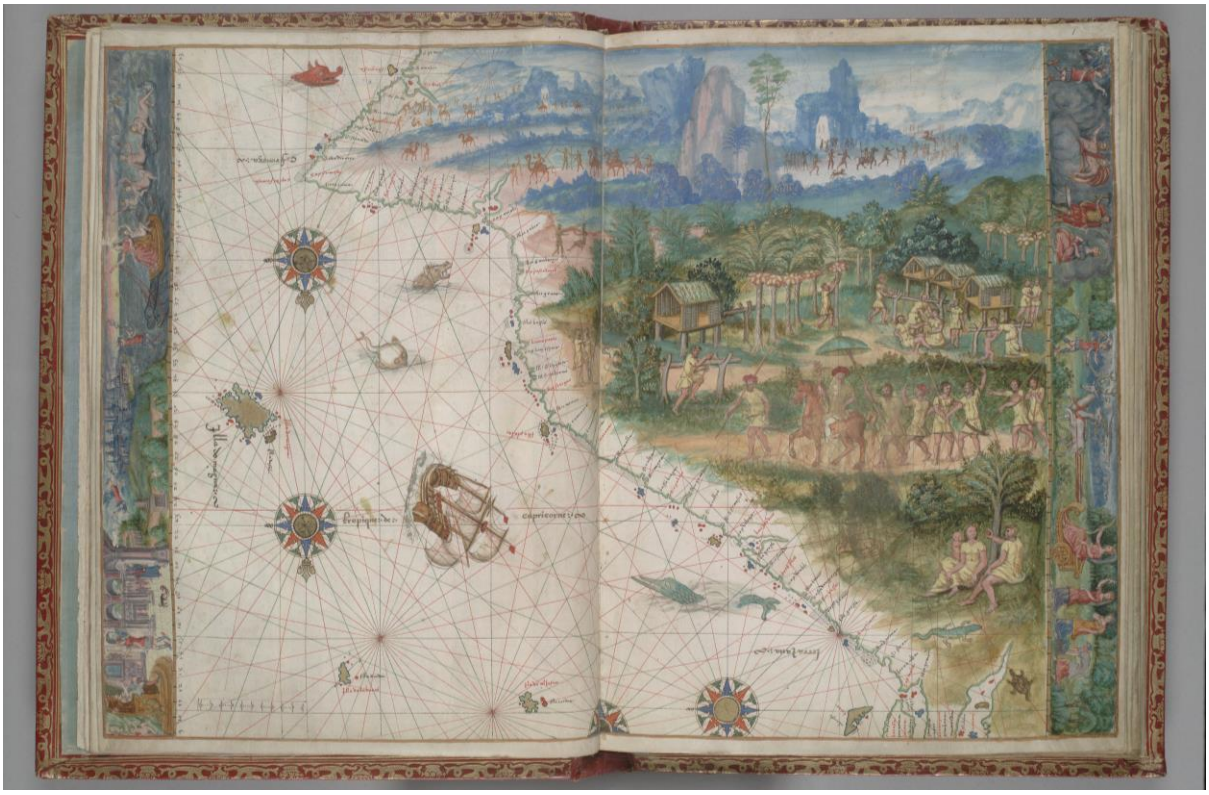


Figure 6.9 "Terra Java" From Vallard Atlas, a Portolan Atlas of the Dieppe school. Henry E. Huntington Library and Art Gallery, San Marino, California. https://web.archive.org/web/20121103140447/http://dpg.lib.berkeley.edu/webdb/dsheh/heh_brf?Description=&CallNumber=HM+29

Beautiful example was used by Hinks (1933) and Winterbotham (1936). Both usages are evaluative. Winterbotham's usage relates to an argument about hachuring[24]. To discuss the controversy, he provides a quote from Sir Roderick Murchison, the President of the Royal Geographic Society in 1854. Here, my interest is not in the controversy, for I will return to it in Chapter 7.

> ""I beg to express my most decided conviction that they produce nothing on the Continent equal to our best maps [hachured old series], of which I lay what I consider a beautiful example before the Committee" (Winterbotham 1936, 98-99; quoting Roderick Murchison, 1854).

[24] At the time of Winterbotham's writing, there was disagreement over when to use hachures and when to use contours, as hachures and contours provide different kinds of information – hachures describe, by providing indication of direction and small detail, but contours define by indicating height above sea level. I return to hachures in Chapter 7.

What is important in this example is the language: the *best map* is a *beautiful example* (Figure 6.10).

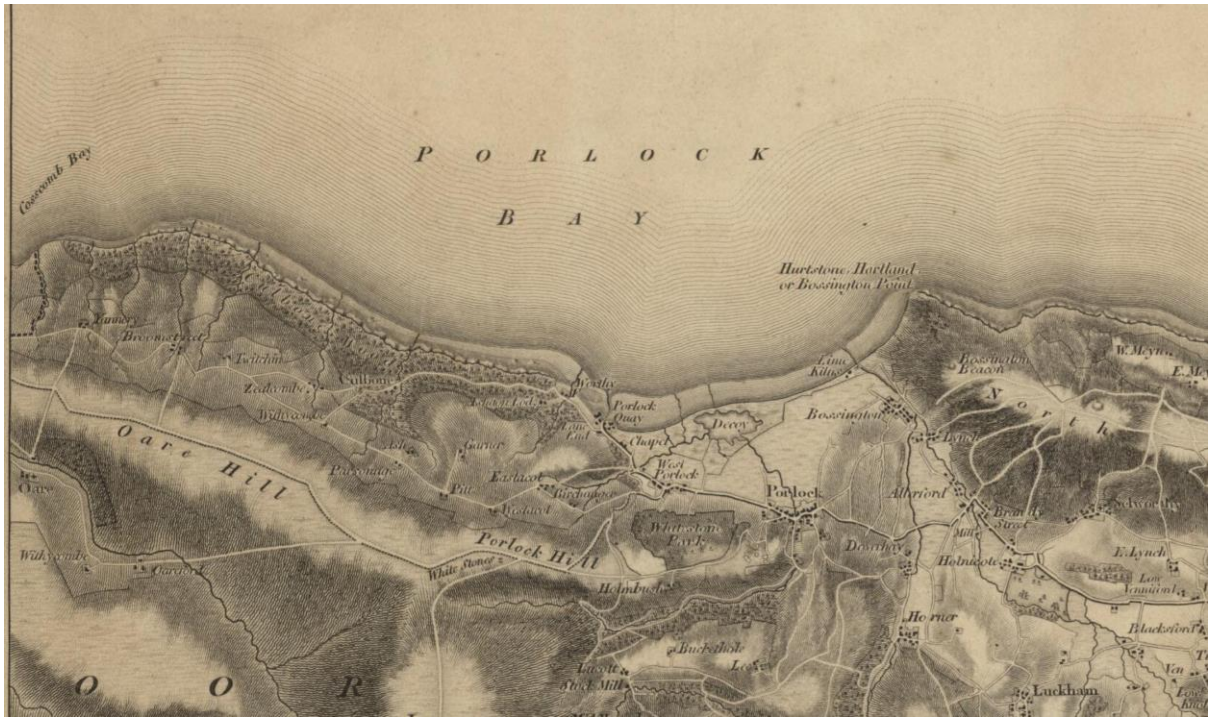


Figure 6.10 Ordnance Survey of the Isle of Wight and part of Hampshire.1809. Hachured Old Series Map. London: Published by Lt. Col. Mudge, Tower [and later] by Lieu M. Colonel Colby of the Royal Engineers https://nla.gov.au/nla.obj-231919289/view

Lastly, Hinks (1933) uses *beautiful example* in reference to a map of Mount Everest by M. Charles Jacot Guillarmod (Figure 6.11). This example of Swiss rock drawing, which has reached the "high pitch of perfection," shows how to depict terrain when contours are impractical (Hinks 1933, 37). Guillarmod's example is cited as the "most beautiful example ever seen" although Hinks notes that "excellent results may be seen on many of the Swiss sheets."

Figure 6.11 Close up of Mount Everest and Chomo Lungma, by M. Charles Jacot Guillarmod. This close up shows Guillarmod's rock drawing. https://exhibits.stanford.edu/cartosym/catalog/fs936cq7374

Thus, but one of the *beautiful maps* and *beautiful examples* relate to terrain representation (Figures 6.7, 6.8, 6.10 and 6.11). The map that is not—the Dieppe school map in Figure 6.9—is highly pictorial.

Deetz (1936) mixes evaluative and functional concerns with hedonism in his conception of a beautiful map:

> Every map should present, as far as possible, legibility, clearness, unity of style, and harmony. A taste of good proportions and a certain distinction of style in the relative prominence of features makes itself felt in the improved appearance of the map. Most of us are sensitive to our surroundings. It is

> beauty that cheers, and we want maps and charts around us that look like something worth while - maps that do not suggest the thought of commonness and cheapness. (Deetz 1936, 79).

"Beauty that cheers" is associated with many aesthetic properties that later become part of good design: "legibility, clearness, unity of style, and harmony" as well as "a taste of good proportions and a certain distinction of style." Achieving these goals produces a beautiful map, which "looks like something worthwhile" rather than "suggest[s] the thought of commonness and cheapness." Notably, this discussion from Deetz is the first attestation of these aesthetic properties in the corpus. As we have seen, by the Post-Robinson Era, *aesthetic** absorbs these meanings, though does not provide instruction on how to achieve them.

Five functional uses of *beauty** appear in Greenhood (1951). Unlike the uses described by Deetz (1936), Greenhood's attestations refer to the ability to do something well, making the point that beautiful things function well:

> So, with the two angles and the base of a triangle known to you, the correct location of the flagmast at T will show up on the plotting sheet. The beauty of this trick is you need never leave the road but can thumb your nose at "No Trespassing" signs, and ignore ferocious dogs, bulls, and poison ivy. It enables you to locate objects across rivers, lakes, swamps, and on distant hills (193-194).

Greenhood likes to demonstrate functional beauty by engaging in word play to communicate the concepts more clearly to the reader. Thus, in writing and in cartography, beauty and function can go together.

The last major usage of *beauty* in the Pre-Robinson Era refers to lost *beauty.* These usages concentrate in Hinks (1933) and Deetz (1936). Fears of lost beauty appear in discussions of lettering, map printing, map coloring, and terrain representation.

Beauty had been lost in many maps because of bad lettering. Bad lettering occurred from cartographers' overreliance on "typed names with their mechanical regularity," which "never look right on a map" (Hinks 1933, 45). Hinks attributes these faults to the "gradual decay of beauty in printing [. . .] about the middle of the nineteenth century". The printer's "worst" type" created too

much variability between letters through excessive exaggeration of the letter's characteristics, especially serifs. Serifs were then connected with other serifs (almost like ligatures), reducing legibility. This "base practice" found its "worst examples" in the "ugly sloping character known as

Figure 6.12 "Stump style." Example from *Essentials of Lettering* (French and Meiklejohn 1912). Beaman 1928 explains that "stump" is a term used in reference to types of engraved lettering: '"stump" corresponds to "lower-case italic"' (Beaman 1928, 332). Note that Figure 6.5, the characteristic sheet of the International Map of the World (1913) also contains stump.

"stump""(Hinks 1933, 46; Figure 6.12). I return this controversial history of typography in Pre-Robinson and Robinson Era cartography in Chapter 7.

The problem is that good lettering is expensive, and as a result, many people are unwilling to pay for it. Hinks (1933, 47) explains that "opinions may differ on the question of beauty, there can be no disputing the fact that present styles of map letting are so expensive that few books are published with adequate maps." As a result, Hinks advocates for "a radical change in style" by "adopting a letter that can be drawn in single strokes of the pen," to reduce production costs.

Hinks (1933) also suggests that *beauty* is lost from changes in the production process, from the switch to lithography to the use of color, connecting beauty with pleasure and happiness:

> The beauty of the impression from the engraved copperplate is now little seen; the unpleasing qualities of surface of paper suited to lithography go far to spoil any map (Hinks 1933, 88)

> Ornament is dead, and not even the border is allowed to be decorative. The use of color has killed the beautiful black of the old maps, without giving them any beauty of color, for the colours are too often sad. (Hinks 1933, 88).

These usages in the Pre-Robinson Era already lament *beauty* as something *already* lost from cartography.

Deetz (1936, 9) agrees with Hinks (1933) that modern maps cannot reach the beauty of the older maps, writing that "it is doubtful if any modern process can ever match the work of some of the old engravers, whose delicate touch and medium of expression achieved the highest degree of beauty in graphic art." (Figure 6.13).

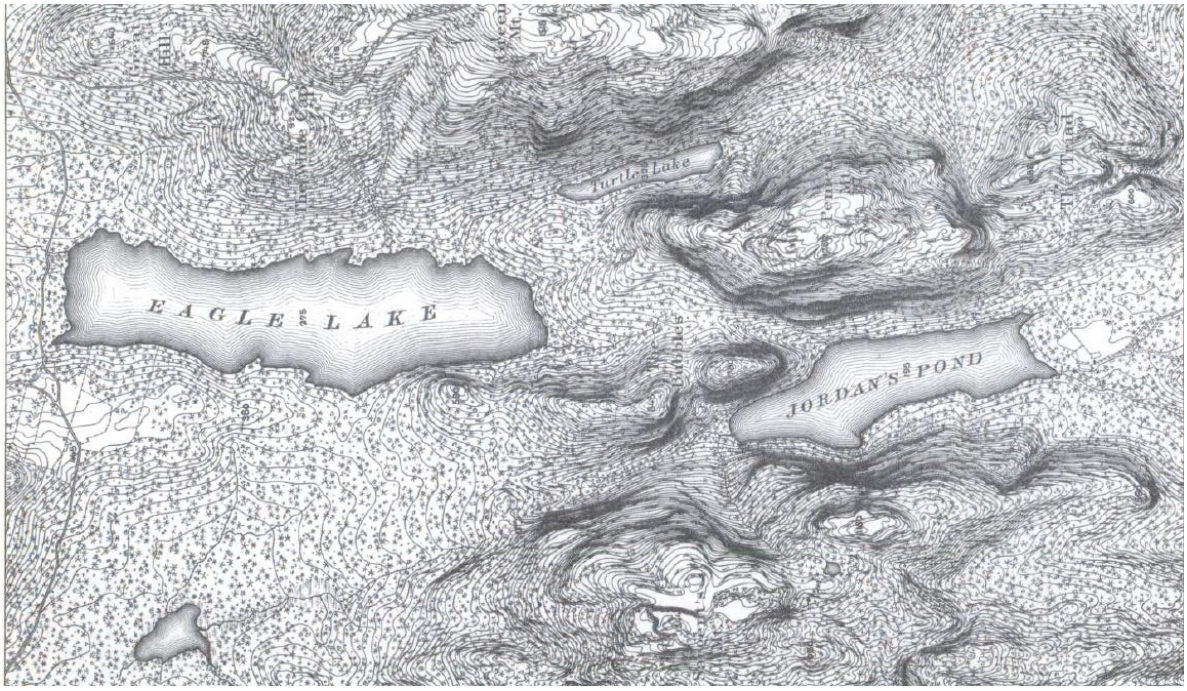


Figure 6.13 Unmatched beauty from the "old engravers": Mt. Desert Island, Maine. U.S. Coast and Geodetic Survey Chart No. 306. 1885. Deetz 1936 uses this plate to emphasize that the economic restrictions on modern cartography mean that modern maps will never be as beautiful as maps from the past, as he laments, "is there anything in art more distressing than a worn-out copperplate?" (Deetz 1936, 9).

According to Deetz (1936, 9), "at its highest stage of development, black was really black and the number of impressions from a plate was limited." Thus, engravers did not have the same practical and economic constraints as modern cartographers. Ultimately, however, Deetz holds that "that method of reproduction is best which expedites publication, lowers the cost, retains clearness and legibility, and reduces distortion in the printed chart to a minimum" (Deetz 1936, 9). Economic and functional concerns are paramount.

In the Robinson Era, discussion of *beauty* is greatly reduced (Table 6.12). Attestations appear in Robinson (1953; 1/29; 3.4%), Imhof 1982[1965]; 21/29; 72.4%), Monkhouse and Wilkinson (1971; 5/29; 17.2%), and Cuff and Mattson (1982; 2/29; 6.9%). Most uses are evaluative and come from Imhof, however, some evaluative and functional uses are present as well, and those functional uses are the most important.

Robinson (1953) associates *beauty* with art, providing the only ***anti-functional*** usage in the corpus, arguing that *beauty* can detract from map use:

> if a map is made too much a work of art, it is very likely that the viewer will be stimulated first by its beauty and will fail to see the concept. (Robinson 1953, 13).

Here, we see aesthetic attention associated with *beauty,* and the map as an aesthetic object, a view with which Robinson (1953, 13) disagrees. A map needs to function, to "'get across' a concept or relationship; it is not to serve as adornment for an office wall." Thus, for Robinson, cartographic concern for *beauty* should extend no more than "to refrain from making the map ugly." Beyond this admonition, Robinson makes no mention of *beauty** in any edition of *Elements of Cartography* in the corpus.

Noun Phrase			Class	Attestations in Robinson Era						
Mod L	Form	Mod R		1953	1965	1971	1973	1982	1984	1995
	beauty		anti-functional	1	4					
clarity as well as	**beauty**		functional					1		
	beauty	peculiar	evaluative /functional		1					
	beauty	and clarity	evaluative /functional		1					
	beauty	of map*	evaluative /functional		3					
	beauty	of Swiss landscape	evaluative		1					
	beauty	of net repro-duction rate	functional			1				
	beautiful		evaluative		1					
	beautiful	or/nor ugly	evaluative		2					
subdued	**beautiful**	blue	evaluative		1					
expressive and	**beautiful**	colored area patterns	evaluative		1					
most	**beautiful**	examples	evaluative		1					
	beautiful	map	evaluative		1					
	beautiful	natural-istic map	evaluative		1					
	beautiful	summer days	evaluative		1					
	beautiful	impress-ions	evaluative							
	beautiful	illustra-tions	evaluative			1				
	beautiful	work	evaluative			1				
outstand-ingly	**beautiful**		evaluative		1					
	beautifully		functional					1		
	beautifully	lettered map	evaluative			1				
	beautifully	drawn symbols	evaluative			1				

Table 6.12 *beauty** noun phrases in the Robinson Era.

Imhof (1982 [1965]) holds an opposite view from Robinson. For Imhof (1982 [1965]), good maps are clear maps, and clear maps are beautiful. An unclear map is *ugly.*[25] Imhof offers a general statement regarding beauty and clarity on maps, which gives beauty evaluative and functional properties:

> A map will only be evaluated as good in the scientific and didactic sense when it sets forth simply and clearly what its maker wishes to express. A clear map is beautiful as a rule, an unclear map is ugly. Clarity and beauty are closely related concepts. (Imhof (1982 [1965], 73)

Imhof emphasizes the link between beauty and nature, particularly of the Swiss countryside (e.g., Imhof (1982 [1965], 13). When a viewer can see the resemblance of the features of the map to nature, they experience pleasure in viewing. Effective use of cartographic techniques enhances beauty and clarity.

> The direct elements make it easier to recognize the natural features in the map; they make map reading simpler. They improve the beauty of the map and increase the pleasure in viewing it. (Imhof (1982 [1965], 84)

Thus, for Imhof (1982 [1965], 86), *beauty* is a top-level quality achieved through accuracy, expression, characterization, legibility, simplicity, and meaning. In that, Imhof explains that *beauty* is the end goal of cartographic relief presentation, a "peculiar beauty," unique to the map itself:

> The goals are the greatest possible accuracy, with respect to the scale of the map; clear expression of metric information; good characterization in the forms; the most naturalistic forms and colors; the greatest possible clarity of meaning and good legibility, simplicity, and clarity of graphic expression; and finally, summarizing all these qualities, a beauty peculiar to the map itself. (Imhof (1982 [1965], 86)

None of these usages are in direct opposition to Robinson's functionalist paradigm: in fact, they would all be considered goals. Instead, Robinson excises beauty and beauty's relationships to aesthetic concepts to replace it with scientific design.

Cuff and Mattson (1982) associate contrast with clarity and beauty. Their usage is reminiscent of Imhof (1982 [1965]:

---

[25] As we have seen, Hinks (1933) predated Imhof's association of lack of clarity with ugliness, for he referred to stump lettering as *ugly* because it was unclear.

> Composition is concerned with avoiding homogeneity (or clutter) and ensuring the all-important *contrasts* that lend clarity as well as beauty to a cartographic work (Cuff and Mattson 1982, 71)

Clarity and beauty are now entrenched in cartographic thought as linked concepts, but not all authors see the need to refer to *beauty.* Instead, they can just refer to clarity and ignore beauty.

The last usages of *beauty* in the Robinson Era I discuss come from Monkhouse and Wilkinson (1971, 325) and are functional: Monkhouse and Wilkinson relate beauty to simplicity, emphasizing functional beauty, in a statement reminiscent of scientific aesthetics, especially Ockham's razor: "The beauty of the net reproduction rate is its simplicity as a measure of replacement."

Noun Phrase				Attestations in Post-Robinson Era						
Mod L	Form	Mod R	Class	1995 c	2009	2010	2016 b	2016 kw	2021	2023
	beauty	[other or none]				3				
	beauty	in modern maps	evaluative			1				
	beauty	of standards	functional	1						
lacks	**beauty**		evaluative		1					
standards of	**beauty**		evaluative			1				
elegance and	**beauty**	in their simplicity	evaluative			1				
	beauty	of words	evaluative					1		
few	**beautiful**	computer produced maps	evaluative/ functional	1						
	beautiful	map	evaluative/ functional		1					
	beautiful	case studies	evaluative					1		
functional and	**beautiful**		evaluative/ functional					1		
readable and	**beautiful**		evaluative/ functional				1			
represent	**beautifully**		evaluative/ functional			1				

6.13 *beauty** noun phrases and charge of phrase.

*Beauty** in the Post-Robinson Era has the fewest number of attestations (15/115; 13.0%) which appear in Clarke (1995; 2/15; 13.3%), Dent (2009; 2/15; 13.3%), Tyner (2010; 7/15; 46.7%), Brewer (2016; 1/15; 6.7%), and Krygier and Wood (2016; 3/15; 20.0%). Thus, most of what had been described by *beauty** has now been given to *design**, with the general sense of the term given to *aesthetic**. Post-Robinson Era attestations touch on aesthetic properties in Dent, Torguson, and Hodler (2009). Tyner (2010) discusses relativity through a brief discussion on the *standards of beauty* in cartography. *Beauty** most commonly appears by itself rather than in a noun phrase (Table 6.13).

One use of *beauty* is from Clarke (1995) who refers to beauty as a problem: "the beauty, and also the problem, of standards is that there are so many to choose from!" (Clarke 1995, 92). This usage of *beauty* seems to relate to functionalism, but the connection to problem suggests instead aesthetic experience. It is reminiscent of the use of *beautifully* by Debenham (1940), who also equates *beauty** with a problem to solve.

Dent, Torguson, and Hodler (2009) associate beauty with the subjective elements of design in an extensive quotation from Karssen (1980)[26]. All uses that Dent, Torguson, and Hodler (2009) describe are evaluations, but they also relate to functional concerns that are difficult to quantify in cartographic design epistemology.

> The subjective elements of design have been listed as follows (Karssen 1980)
> - Generalization—beauty of simplified shapes
> - Symbolization—beauty of graphic representation
> - Color—beauty of color accent and balance
> - Layout—beauty of composition
> - Typography—beauty of typographic appearance
>
> Dent, Torguson and Hodler 2009, 207; quoting Karssen (1980).

[26] Because these usages were confined to a single excerpt from Karssen (1980), they were counted as a single usage.

These usages of *beauty* relate to aesthetic judgment and value. They are, essentially, 'good' instances of these aspects of cartographic design, which are difficult to quantify. In that sense, *beauty* stands in directly as an aesthetic synonym.

Like Dent, Torguson, and Hodler (2009), Tyner (2010) emphasizes subjectivity, bringing up a key phrase, *standards of beauty,* that does not appear elsewhere in the corpus. To make her point, Tyner contrasts maps from three different periods together—cartography in the colonial era, early computer cartography, and "modern cartography":

> A significant aspect of the overall appearance that has often been overlooked or even considered unimportant in recent years is beauty. Old maps are often valued for their beauty and framed to hang on a wall, but it is hard to imagine an early computer map being treated in this way. Of course, beauty is hard to define and standards of beauty change, but readers still react to the aesthetics of maps. We don't equate beauty in modern maps with ornate lettering, elaborate title cartouches, and drawings of mermaids and ships, but maps can still be attractive. Some maps are small, informal, and plain; they are devoid of ornament, because ornament would be inappropriate and distracting. These maps have elegance and beauty in their simplicity (Tyner 2010, 41)

The elements that Tyner (2010) points out as belonging to *beauty* in an earlier era, but not the modern era, are the same elements Robinson (1952) inveighs against—and the aesthetic properties that Tyner praises are praised by very early authors in the corpus too, such as Deetz (1936). Modern cartography's aesthetic norms have stayed relatively static over a long time. In Tyner's passage once again demonstrates the influence of functionalism—Tyner's example of a beautiful and elegant modern map is a map "small, informal and plain" (Tyner 2010, 41).

Like many earlier authors, Clarke (1995) associates a lack of beauty with money. However, Clarke's usage is interesting, because instead of cost being a limiting factor, cost is used in a more opposing sense—leading one to create with technology simply because the technology was there, and it had not yet been done (and also, was expensive):

> The desire to produce computer maps at any cost, or plain ignorance, has often led cartographers to abandon these basic design principles, and as a result we have few beautiful computer-produced maps to show.

Figure 6.14 shows examples of these early maps, which by the Post-Robinson Era, were considered unattractive, as Tyner (2010) commented. Perhaps some of the rush to produce maps quickly may have been in response to the pressures on cartography to appear more technical, following in the wake of GIS. Also notable in this usage is that beauty derives from the application of design principles, and is lost when principles are not adhered to, again demonstrating how aesthetic properties that had been associated with beauty had become associated with design—objectified through being turned into a principle.

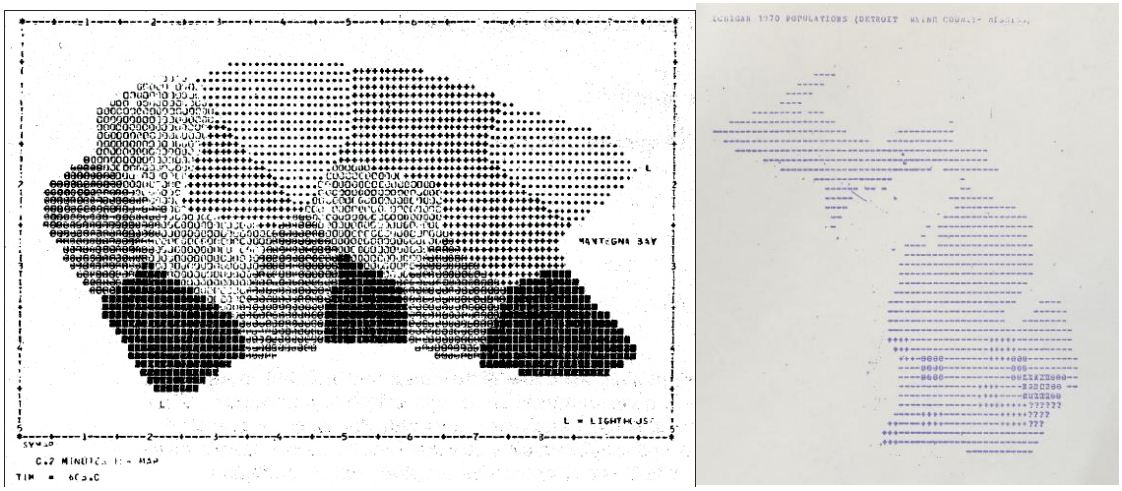


Figure 6.14 Early Computer Maps.
Left: SYMAP Raster Generated Map from the Harvard Laboratory for Computer Graphics and Spatial Analysis. Example courtesy Steven Holloway. Scan from ESRI.
https://www.esri.com/about/newsroom/arcnews/beginnings-of-geodesign-a-personal-historical-perspective/
Right: Michigan 1970 Populations. Waldo Tobler, 1970. Library of Congress. Scan courtesy Joel Masselink.

In summary, *beauty** changed from the Pre-Robinson to Post-Robinson Era as a means to evaluate historical maps to a means to evaluate functional maps. By the Post-Robinson Era, the evaluative properties of *beauty** mostly are subsumed into *design**. 'Clear', 'legible', 'harmonious', and 'expressive' become properties of design and are discussed within the context of *design**. I return to this evolution of aesthetic concepts into design in Chapter 8. There is no need to continue to describe maps as *beautiful* to emphasize that they are good, and beyond the single mention of

beauty in *Elements of Cartography 1E, Elements of Cartography 1E* and *6E* do not reference *beauty**.

The split between Robinsonian cartography and terrain representation is seen in *beauty**, however. Beauty is most commonly associated with terrain representation, which is closer to nature. Textbooks do not teach much in the way of terrain representation after the Robinson Era, as I discuss in Chapter 7.

*Beauty** comes with problems, particularly a difficulty with balancing beauty and functional concerns, especially economic. Just because *beauty** largely was subsumed into *design** does not mean that the trouble with *beauty** went away: just as *beautiful maps* were expensive to produce, well-designed maps are also expensive. The production process in client work often requires many revisions, a time-consuming process. In the context of professional cartography and graphic design, which operates by billable hours, time really is money. Getting lettering 'right', as students of cartography quickly learn, remains a time-consuming process.

6.5 *Art**

The key word *art** had 483 concordances with six POSs: *art nn* (293/483; 61.0%), *arts nns* (46/483; 9.5%), *artistry nn* (4/483; 0.8%), *artful jj* (2/483; 0.4%), *artistically rb* (12/483; 2.5%), and *artistic jj* (126/483; 26.1%). Overall, reference to *art** declines after Imhof (1982 [1965]), except for Cuff and Mattson (1982), an outlier I discuss in this section. *Art nn* peaked in usage during the Robinson Era, reflecting the use of *art nn* as a trade or technical term. The use of *art nn* as a technical term sharply dropped off after 2009, replaced by uses of *artistic jj* (Figure 6.15).

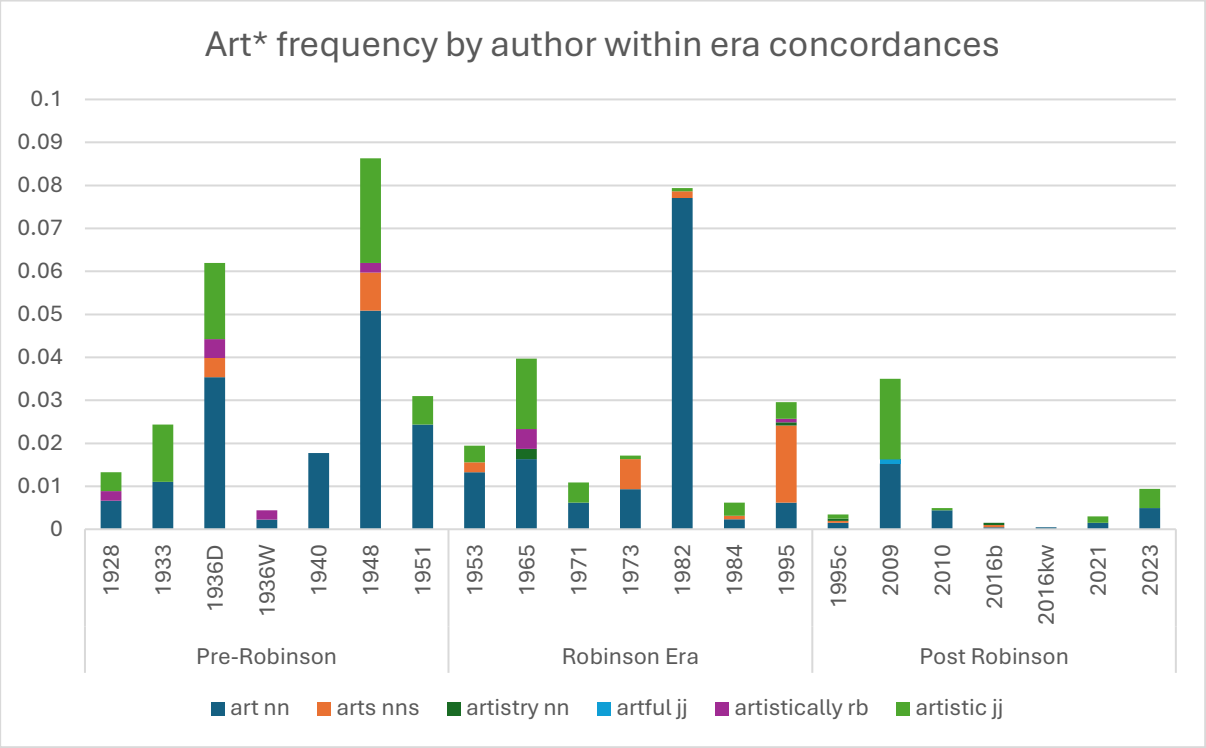


Figure 6.15 *art** frequency by author within era concordances.

The concordances of *art** revealed several unexpected patterns. Even though cartography was not yet citing graphic design literature in its textbooks (and until Raisz 1948, corpus authors only had very informal citations, if any) graphic design already was beginning to appear in cartography, first attested in Deetz (1936) through the terms *graphic art* and *graphic arts* industry and *graphic art / graphic arts* repeat through every era in the corpus. Furthermore, *pieces of art, works of art*, and *art of cartography* also appear in every era of the corpus (Table 6.14).

The two most common phrases appearing in the Pre-Robinson Era were *artistic map* (4/108; 3.7%) and *artistic effects* (4/108; 3.7%). I discuss both in this overview, along with the longstanding debate over whether cartography is an art or a science.

Art Noun Phrase			Stats		Attestations in Pre-Robinson Era						
Mod L	Form	Mod R	#	%	1928	1933	1936 d	1936 w	1940	1948	1951
science and	**art**		3	2.8			1			1	1
cartographic	**art**		2	1.9						2	
cartographer's	**art**		2	1.9						2	
whole	**art**		2	1.9		1			1		
	art	of [map-making]	2	1.9					1	1	1
	art	of carto-graphic	2	1.9						2	
	art	of [survey]	3	2.8		1			2		
	art	of [engraving]	2	1.9			1			1	
decorative	**art**		2	1.9			1			1	
cherished	**art**		1	0.9						1	
complex	**art**		1	0.9						1	
contemporary	**art**	and architecture	1	0.9						1	
difficult	**art**		1	0.9		1					
useful and entertaining	**art**		1	0.9					1		
graphic	**art**		1	0.9			1				
pieces of	**art**		1	0.9						1	
works of	**art**		1	0.9			1				
many-sided	**art**		1	0.9			1				
mapmaking	**art**		1	0.9						1	
occult	**art**		1	0.9					1		
topographic	**art**		1	0.9						1	
	art	of cart-ography	1	0.9			1				
	art	and science	1	0.9			1				
	art	and advertising	1	0.9						1	
	art	and literature	1	0.9		1					
	art	gum	1	0.9							1
	art	supply	1	0.9							1
	art	of hachuring	1	0.9						1	
	artistic	map(s)	4	3.7						3	1
	artistic	effect(s)	4	3.7	1		3				
	artistic	appearance	3	2.8		1	1			1	
	artistic	judgment	2	1.9		1				1	
	artistic	ability	2	1.9						2	
	artistic	side	2	1.9		1	1				

	artistic	touch	2	1.9			1			1	
little	**artistic**	merit	1	0.9		1					
	artistic	success	1	0.9		1					
	artistic	drawing	1	0.9	1						
	arts	and sciences	2	1.9			1			1	
graphic	**arts**	industry	1	0.9			1				
fine	**arts**		1	0.9						1	
finer	**arts**		1	0.9						1	
	artistically	added	1	0.9	1						
	artistically	placed	1	0.9			1				
	artistically	delineated	1	0.9						1	
technically and	**artistically**		1	0.9			1				
poor	**artistically**		1	0.9				1			

Table 6.14 *art** noun phrases in the Pre-Robinson Era. Yellow highlights appear in the Robinson or Post Robinson Eras, but not both. Orange highlights appear in all eras. Underlined phrase shows meaning change in Robinson Era.

By the start of the corpus, cartographic textbooks *already* had sequestered art to the doing of cartography—what today is referred to as the mapmaking or cartographic design process—rather than to the final cartographic product (i.e., the map). Thus, *prior* to Robinson (1952)'s challenge of art in cartography, *The Look of Maps*, the place of art in cartography *already* is substantially in the creation process. So long as the map contained science—which was mostly a given assumption, as all Pre-Robinson Era works prior to Raisz (1948) and Greenhood (1951) discussed surveying (5/7 of Pre-Robinson Era authors; 71.4%)—art and drafting were welcome backgrounds for cartographers and artistic skill was noted to sometimes accompany scientific or engineering skill.

Art appears in verb and gerund phrases (vv, vvg) relating to the doing of cartography (23/67; 34.3%). The most commonly used phrases include *art of mapmaking* (3/67; 4.5%) *art of [survey]* (3/67; 4.5%), *art of [engraving]* (2/67; 3.0%) as well as phrases like *art of contour sketching* (Beaman 1928), *art of hachuring* (Raisz 1948), *and science and art of measuring* (Greenhood 1951). Likewise, *artistically rb* is used with verbs relating to the doing of cartography, such as *artistically added*

(Beaman 1928), *artistically placed* (Deetz 1936), and *artistically delineated* (Raisz 1948). These usages associate cartographic skill as an art.

Third, the association of cartography with science is strongly present in the Pre-Robinson Era. This finding was not a surprise, since other authors already had been making such claims, such as Eckert (1907) in *Die Kartographie als Wissenschaft*, which eventually lead to the publication of his primary theoretical work known for this argument, *Die Kartenwissenschaft* in 1925 (Ostrowski 2008). Deetz (1936), Winterbotham (1936), Debenham (1940), and Raisz (1948) follow this trend, referring to cartography, mapmaking, or important maps as science and art (Table 6.15).

Author	Concordance
Deetz (1936)	Cartography may be defined as the science and art of expressing graphically, by means of maps and charts, our knowledge of the earth's surface and its varied features (Deetz 1936, 1).
Winterbotham (1936)	"[. . .] I think it would produce but an imperfect representation of the country and the public have a right to expect that the national map shall be a triumph of art as well as of science." (Winterbotham 1936, 100; quoting Major Larcom on the need for hachures to accompany contours)
Debenham (1940)	So, for these reasons, besides others, there is justification for the sketching in of detail by estimation, and it is in this aspect that the making of maps becomes an art rather than a science (Debenham 1940, 6).
Raisz (1948)	The production of maps is bound to grow the growth of the population and its interest and activities; yet when we look for literature on the science and art of map making, we find that surprisingly little has been written (Raisz 1948, vii).

Table 6.15 attestations of cartography, mapmaking, or important maps as science and art.

Among authors, Raisz (1948) most closely associated cartography with art. By share of era concordances, he refers to *art** more than any other author in the corpus. However, it should be noted that for Raisz, science generally comes before art in mapmaking. Raisz' section headers (removed from analysis) explicitly refer to *cartography: Science and Art*. He also places scientific skill ahead of artistic skill:

> The cartographer is both a scientist and an artist [. . .] a cartographer is 50 per cent geographer, 30 per cent artist, 10 per cent mathematician, and 10 per cent everything else (Raisz 1948 xii-xiii).

In the Pre-Robinson Era, the skillset of the cartographer and the artist are viewed as distinct but related to one another, a pattern mirrored in the background of the writers. Winterbotham (1936), Debenham (1940), Raisz (1948), and Greenhood (1951) all had a background in art, and as engineers, Beaman (1928) and Deetz (1936) had extensive training in technical drawing, which they applied to their topographical work. Thus, when Deetz writes that cartographers have "attained prominence in other engineering pursuits as well as in the world of art" he describes the state of affairs in Pre-Robinson Era cartography. Because these skillsets go together, there is not an overt hostility towards art in this era, even if cartography is identified as more than just art.

Relatedly, *artistic judgment* (2/30; 6.7%) found in Hinks (1933) and Raisz (1948) refers to functional considerations in what today we would call part of design (Table 6.16)

Author	Concordance
Hinks (1933)	To make full use of the possibilities [in lettering variation] requires, however, a higher standard of draughtsmanship than is easily required: and when the necessary skill is reached, there remains the more exacting requirement of artistic judgment in selecting the appropriate size of lettering, of spacing out, and of placing so that the map is a harmonious composition (Hinks 1933, 46).
Raisz (1948)	[The cartographer] must have a thorough understanding of his subject and model, the Earth. In representing it in different ways he must omit more or less, according to the scale and purpose of his map. This means that he must have the ability to generalize intelligently and to make a correct selection of the essential features to be shown. These features are represented by lines, patterns, and colors ,the effective use of which requires more than knowledge of the subject—it requires artistic judgment.
Table 6.16 attestations of artistic judgment.	

However, *artistic effects* are spoken of neutrally or negatively. Beaman (1928) delivers a warning to the cartographer to "beware of wasting time and effort on artistic effects or excessive refinement" when contracting with an engraver (Beaman 1928, 278). Deetz (1936, 79) advises not to put "special attention [on] artistic effect" when compiling a map in progress, which resonates with modern production processes, in which finishing design work comes at the end, rather than the beginning.

Towards the end of the Pre-Robinson Era, art in cartography is more directly policed (Table 6.17). Raisz (1948) has mixed opinions of *artistic maps*. If done by a trained cartographer, he approves. If by an artist, he is suspicious that the map will not be functional, as is Greenhood (1951).

Author	Concordance
Raisz (1948)	The artistic maps of the Royal Geographical Society in London have also created a style which is now widely imitated in England (Raisz 1948, 223).
Raisz (1948)	[Artistic maps] are fairly common in newspapers and periodicals and in the pamphlets of travel agencies. Unfortunately, they are made by artists and not by cartographers, and by their single desire to appeal to the eye they often violate every rule of good cartography. Most of these maps are decorated with pictures or, more correctly, consist of a set of small pictures placed according to their location on a very generalized map, the pictures being often more important than the map (Raisz1948, 223)
Raisz (1948)	The decoration of maps with pictures is an age-old custom, and the medieval maps especially were full of them. This custom gradually died out in the eighteenth and nineteenth centuries and only recently has it been revived in artistic maps (Raisz 1948, 223).
Greenhood (1951)	[. . .] when the plane lands we know the place at once by the Washington Monument, which is now used as a map symbol. All because nothing competes with anything else in the map for our attention. This is a long way from those supposedly "artistic" maps which are no more than mere outlines cluttered up with "Ye Olde Towne Pump" and "Here Ye Game of Golf Is Played" and the like, until, even though the elements purport to be there for aiding us in location, we are more lost and confused than ever. (Greenhood 1951, 171).

Table 6.17 attestations of cartography, mapmaking, or important maps as science and art.

Deetz (1936) summarizes the prevailing attitude respecting art, but prioritizing scientific accuracy:

> While the artistic side of cartography is a heritage transmitted from the nineteenth century and should not be disdained, we should ever keep foremost in mind, and in an ordered fashion, depict the scientific side of the product so as not to give out a dream of our imagination but a faithful portrayal of the area charted.

*Art** in the Robinson Era comprises 260/480 usages, or 54.2% of all attestations. Even though Robinson rejects the place of art in cartography, the term increases in usage because of technological change. The cartographer becomes responsible for all aspects of the map production process. As technology develops, particularly photomechanical processes, new terms are needed to describe them (Table 6.18). Thus, towards the second half of the Robinson Era, a very large number of new terms emerge, with the most common terms being *art work* (82/260; 31.5%; Table

6.15) and *graphic arts* (36/260; 13.8%; Table 6.16). *Pieces of art* (7/260; 2.7%), *fine art* (6/260; 2.3) *art supply* (6/260; 2.3%), *original art* (2/260; 0.8%), *finished art* (2/260; 0.8%), and *line art* (2/260) also are technical terms found in the corpus.

Art Noun Phrase			Stats		Attestations in Robinson Era						
Mod L	Form	Mod R	#	%	1953	1965	1971	1973	1982	1984	1995
	art	work	82	31.5		1		2	79		
camera ready	**art**		10	3.4					10		
positive	**art**		7	2.7					7		
piece(s) of	**art**		7	2.7					7		
	art	and science	7	2.7	5	1				1	
	art	supply	6	2.3					6		
fine	**art**		6	2.3			2	4			
	art	of cart-ography	4	1.5	2		1	1			
negative	**art**		3	1.1					4		
	art	form	3	1.1				1			2
work(s) of	**art**		3	1.1	1	2					
finished	**art**		2	0.8					2		
graphic	**art**		2	0.8		2					
line	**art**		2	0.8							2
original	**art**		2	0.8					2		
science or	**art**		2	0.8	1		1				
	art	paper	2	0.8							
	art	itself	1	0.4							
aesthetic	**art**		1	0.4							1
ancient	**art**		1	0.4	1						
artist and	**art**	philosopher	1	0.4		1					
commercial	**art**	practice	1	0.4				1			
principles of	**art**		1	0.4				1			
complex	**art**		1	0.4	1						
original	**art**		1	0.4					1		
creative	**art**		1	0.4	1						
high	**art**		1	0.4	1						
intellectual	**art**		1	0.4	1						
poor	**art**		1	0.4		1					
standard	**art**	term	1	0.4							1
	artistic	talent(s)	6	2.3	1	4					1
	artistic	ability(ies)	5	1.9	1	1	1	1		1	
	artistic	skill	2	0.8			2				
	artistic	sensitivity	2	0.8		1	1				
strong	**artistic**		2	0.8		2					

	artistic	principles	2	0.8	**1**					**1**	
	artistic	sensibility	1	0.4						**1**	
	artistic	touch		0.4		**1**					
graphic and	**artistic**	quality	1	0.4		**1**					
great skill and	**artistic**	ability	1	0.4				**1**			
realistic and	**artistic**	appearance	1	0.4			**1**				
free	**artistic**	interpret-ation	1	0.4		**1**					
graphic	**arts**		36	13.8	**3**			**9**	**2**	**1**	**22**
visual	**arts**		1	0.4	**1**						
scientific	**artistry**		1	0.4		**1**					
cartographic	**artistry**		1	0.4		**1**					
skill and	**artistry**		1	0.4							**1**
	artistry	and drafts-manship	1	0.4		**1**					
technically and	**artistically**		1	0.4		**1**					
	artistically	stimulating	1	0.4		**1**					
	artistically	gifted person	1	0.4		**1**					

Table 6.18 *art** noun phrases in the Robinson Era. Yellow highlighted phrases also appear in either the Pre-Robinson or Post Robinson Era, but not both. Orange highlighted phrases appear in all eras. Underlined phrase shows meaning change through "and" turning to "or".

Art work, found in Cuff and Mattson (1982; Table 6.19) is used to refer to the physical objects containing linework combined to make the map:

> The trade term art work (or simply "the art" is applied to the piece or pieces that leave the drafting table and go to photography, or possibly to plate making without need for a photographic negative. The term, camera-ready, is not ideal for the purpose, because the art work used for separations is also ready for the camera. (Cuff and Mattson 1982, 132)

Today, these objects are digital *layers* within GIS and graphics programs like Adobe Illustrator. The term *art work* gives a snapshot of map reproduction before the transition to digital cartography.

Art Work Noun Phrase			Attestations in Robinson Era						
Mod L		**Mod R**	**1953**	**1965**	**1971**	**1973**	**1982**	**1984**	**1995**
	art work						**45**		
positive	**art work**						**5**		
camera-ready	**art work**						**5**		
negative	**art work**						**4**		
piece(s) of	**art work**						**4**		
fine	**art work**					**2**			
finished	**art work**						**2**		

the cart-ographer's	**art work**						**2**		
large	**art work**						**1**		
original	**art work**						**1**		
poor	**art work**			**1**					
preprinted	**art work**	materials					**1**		
satisfactory	**art work**						**1**		
single-piece	**art work**						**1**		
transparent	**art work**						**1**		
	art work	features					**1**		
	art work	image					**1**		
	art work	itself					**1**		
	art work	scale					**1**		

Table 6.19 Noun Phrases produced by Art Work

Graphic Arts Noun Phrase			Attestations in Robinson Era						
Mod L		**Mod R**	**1953**	**1965**	**1971**	**1973**	**1982**	**1984**	**1995**
	graphic arts		**1**			**6**			
	graphic arts	photography							**7**
	graphic arts	industry							**4**
	graphic arts	materials							**2**
	graphic arts	film						**1**	**1**
	graphic arts	applications						**1**	
normal commercial	**graphic arts**	applications				**1**			
high quality	**graphic arts**	camera							**1**
high quality	**graphic arts**	industry							**1**
precision	**graphic arts**	photography							**1**
principal	**graphic arts**	products							**1**
process	**graphic arts**	cameras and emulsions							**1**
generic	**graphic arts**	software							**1**
mathematics and	**graphic arts**		**1**						
	graphic arts	and printing industries							**1**
	graphic arts	processes					**1**		
	graphic arts	reproduction				**3**			
	graphic arts	supplies							**1**
	graphic arts	camera							**1**

Table 6.20 Noun Phrases produced by graphic arts

Likewise, *graphic arts* gives a window into the intersection between graphic design and cartography at the time (Table 6.20).

Like *art work*, many of the technologies are now completed with computers. Most attestations of *graphic arts* comes from Robinson, Morrison, Muehrcke, and others (1995; 23/36; 64.0%) including the first attestation of design software: *graphic arts software*. Additional attestations of *graphic arts*, *graphic arts film*, and *graphic arts reproduction* come from Keates (1973; 10/36; 27.8%). The first references in the era, *graphic arts* and *mathematics and graphic arts* were from Robinson (1953; 2/260; 0.8%) himself.

Robinson, of course, was critical of the place of art in cartography, but like many authors, his writing showed mixed opinions—both decidedly in favor of cartography being art, and yet careful to qualify any association of cartography with art. Robinson (1953) and Keates (1971) emphasizes communication, to which Imhof (1982[1965]) and Robinson, Morrison, Muehrcke, and others (1995) add restraint. Monkhouse and Wilkinson (1971) and Campbell (1984) do not weigh in on the debate, other than to describe cartography as an art and a science (Table 6.21), a definition that had been adopted by the International Cartographic Association during the early 1970s.

Curiously, Robinson, Morrison, Muehrcke, and others (1995) provide a positive, if somewhat metaphysical endorsement of cubism in a sidenote:

> This use of multiple vantage points in mapping predates cubism in the aesthetic arts. Although cubism is treated with considerable skepticism, the practice does take advantage of the liberating nature of representational technique. This freeing of expression from the constraints of our physical being has great creative power and probably deserves broader recognition in both art and cartography. (Robinson, Morrison, Muehrcke, and others 1995, 337).

Cubism may seem an unlikely match for cartography. However, cubism integrates text and symbols in art, particularly symbols recognizable to the public (Varanka and Krygier 2016), and places emphasis on abstract representation rather than resemblance. In that respect, the interest of Robinson, Morrison, Muehrcke and others (1995) is logical, if unexpected.

Author	Concordance
Robinson (1953)	Cartography, according to the late Max Eckert, the great German cartographer, is a mixture of science and art. It is concerned on the one hand with problems of exactitude susceptible of precise treatment and varying according to the laws of mathematics and geometry. On the other hand, a map is made to be looked at, and in this respect it is one of the visual arts (Robinson 1953, v).
Robinson (1953)	The question is frequently raised as to whether cartography is a legitimate branch of art and what function artistic talent plays in the making of a map. Prior to the last century the question never arose for cartography was very definitely an art. [. . .] Most maps are functional in that they are designed, like a bridge of house, for a purpose. Their primary purpose is to "get across" a concept or relationship, it is not to serve as adornment for an office wall. As a matter of fact, if a map is made too much of a work of art, it is very likely that the viewer will be stimulated first by its beauty and will fail to see the concept (Robinson 1953, 12-13).
Imhof (1965)	The map is a graphic creation. Even when it is so highly conditioned by scientific purpose, it cannot escape graphic laws. In other fields, art and science may take different pathways. In the realms of cartography, however, they go hand in hand. A map will only be evaluated as good in the scientific and didactic sense when it sets forth simply and clearly what its maker wishes to express (Imhof 1982[1965]. 73)
Imhof (1965)	Certainly it is not the function of cartography to create art in the higher sense of the word: the cartographer has scarcely the opportunity of doing so. Art presupposes the widest ranging freedom of form and structure, whereas cartographers are confined to the smallest details by topographical survey, statistical figures, standardization of symbolization and color, and what is essentially a non artistic purpose (Imhof 1982[1965], 359).
Monkhouse and Wilkinson (1971)	During the decade that has elapsed since the original publication of Maps and Diagrams, while the main principles and tenets have held good, the science and art of cartography have progressed (Monkhouse and Wilkinson 1971, xiii).
Keates (1973)	The principle objective here is to demonstrate how the map image is devised to convey information, and to show that this should be done through a systematic use of the graphic language. Although this can be regarded as the 'art' of cartography, its principles can be learned, just as the principles of any other art can be mastered by study and application (Keates 1973, xi).
Campbell (1984)	This book is about *cartography*, the art and science of making maps.
Robinson, Morrison, Muehrcke, and others (1995)	Cartography does not qualify as an aesthetic art form like painting, music, fiction or dance. Unless a map bears strong fidelity to reality, the purpose of mapping will not be served. The functionalism of cartography, together with the limitations imposed by external controls on the mapping process put too many constraints on the cartographer to allow "full freedom of expression" (Robinson, Morrison, Muehrcke, and others 1995, 317).
Table 6.22 attestations of cartography, mapmaking, or important maps as science and art.	

Artistic talent (6/260; 2.3%) is discussed by Robinson (1953; 1/260; 0.4%), Imhof (1982 [1965]); 4/260; 1.5%), and Robinson, Morrison, Muehrcke, and others (1995; 1/260; 0.4%). Robinson (1953) brings up *artistic talent* in cartography as a historic concern centering around technical skills, such as "fine pen and brush skill" (Robinson 1953, 13). However, Robinson's aim is

to emphasize that vulgar assumptions regarding *artistic talent* (i.e., that artistic talent is something one is born with, rather than developed) do not apply to cartography. Robinson writes:

> Today a great many people still think of cartography as being an artistic calling, and it is likely that a considerable number of otherwise intelligent students shy away from it for fear they are "not artistic." Good judgment, based on principles, is the major requirement of design in cartography, and such judgment may easily be acquired by training. (Robinson 1953: 13)

What Robinson describes is a growth-based mindset and, importantly, a cartographic aesthetic judgment.

Interestingly *clip-art* is introduced as a technical term in Robinson, Morrison, Muehrcke, and others (1995) to describe raster images and a certain type of simplistic map (Table 6.23). *Clip-art* reappears as much more common noun phrase in the Post-Robinson Era under its contemporary digital meaning of pre-processed, generic visual material.

Clip art concordances
Bit-mapped patterns are available from a variety of sources in a form called clip-art. The term clip-art has come to mean any raster image, either scanned or mathematically specified, that can be used as a cell or entire image in a computer graphics program (Robinson, Morrison, Muehrcke, and others 1995, 374).
Outline and base maps are now widely marketed as clip-art. After you select a clip-art map, it is "cut" from the database and "pasted" to the screen. (Figure 31.2). You can send these maps to a printer "as is" for reproduction. Or you can tailor the map design on screen to suit your specific needs. Before sending the map on for reproduction, you can add or delete features, change color and other symbols, and modify the size and style of type. [. . .] But collections of "cut-and-paste" maps are still too limited for most professional cartographers. (Robinson, Morrison, Muehrcke, and others 1995, 589).
Table 6.23 *clip art* in Robinson, Morrison, Muehrcke, and others (1995).

By the Post-Robinson Era, *art** is used much less frequently, accounting for 115/480 (23.9%) of total art concordances in the corpus. The most common usages involve software supporting the map creation process (29/115; 25.2%), though how to refer to such software still is not settled by 2009, with labels including *artistic software* (11/115; 9.6%), *artistic design software* (4/115; 3.5%) and *artistic drawing* (software or packages) (17/115; 14.8%; Table 6.24).

Art Noun Phrase			Stats		Attestations in Post Robinson Era						
Mod L	Form	Mod R	#	%	1995	2009	2010	2016 b	2016 kw	2021	2023
clip	**art**		6	5.2		4					2
works(s) of	**art**		3	2.6		1	2				
	art	of cartography	3	2.6		3					
	art	or process	3	2.6							3
piece(s) of	**art**		2	1.7		2					
	art	in cartography	2	1.7		2					
final	**art**		1	0.9		1					
graphic	**art**		1	0.9		1					
map design research and	**art**		1	0.9							1
nature and	**art**		1	0.9			1				
original	**art**	form	1	0.9		1					
reproducing	**art**	and cartography products	1	0.9		1					
language of	**art**		1	0.9				1			
principles of	**art**		1	0.9		1					
product of	**art**		1	0.9						1	
title and cover	**art**		1	0.9							1
	art	deco period	1	0.9			1				
	art	editor	1	0.9			1				
	art	museum	1	0.9		1					
	art	or as science	1	0.9		1					
	art	and advertising	1	0.9		1					
	artistic	drawing	17	14.8		17					
	artistic	software	11	9.6		11					
	artistic	design	4	3.5		4					
	artistic	aspects of/a map(s)	2	1.7							2
	artistic	display(s)	2	1.7		1	1				
	artistic	skills	1	0.9							2
	artistic	work	1	0.9						2	
	artistic	sensibility	1	0.9							1
personal	**artistic**	creation	1	0.9						1	
	artistic	style	1	0.9							1
	artistic	exploration	1	0.9							1
graphic	**arts**		2	1.7	1			1			
	artful	blending	2	1.7		2					

Table 6.24 Art* noun phrases in the Post-Robinson Era. Yellow highlighted phrases appear in the Robinson Era. Orange highlighted phrases appear in all eras. Not all noun phrases selected for inclusion.

Clip art is among the most common art phrases found in the Post-Robinson Era (6/115; 5.2%; Table 6.14). In the Post-Robinson Era, *clip art* has become kitschy, as well as found a place in the development of symbols for use on maps (Table 6.17).

Author	Concordance
Dent, Torguson, and Hodler (2009)	Two other capabilities add to the GIF's usefulness. First, the GIF format can also be used for short animation sequences. Although this capability is often associated with clip art that often clutters many Web pages, the format can be useful for making animated maps, usually of shorter duration (Dent, Torguson, and Hodler 2009, 285).
Dent, Torguson, and Hodler (2009)	Clip art and other sources of pictorial symbols have widened the options of the cartographer significantly. (Dent, Torguson, and Hodler 71).
Dent, Torguson, and Hodler (2009)	The use of clip art for patterns provides the cartographer with a large variety of symbol options that can be used in area symbols. (Dent, Torguson, and Hodler 74).
Dent, Torguson, and Hodler (2009)	Pictorial symbols, also called pictographic, mimetic, or replicative symbols, are increasing in use for proportional symbol maps. This is due both to widespread availability of digital artwork (that is, clip art), and the ease with which the artwork can be imported into GIS and other software packages. Maps so produced are usually attention grabbing for the map reader and introduce an element of fun for the map designer. (Dent, Torguson, and Hodler, 135).
Slocum, McMaster, Kessler, and others (2023)	Alternatively, one can find numerous pictographic symbols already in digital form in **clip art** files. (Slocum, McMaster, Kessler, and others 2023, 331)
Slocum, McMaster, Kessler, and others (2023)	**clip art:** pictures that are available in a digital format; such pictures can serve as the basis for creating pictographic symbols (Slocum, McMaster, Kessler, and others 2023, 553).
Table 6.17 *clip art* concordances in the Post-Robinson Era.	

These kitsch meanings suggest the distance of art from cartography. Four uses of *art** in the Post-Robinson Era even have scare quotes (Table 6.18).

Author	Concordance
Clarke (1995)	Although programming has been around for many years, only recently has "software engineering," the application of engineering and computer principles to the act of programming, turned the "art" of computer programming into more of a science.
Dent, Torguson, and Hodler (2009)	High end drawing programs usually have the excellent text and color management capabilities and provide a greater number of artistic tools in which to practice the "art" in cartography.
Dent, Torguson, and Hodler (2009)	John S. Keates, a British cartographer, remarked, "The 'art' of cartography... is not simply an anachronism surviving from some prescientific era; it is an integral part of the cartographic process" (Keates 1982, 127).
Slocum, McMaster, Kessler, and others (2023)	Although most map design research represents a scientific approach to understanding how maps work, the "art" of maps also plays an important role in cartographic communication.
Table 6.18 *Art nn* as "art" (scare quotes).	

Despite the scare quotes, the debate of whether cartography is a science or art is much less contested in the Post-Robinson Era, as *art** no longer is presented as a threat to science or functionalism. Instead, *art** simply is an established part of the production process, as artistic software is used *after* a student has first used a GIS program to construct the map. Thus, the map creation process itself contains *art**, but to get to the 'art' in cartography, one must first complete the scientific part of mapmaking first using a GIS. Thus, to find the 'art' in cartography, one must first follow cartography's scientific design epistemology. All works in the Post-Robinson Era assume that students are using GIS programs to produce maps, rather than any other map production technique.

Given that GIS is now *de rigueur*, there are no longer fears in the Post-Robinson Era that cartography is not a science. Further, fears of cartography's demise in the Post-Robinson Era also are dissipating. After all, by the middle of the Post-Robinson Era, cartography already had staked its disciplinary claim to *design process*—perhaps, more tellingly, with the added *cartographic design process*.

Thus, having established its scientific and technological identity, it seems that by the publication of *Thematic Cartography and Geovisualization 4E* (Slocum, McMaster, Kessler and others, 2024) Cartography is no longer worried about art. But what has been lost, leading to this passive acceptance of art? Students who come to cartography in the Post-Robinson Era are no longer from art programs as they were in the past when drafting and manual techniques were important to the map production process. Instead, GIScientists and others in computer science and technology enter the field, signposted by Clarke's (1995) *Analytical and Computer Technology 2E*, continuing with the development of dynamic maps and web mapping. These new fields brought important new perspectives to cartography, including perspectives on how to make better maps.

Without students already exposed to these ideas, and with the memory of manual techniques slipping further from practice, the other noun phrases appearing with *art** start making sense, such as *art of cartography* (rather than art in cartography), *art museum*, and *making maps as art* (Krygier and Wood 2016). These uses not only suggest distance, but something lost, that cartographers might want to seek out, through visiting an *art museum*, through making *maps as art*, through studying the art of cartography with which they are no longer assumed to be familiar.

6.6 Conclusions

Several broad patterns emerged from my analysis in Chapter 6. First, *aesthetic** increased in usage, but its usages became more general, referring to evaluation using elements that had been lost from *beauty**, the subjectivity from *taste**, and may have captured something lost from the transition away from manual production process. Hedonic grounds usually were considered acceptable reasons to act aesthetically if derived from experimentation. If not, then *aesthetic** is used in a general sense instead of providing reasons to act.

*Beauty** had been used in an evaluative sense in the Pre-Robinson Era, however, during the Robinson Era, *beauty* and *taste* were no longer acceptable reasons to justify design decisions. Secondly, the split between Imhof (1982[1965]) and Robinson (1953) may be less of an outlier than apparent in the corpus. For the split also represents the divergence between terrain representation and other, more general types of cartography. Robinsonian design epistemology transitions away from terrain representation. *Elements of Cartography* (1953) contains extensive description, but directs the student to other resources for instruction, a trend that largely continues throughout the Robinson and Post-Robinson Eras.

Although the place of art in cartography was questioned during the Robinson Era through the debate over cartography's status as an art or science, *art** became relegated to the end of the

map creation process because of technological change in cartography that forced the ‘science’ in cartography to happen first using GIS. Although the debate continues, the technological changes in cartography seem to have made art less threatening through placing it in a confined area where its subjectivities can be managed.

The next chapter covers the last key word, *style*,* which is heavily involved in another controversial part of cartography: typography.

Chapter 7: *style**

7.1 Introduction

Aesthetics as the 'look and feel' of a map often is used synonymously with *style**. *Style** is a practical word in the sense that cartographic textbooks teach stylistic conventions and traditions. Within cartography, these conventions and traditions often concern the use of type. Style* can refer to an individual act of choice, such as the choice of a typeface. However, style* often refers to the accumulation of such acts, which determine the appearance of a map as a whole. Thus, style * is holistic. In this holistic sense, a map's style refers to the aesthetic profile of its aesthetic domain. Different authors teach styles emphasized by aesthetic domains, particularly in the Pre-Robinson Era, such as Beaman (1928; USGS), Hinks (1933; Royal Geographic Society), Winterbotham (1936; Ordnance Survey), and Deetz (1936; USCGS).

There is little that cartographers enjoy critiquing more than aesthetic preferences on maps, and within the corpus there are strong views regarding *style**. Some of the arguments seem like they are inconsequential—not much seems to ride on the difference between a map which uses an *Old style typeface* versus a *Modern style typeface*, at least, not in the same way that there is a functional difference between a map of the contiguous United States that uses Albers Equal Area Conic versus Lambert Conformal Conic. The visual difference between the two projections may not be readily apparent to a map viewer, but cartographers understand that equal area projections are recommended for thematic maps.

And yet, such a choice does also have aesthetic implications, for not all aesthetic properties are perceptual. Sometimes Albers Equal Area Conic and Lambert Conformal Conic are visually indistinguishable. However, a footnote or metadata explaining which was used, and why, can communicate cartographic expertise. For a loose comparison, we might consider Andy Warhol's *Brillo Boxes*. Andy Warhol's *Brillo Box* is indistinct from an actual Brillo Box. However, one

was made by Andy Warhol, the other was mass produced. The thematic map using Albers Equal Area Conic conforms to the aesthetic profile of professional cartography in the way that the map using Lambert Conformal Conic will not, but the metadata is the only way to tell.

Thus, the difference between *Old Style typeface* and *Modern style typeface* is not as modest as it might seem, because different typefaces—and different visual variables—work together in different ways, producing different unified wholes. Style sheets, sometimes called specification sheets or branding guides, teach design elements that go together, forming the style of a mapping institution. USGS, for instance, has chosen Univers Condensed as its sans-serif for topographic mapping. Conversations about these matters are important discussions towards defining the identity of institutions, or in terms of the network theory, the *aesthetic profile* of each *aesthetic domain*. These conversations can and do intersect functional concerns. Which functions should the brand elevate? What are the brand's values? These are, in part, aesthetic questions related to the image the institution wants to put forth.

When there is strong disagreement regarding aesthetic matters, I discuss aesthetic disagreement as antagonism. These are arguments over the identity of cartography. Within this analysis, antagonisms emerged regarding lettering and typography in the Pre-Robinson and Post-Robinson Eras and hachuring in the Pre-Robinson and Robinson Eras. Antagonisms can indicate a split or schism developing within an aesthetic domain. I conclude the chapter with a discussion of the schisms and their relationship to cartographic scientific and technological aesthetics.

7.2 *Style** in the Pre-Robinson, Robinson and Post-Robinson Eras

*Style** decreases in frequency of use through the corpus, from one hundred and thirty-three usages in the Pre-Robinson Era (133/452; 29.4%) to two hundred seventy-five usages in the Robinson Era (275/1,285; 21.4%) to two hundred and twelve usages in the Post-Robinson Era

(212/2,030; 10.4%). However, *style** shows the most stability in meaning over every other key word, because *style** is used in reference to definitions from lettering and typography, outside bodies of knowledge with long traditions. Many attestations of *style** can be considered technical terms. The decline in *style** should be read instead as stability: the knowledge from lettering and typography does not change, and fewer new words are needed to describe it (Figure 7.1).

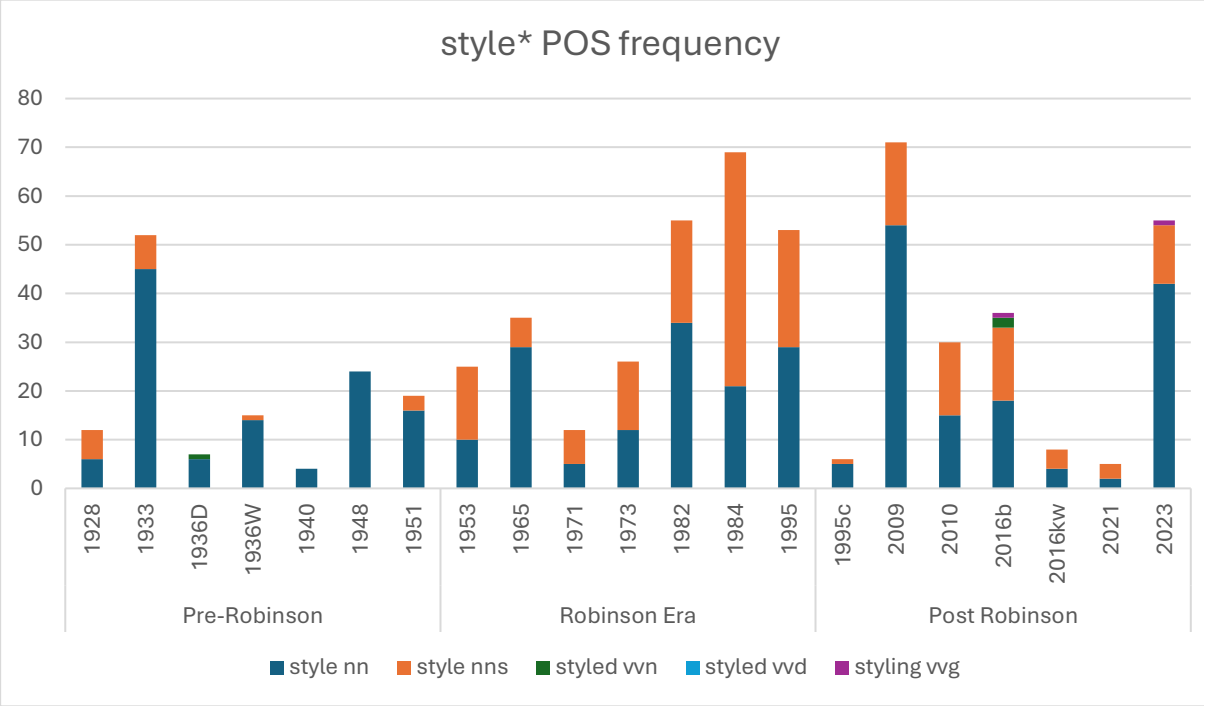


Figure 7.1 *style** key word frequency by POS.

However, just because the typographical reference become stable, does not mean that the cartographic epistemology in *style** attestations is stable. To study the changing meanings of *style**, I examine five categories of *style** attestations. The first category is ***aesthetic domain***. These usages indicate the existence of a particular aesthetic domain within cartography. An aesthetic domain signposts conventions and traditions that the map follows, and by which the map is to be evaluated. For example, there are different traditions and conventions that a *portolan map* follows, versus a map produced by the Ordnance Survey, USGS, Rand McNalley, or outside of cartography,

such as an experiential graphic design firm. Different aesthetic domains interact with and influence each other, and so aesthetic domains both overlap and intersect (Lopes 2018).

Different aesthetic domains produce different reasons for aesthetic actions. In this section, I discuss both ***reasons*** to act and ***aesthetic actions***, because *style*,* more than any other key word in my analysis, is an action word. Aesthetic actions are the choices that cartographers make when producing maps, such as using "inclined italic lettering for smaller features," (Raisz 1948, 133) to conform with the core aesthetic norms of the domain (in Raisz' example, 16th century Dutch cartography).

A good example of aesthetic actions can be found in the various styles and selections on a branding guide produced by an organization. Such a guide specifies the aesthetic decisions that a designer can make to conform with the identity of an organization. All the design specifications in these guides are considered aesthetic actions that designers should undertake to conform with the aesthetic profile of the organization. However, there are many other aesthetic actions that are *not* listed on such sheets which are still part of cartography's core aesthetic norms, such as general rules regarding the appropriate selection of projections. So aesthetic actions go beyond the list supplied by organizations to encompass countless norms and expectations.

Many aesthetic actions also intersect with nonaesthetic actions. So, a cartographer may be acting aesthetically to select a sans-serif typeface, but the cartographer may also be acting for other reasons, too. Perhaps the sans-serif selected is simply the one of the first typefaces alphabetically on the dropdown list, rather than the best choice aesthetically. Likewise, sometimes other non-aesthetic reasons may override a reason to act aesthetically, such as financial constraints or even the competing expectations of different aesthetic domains., e.g., an ocean sheet with little design that conforms to the expectations of USGS, because it follows the

conventions prescribed by the organization, but outside of that domain appears to have a pointless design devoid of variation (Figure 7.2)

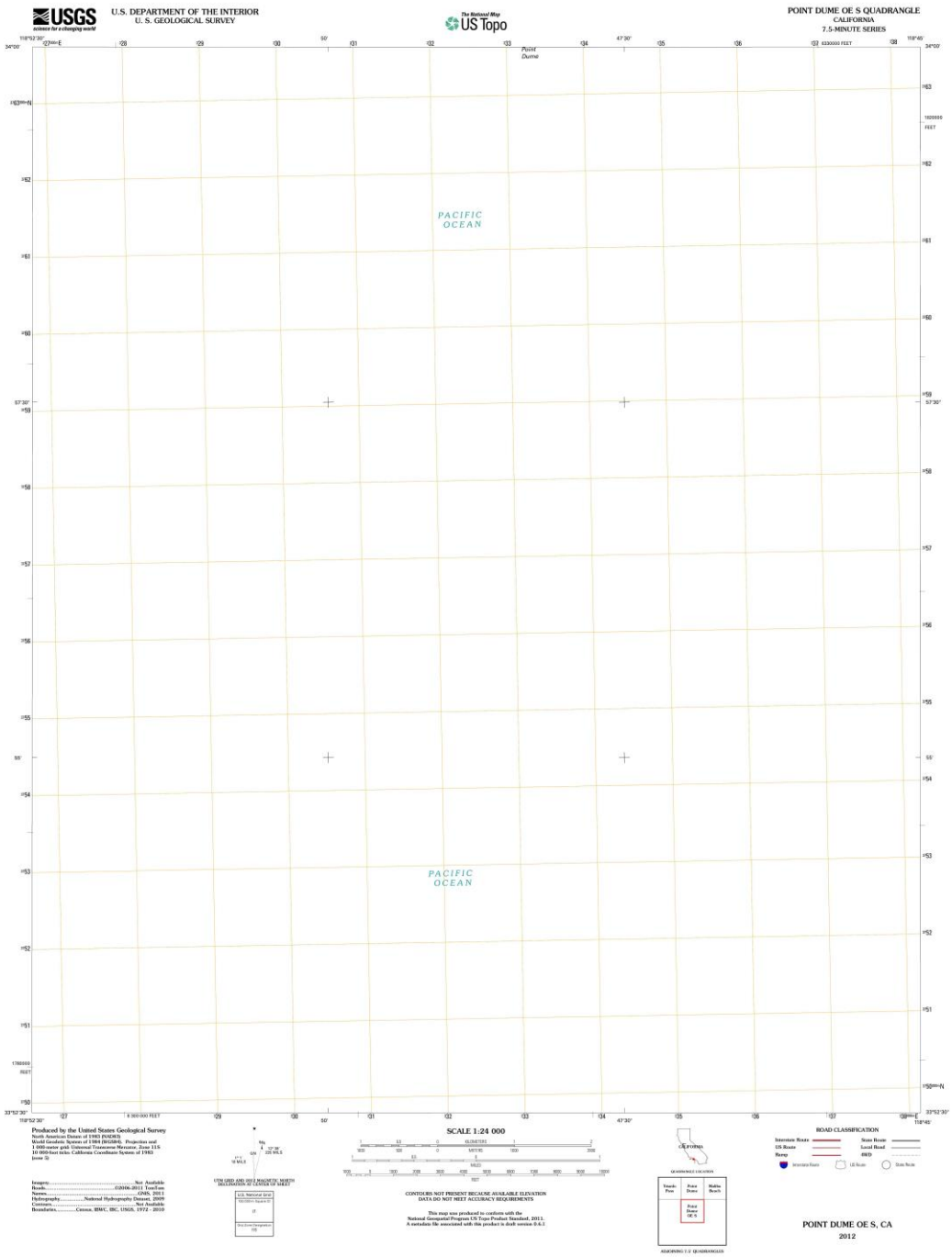


Figure 7.2 Point Dume. CA. 2012. 1:24,000. 24 x 29 in. A USGS Quadrangle showing only the Atlantic Ocean. Available at: https://ngmdb.usgs.gov/topoview/viewer/#13/34.0295/-118.8098

Because the corpus is of textbooks, aesthetic actions are prescribed to readers. That is, textbooks generally tell cartographers what aesthetic actions they *should* take. In that sense, most aesthetic actions are evaluative, because maps which do not comply are generally negatively evaluated. A minority of usages are not evaluative and simply list different options without judgment.

Some attestations of *style** give aesthetic verdicts, but they do not give a specific aesthetic action that a cartographer should take to make a good map. These attestations I categorize as ***evaluative.*** Although all evaluative attestations contribute to calibrating the aesthetic profile of cartography, ***antagonistic evaluations*** reference 'hot button' issues regarding the aesthetic profile of cartography. Thus, antagonistic attestations reflect strong aesthetic disagreement among cartographers. For example, a usage disparaging *modern style lettering* in favor of *old-style lettering* is an antagonistic attestation.

The last category of *style** attestations is ***aesthetic***. Although all attestations are aesthetic, this class uses language that connects directly to aesthetic concepts, typically experience. An example is "unity of style," first attested in Hinks (1933).

Unlike the other sections, I do not categorize each of the usages in the tables that follow, because of the overlap between categories. Many attestations would have three or even four categorizations, simply because of the interrelationships between aesthetic domains, aesthetic evaluations, reasons to act aesthetically, and aesthetic acts, especially given the length of the full 101-word concordances. Instead, I discuss the most relevant category to understanding the meaning of the *style** phrase and the contribution of the *style** phrase to cartography's aesthetic epistemology.

Within the Pre-Robinson Era, most usages of style reference lettering or typography. The most common noun phrases were *style(s) [of lettering]* (10/133; 7.5%), *same style* (4/133; 3.00%),

and *unity of style* (3/133; 2.3%). *Old style* (2/133; 1.5%), *style [of map]* (2/133; 1.5%), *various styles* (2/133; 1.5%), *different style* (1/133; 0.7%), *individual style* (1/133; 0.7%), and *styled* (1/133; 0.7%) repeat in either the Robinson or Post-Robinson Era. *Styles of type* (1/133; 0.7%), introduced by Beaman (1928), repeats across all eras.

style* **phrase**					**Attestations in Pre - Robinson Era**						
Mod L		**Mod R**	**#**	**%**	**1928**	**1933**	**1936d**	**1936 w**	**1940**	**1948**	**1951**
	style	of [lettering]	6	4.5	1	2			1	2	
same	**style**		5	3.8				2		3	
unity of	**style**		3	2.3		1	2				
	style	of / of the map	2	1.5		1				1	
best	**style**		2	1.5		2					
expensive	**style**		2	1.5		2					
new	**style**		2	1.5		1				1	
old	**style**		2	1.5		1		1			
portolan	**style**		2	1.5						2	
usual	**style**		2	1.5				1	1		
accepted	**style**		1	0.7			1				
attractive	**style**		1	0.7		1					
“caterpillar”	**style**		1	0.7							1
ugly compressed	**style**		1	0.7		1					
different	**style**		1	0.7		1					
Dufour	**style**		1	0.7							1
German Renaissance	**style**		1	0.7						1	
gothic	**style**		1	0.7						1	
individual	**style**		1	0.7							1
international	**style**		1	0.7				1			
mechanical	**style**		1	0.7		1					
ornamental	**style**		1	0.7						1	
present	**style**		1	0.7		1					
prewar	**style**		1	0.7						1	
quaint	**style**		1	0.7						1	
scale and	**style**		1	0.7						1	
similar	**style**		1	0.7		1					
single-stroke	**style**		1	0.7	1						
written	**style**		1	0.7							1
	style	of writing	1	0.7			1	1			
	style	of the International Map	2	1.5		2					

	styles	of [lettering]	4	3.0	**2**	**1**					**1**
various	**styles**		2	1.5		**2**					
	styles	of type	1	0.7	**1**						
purer	**styles**		1	0.7		**1**					
distinct	**styles**		1	0.7		**1**					
present	**styles**		1	0.7		**1**					
related	**styles**		1	0.7		**1**					
standard	**styles**		1	0.7	**1**						
	styled vvn		1	0.7			**1**				

Table 7.1 attestations of *style** in the Pre-Robinson Era.

Sample concordances from the most common noun phrase produced by *style*, style(s) of [lettering],* are reproduced in Table 7.2. These concordances are classified as domain, action, and antagonistic.

The domains referenced include USGS topographic maps (Beaman 1928), maps produced by scientists who are trained in cartography, but are not professional cartographers, and therefore, not held to the standard of professional cartographers (Debenham 1940), Dutch masters, including Mercator (Raisz 1948), and general cartographic practice (Hinks 1933, Greenhood 1951, and the very end of Raisz 1948).

Author	Concordance
Beaman (1928)	The style of hand lettering for plans and profiles should be as follows: stream names, slanting block, capitals or lower case as appropriate. Place names and topographic features, upright block, capitals or lower case as appropriate. Falls, rapids, eddies, dam sites, power plants, and ranger stations, slanting block capitals. (Beaman 1928, 351).
Debenham (1940)	He should not attempt to copy the style of lettering used in printed maps, which are built up with many strokes of the pen, but should adopt some style of written letters which are, in slope and formation, a reasonable approximation to his usual style of writing (Debenham 1940, 221).
Raisz (1948)	The style of lettering changed profoundly with the copper-cut maps of the Dutch masters. Mercator introduced the inclined italic lettering for smaller features and used a beautifully proportioned roman lettering for the larger letters. This lettering was still further perfected by his successors, and their style is imitated even now. (Raisz 1948, 133).
Hinks (1933)	While opinions may differ on the question of beauty, there can be no disputing the fact that present styles of map lettering are so expensive that few books are published with

	adequate maps. This is the strongest argument for a radical change in style, and the change must come by adopting a letter that can be drawn in single strokes of the pen, without elaborate building up, except for the largest names. There is here much room for study and experiment. (Hinks 1933, 47).
Greenhood (1951)	There are two forms of lettering everybody knows: upright, *slanted*. There are two ways of using each of these forms: ALL CAPITALS. Capitals with lower-case. This gives us four styles of lettering names on maps: ALL UPRIGHT CAPITALS *ALL SLANTED CAPITALS* Upright Capitals with lower-case *Slanted Capitals with lower-case*. A cartographer adopts some definite scheme for using these four styles to go with the different classes of map features, according to what he thinks is an order of importance. (Greenhood 1951, 172).
Table 7.2 Concordances of *style(s) of [lettering]*, Pre-Robinson Era	

Each aesthetic domain has actions that cartographers can take to conform with the aesthetic profile of that cartographic domain. These actions are listed explicitly in all concordances. Taking these actions increases the likelihood that the map lettering, and the map, will be evaluated positively within that domain.

For example, Raisz (1948) describes the aesthetic act of using "inclined italic lettering for smaller features" within the domain of 16th century Dutch cartography. Cartographers who used inclined italic lettering within the domain of 16th century Dutch cartography were more likely to make good maps. He also tells us that this aesthetic act continues to the time of his writing (1948), suggesting that these acts have formed a tradition within the larger domain of cartography.

Greenhood's (1951) description of *styles of lettering* provides a list of general aesthetic acts within the domain of cartography. However, these acts do not also correspond with an evaluation, other than an instruction for the cartographer to use these *styles* "according to what he thinks is an order of importance." (Greenhood 1951, 172).

Within the domain of USGS topographic maps, described by Beaman (1928) in *Topographic Instructions of the USGS*, the use of block (stump) is required on plan and profile maps. Stump is a form of lower-case serif, known for letters that show a sharp contrast between thick and thin (Figure

7.3). Beaman's usage describes domain and action, laying out what, specifically, a cartographer should do to produce good hand lettering on a topographic map according to the aesthetic domain of USGS. Importantly, the *Topographic Instructions of the USGS*, as a work, exists to standardize topographic mapping in USGS. So, all maps must conform to instructions to be "good."

Figure 7.3 Practice Strokes for Stump Letters. Reproduced from *Essentials of Lettering* (French and Meiklejohn 1912). Each letter requires two strokes for the shaded lines.

However, outside of the domain of USGS topographic maps, the use of stump becomes controversial during the Pre-Robinson Era. The fourth concordance on Table 7.2 is an antagonistic evaluation of map lettering by Hinks (1933), who explains that due to expense, maps produced using the "present styles of map lettering" are generally not of sufficient quality (Hinks 1933, 47). The *present styles of map lettering* that Hinks (1933) complains about in this concordance are copperplate styles, including the block (stump) to which Beaman (1928) refers.[27] Other text in Hinks (1933) inveighs against stump on aesthetic grounds, referring to stump as an "ugly sloping character" (Hinks 1933, 46). Therefore, for practical and aesthetic reasons, Hinks (1933) advocates a change in cartographic lettering style.

[27] Copperplate styles, and the possibility of developing a new lettering style for maps that improves on copperplate styles, had been debated hotly outside of the corpus by members of the Royal Geographic Society and the Ordnance Survey, including by corpus authors A.R. Hinks and H.S.L. Winterbotham (Hinks 1933, Winterbotham 1936). This debate was written up in a well-known paper by Withycombe (1928) *Lettering on Maps*.

Same style, the second most common noun phrase in the Pre-Robinson Era, also reveals aesthetic domains: the International Map (Winterbotham 1936), cartography (Winterbotham 1936), 16th Century Dutch cartography (Raisz 1948), and Rand McNally (Raisz 1948).

Author	Concordance
Winterbotham (1936)	Each country lays down the spelling of every place name within its own borders. Now that so many sheets have appeared it is beginning to be possible to make national sheets from them in exactly the same way as district sheets of the 1-inch followed the completion of the regular series. The Ordnance 1/M of Great Britain in two sheets is but the result of joining up the appropriate parts of seven international sheets. The more this principle is followed the better will other sheets of the same style be understood and used (Winterbotham 1936, 143).
Winterbotham (1936)	Supposing that all town and village names were in the same style and of the same size the map would look dreadful. On plans and maps therefore the names are carefully graded in importance and written in the style and size appropriate to the occasion (Winterbotham 1936, 28).
Raisz (1948)	The old Dutch cartographers of the seventeenth century were masters of producing well-balanced and beautifully composed sheets; a study of the maps by Janszoon and Blaeu is recommended, for we still use the same style in the make-up of our maps. (Raisz 1948, 144).
Raisz (1948)	The largest American atlas is the Rand McNally "Commercial Atlas," which reached its 77th edition in 1946. It weighs 20 pounds, is 21 by 15* inches, and is sold by subscription. It is primarily a reference atlas for businessmen of the United States with lesser emphasis on foreign countries of the world. Rand McNally publishes a number of smaller atlases for the general public in the same style but with some noteworthy addition of pages that are doubtlessly composed by geographers (Raisz 1948, 217).

Table 7.3 Attestations of *same style* in Pre-Robinson Era.

The aesthetic domain of the International Map appears in the first concordance of *same style* in Table 7.3, by Winterbotham (1936). This usage provides an aesthetic action that cartographers working on the sheets must take: they must determine the spelling of each place name based on the country that the place is in. All sheets of the International Map follow this *style*. The rest of the concordance provides an account of the *style* of the International Map, explaining that the 1/M sheets are comprised of joining together seven international sheets. In cartography today, this action would be called *mosaicking* and *clipping*, and would be performed with a GIS.

The second concordance by Winterbotham (1936) describes an aesthetic action to comply with the aesthetic domain of cartography, explaining that populated place names are to be varied in

style based on the importance of the populated place. Today, this action would be called creating a text hierarchy.

Raisz's (1948) first attestation of *same style* refers to the aesthetic domain of seventeenth century Dutch cartography[28]. Raisz provides an aesthetic action for cartographers today, to make (cartographically) good maps: to study the balance and composition of "the maps by Janszoon and Blaeu" (Raisz 1948, 144).

Raisz's (1948) last usage of *same style*, concordance four in Table 7.3, refers directly to the concept of an aesthetic profile. Two map products published "in the same style" are described. Thus, these atlases both conform to Rand McNally's aesthetic profile.

The next set of usages I discuss, *very attractive style* and *Dufour style*, also relate to aesthetic domains. Specifically, they describe aesthetic merits as judged within an aesthetic domain. Hinks (1933) believes that the Ordnance Survey maps are the best maps in the domain of cartography. While arguing for the superiority of Ordnance Survey maps, Hinks identifies two other aesthetic domains: Swiss and Norwegian cartography, which are known for rock-drawing and hill shading, respectively. In particular, Norwegian cartography has the aesthetic merit of a *very attractive style* of hill-shading:

> The question is often asked: How do British maps compare with those of other countries? The answer is that while in a few specialties some foreign maps may excel those of the Ordnance Survey - the Swiss in rock-drawing; the Norwegian in a very attractive style of hill-shading—there is no other country with so large a range of excellent maps on many different scales, and particularly, there is no other country with anything like the large-scale series on 1/10,560 and 1/2500, and the town plans of five and ten feet to the mile. (Hinks 1933, 63).

Greenhood (1951) praises the aesthetic profile of Swiss maps, describing in detail the aesthetic merits of the hachuring of the *Dufour style* (Figure 7.4).

[28] Earlier, I discussed Raisz's (1948) reference to the lettering of sixteenth century Dutch cartography.

> If you wish to see specimens of hachuring at perhaps its best, look in some large library for the Dufour maps, particularly the atlas of Switzerland. In the Dufour style the hills are given sunny as well as shaded styles, with striking effect of three-dimensional reality. (Greenhood 1951, 75).

Although this attestation is not antagonistic, hachures are becoming controversial within the Pre-Robinson Era for reasons of practicality.[29] By the Robinson Era, attitudes towards hachuring sour among some corpus authors.

I now briefly discuss aesthetic usages of style, discussed by three authors: Hinks (1933), Deetz (1936), and Greenhood (1951). *Unity of style* (concordances one, two, and three in Table 7.4) describes how the style of the map is perceived as a whole. The fourth concordance, from Greenhood (1951), describes the relationship of the individual *style* of the cartographer to the aesthetic domain of cartography (concordance four in Table 7.4):

[29] Winterbotham (1936) describes debates at the Ordnance Survey over hachuring, because hachures "fail to give any accurate idea of height." Eventually, the supporters of hachures won over the opponents to hachuring. Regardless, Winterbotham notes that hachures "[have] this grave disadvantage, that [hachuring] calls for very special training both in the field and in the office" (Winterbotham 1936, 98-100).

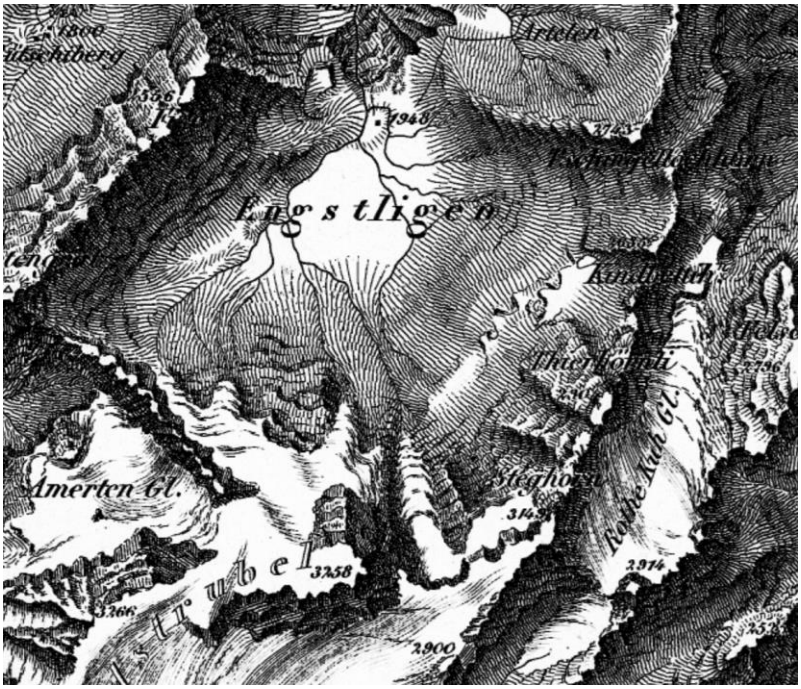


Figure 7.4 *Dufour style,* hachuring at its best, according to Greenhood (1951). Notice the lettering on this map: many labels are barely legible. By the Robinson Era, illegible text is an aesthetic demerit. https://map.geo.admin.ch/#/map?lang=de&center=2605214.12,1142797.96&z=6.251&bgLayer=ch.swisstopo.pixelkarte-farbe&topic=ech&layers=ch.swisstopo.hiks-dufour

Author	Concordance
Hinks (1933)	The map-engravers of the best period, round about 1600, used two characters, Roman and Italian, treated with great freedom in tails and flourishes wherever it was desirable to fill a space more completely than the unadorned letter would do, but preserving a unity of style. The letters they engraved were not all precisely to pattern, being subtly varied to suit the occasion just as the spacing has always to be varied a little to avoid other detail, which is of course the reason why typed names with their mechanical regularity never look right on a map. (Hinks 1933, 45).
Deetz (1936)	By careful use of roman, italic, and block letters, much information can be conveyed to serve a useful purpose in the differentiation of groups of unrelated material. A unity of style in each class of lettering should be maintained in order to secure the best results. Too much variation, however, is bad for the general appearance of a map and should be avoided (Deetz 1936, 76).
Deetz (1936).	The symbolism to be employed is an approved conventionalism, and in this respect the cartographer must ever employ the symbols in use today in order to meet communities of opinion. Every map should present, as far as possible, legibility, clearness, unity of style and harmony. A taste of good proportions and a certain distinction of style in the relative prominence of features makes itself felt in the improved appearance of the map (Deetz 1936, 79).
Greenhood (1940)	There is a knack, a style about handling [symbols.] In all likelihood the conventional symbols on your base map will not be your style at all. Besides, you may wish to add some of your own. It wouldn't do to mix styles. These shown here are merely suggestive. The moment you

	put your hand to them they will have to change, the same as an alphabetical character submits to your style. But avoid any elaboration of them if you wish them to be convincing. The more you try to change them for originality the less they will actually have. Try to get their directness, concision, and clarity. And while you think you are simply copying them you'll be surprised how your own individuality will come through, unforced. (Greenhood 1951, 170).
Table 7.4 aesthetic uses of *style** in the Pre-Robinson Era.	

The last attestation I discuss from the Pre-Robinson Era is *styles of type*, from Beaman (1928):

> The styles of type that are in general use for the marginal lettering as designated in the engraving division type book (edition of January, 1926) are as follows:
>
> Title, light copperplate gothic Nos. 5 and 6.
> "Sheet A," etc., light copperplate gothic No. 7.
> Federal heading, Celtic No. 1, 8 point.
> Number of sheets, lining gothic No. 60, 10 point.
> (Beaman 1928, 351).

This attestation demonstrates how the aesthetic domain of engraving influenced cartography. All of the styles listed in Beaman (1928) are copperplate engraving styles, developed by engravers, and not cartographers. However, to produce good marginal lettering on a USGS topographic map, USGS cartographers were required to use copperplate styles. This usage of styles of type is important because it describes the literal meaning that *styles of type*, and later, *type style,* takes on: a selection of font, size and weight from a pre-arranged assortment of letters.

In the Robinson Era, *style** noun phrases are most closely associated with type (Table 7.5). The most common *style** noun phrases include *type styles* (38/275; 13.8%), *type style* (15/275; 5.4%), *lettering styles* (9/275; 3.3%), *styles of type* (8/275; 2.9%), *style of lettering* (5/275; 1.8%), *sans-serif styles* (5/275; 1.8%), *old/old face style* (5/275; 1.8%), *sizes and styles* (5/275; 1.8%), *selection [of] styles* (5/275; 1.8%), *classic style* (3/275; 1.1%), *style of type* (3/275; 1.1%), *modern style* (3/275; 1.1%), *styles of lettering* (3/275; 1.1%), *letter styles* (2/275; 0.7%), *text styles* (2/275; 0.7%), *roman and italic styles* (2/275; 0.7%), *typographic styles* (2/275; 0.7%), *classic styles* (2/275; 0.7%), and *available styles* (2/275; 0.7%).

*Style** noun phrase					Attestations in Robinson Era						
Mod L			#	%	1953	1965	1971	1973	1982	1984	1995
type	**style**		15	5.4		1		1	3	2	8
old / old face	**style**		5	1.8				3		1	1
same	**style**		4	1.4					3	1	
graphic	**style**		4	1.4		3		1			
particular	**style**		3	1.1						3	
classic	**style**		3	1.1	1				1		1
modern	**style**		2	0.7				1			1
	style	of lettering	5	1.8	1	1	2		1		
	style	of type	3	1.1						1	2
	style	of presentation	3	1.1		1			2		
	style	for/to physical features	2	0.7					2		
	style	of / of the map	2	0.7					1	1	
unity of	**style**		1			1					
maps of this	**style**		3	1,1					3		
variants; variation(s)	**style**		6	2.2					2	1	3
type	**styles**		38	13.8	2			3	6	18	9
lettering	**styles**		9	3.3	2	1	2		2	1	1
different	**styles**		8	2.9	1	2		2		1	2
	styles	of type	8	2.9	3		1	2		1	1
variety [of]	**styles**		6	2.2	1				2	3	
sans-serif	**styles**		5	1.8					2	3	
sizes and	**styles**		5	1.8	1			3	1		
selection [of]	**styles**		5	1.8	1			1	2		1
	styles	of lettering	3	1.1	3						
available	**styles**		2	0.7						2	
book	**styles**		2	0.7						2	
certain	**styles**		2	0.7						1	1
classic	**styles**		2	0.7	1						1
contrasting	**styles**		2	0.7				1	1		
decorative	**styles**		2	0.7				1		1	
roman and italic	**styles**		2	0.7			2				
letter	**styles**		2	0.7	1			1			
symbol	**styles**		2	0.7						2	
text	**styles**		2	0.7							2
typographic	**styles**		2	0.7				1		1	
various	**styles**		1						1		

Table 7.5 *style** noun phrases in the Robinson Era.

In Chapter 3, I demonstrated that Robinson (1953) had drawn from multiple works from advertising, graphic design and typography, a change from the primary sources of his predecessors, whose influences were the history of cartography, and engraving. Robinson uses these fields to develop properties associated with *style* that can be modified for cartographic purposes, breaking lettering up into elements by providing a checklist of lettering considerations. These considerations regarding the *style of the lettering*, and their explanation, explicitly connect *style* to *design*.

1. The style of the lettering.
2. The form of the lettering.
3. The size of the lettering.
4. The color of the lettering and its background.
5. The method of lettering.
6. The positioning of the lettering.
7. The relation of the lettering to reproduction.

"The style refers to the appearance of lettering, i.e., its design, and it includes such elements as thickness of line and serifs" (Robinson 1953,143).

Style of lettering and *lettering styles* emphasize variation for cartographic purposes:

Type Noun Phrase			Attestations in Robinson Era						
Mod L		Mod R	1953	1965	1971	1973	1982	1984	1995
map	**lettering styles**		1						
cartographic	**lettering styles**		1						
several	**lettering styles**							1	
different	**styles of lettering**		1						1
choice of	**lettering style**		1						

Table 7.6 Noun Phrases produced using *type* + *style**

Robinson (1953)'s concordances of *styles of lettering* shows a specialized usage of the term to make it more useful to specify aesthetic actions in cartography. Furthermore, from the full concordances of *styles of lettering,* Robinson expands justification for lettering choices beyond aesthetic properties, which are extremely common in descriptions of *type styles*, even into the Robinson and Post-Robinson Eras. Compare the same sentence in Table 7.7 between Robinson (1953) and Robinson, Morrison, Muehrcke, and others (1995):

Author	Concordance
Robinson (1953)	It is the convention in cartography to utilize different styles of lettering for different classes of features, but this may be easily overdone. As a general rule, the fewer the styles, the better harmony there will be. Different size combinations of capitals, small capitals, and lower case provide considerable variety, and most common type faces are available in several variants; it is better practice to utilize these as much as possible. (Robinson 1953, 146).
Robinson, Morrison, Muercke and others (1995)	Cartography conventionally uses different styles of lettering for different nominal classes of features, but this may be easily overdone. The average map reader probably does not detect type differences nearly as well as cartographers have assumed. Using many subtle distinctions in type is probably a waste of effort, and should be avoided. As a rule, the fewer the styles, the better harmony there will be. Most common typefaces are available in several variants. It's better to use variants of a single type style rather than many different styles (Robinson, Morrison, Muehrcke and others 1995, 409).

Table 7.7 Concordance of *different styles of lettering* from Robinson (1953) and Robinson, Morrison, Muehrcke, and others (1995).

In the first concordance, Robinson (1953) offers an overtly aesthetic reason to act: "the fewer the styles, the better the harmony there will be" (Robinson 1953, 146). By 1995, Robinson, Morrison, Muehrcke, and others modify this explanation. First, they specify "nominal classes of features," thereby integrating the language of measurement. Then, they provide an assessment based on a hypothetical, objectified "average map reader" to ground the argument before offering an overtly aesthetic reason to act. Finally, the authors switch from the technical term typeface to refer instead to *type style* (Robinson, Morrison, Muehrcke and others 1995, 409).

Type styles, the most common *style** noun phrase in the Robinson Era, is first attested without modifiers in Robinson (1953), and a variation (e.g., *type style* or *style(s) of type*) is subsequently found in every following author in the Robinson Era. In addition to *style** becoming systematic in its description of type, references to *type styles* become systematic over the Robinson Era, forming a means of referring to type that emphasizes the kinds of variation practiced with the aesthetic domain of cartography, as shown in Table 7.8:

Type Noun Phrase			Attestations in Robinson Era						
Mod L		Mod R	1953	1965	1971	1973	1982	1984	1995
different	**type styles**					3	1	1	1
lettering and	**type styles**		1						2
range of	**type styles**					1	2		
selection of	**type styles**							1	1
standard	**type styles**							2	
appropriate	**type styles**							1	
italic	**type styles**							1	
Kroy	**type styles**						1		
modern	**type styles**							1	
proportions of	**type styles**							1	
roman	**type styles**							1	
characteristics of	**type styles**							1	
classification of	**type styles**							1	
forms of these	**type styles**								1
variation among	**type styles**								1
development of lettering and	**type styles**								1
different/ differences in	**styles of type**		1			2			
dissimilar	**styles of type**								1
variants/variation/ variable in	**type style**						2	1	3
according to	**type style**					1			1
single	**type style**								2
“congeniality” of	**type style**								1
uniform	**type style**			1					
typical	**type style**	book						1	
size and	**style of type**							1	1
one	**style of type**								1

Table 7.8 Noun Phrases produced using *type* + *style**

These attestations show how modifiers are closing in on the noun phrases, reifying typographic concepts as part of cartographic epistemology. Most of the discussion comes from Campbell (1984) and Robinson, Morrison, Muehrcke, and others (1995). The increase in uses of type, unsurprisingly, corresponds with the transition to computer cartography. Prior to this time, lettering was the preferred term (Table 7.6).

Regarding the use of specific *type styles* in cartography, discussion focused *on old/old face styles, classic style, serif* and *sans-serif styles*. *Old face style(s)* and *classic style(s)* describe the same *type style. Old face style / classic style* is positively regarded partially because it draws from cartographic tradition but can only continue to remain positively regarded because it is useful, as Robinson (1953) explains (first concordance, Table 7.9).

Author	Concordance
Robinson (1953)	The great Dutch atlas makers were wont to include many pictures of animals, ships, and wondrous other thing for, as Hondius explained, "adornment and for entertainment"; but their lettering was generally well planned in the classic style and well executed, as is that illustrated in Fig. 112. As might have been expected, when the lettering was done by those more interested in its execution than in it use, it became excessively ornate(Robinson 1953, 119).
Keates (1973)	The distinction in form and dimension must be sufficiently large for the user to recognise them readily. Subtle typographic differences, such as the contrast between old-face and modern style, would be lost on most map users. (Keates 1973, 206-207).
Cuff and Mattson (1982)	The range of Kroy type styles is not very extensive, and currently (1981) lacks a classic (with serif) style suitable for physical features such as drainage and mountain ranges. Within the type styles available, however, the range of variants and sizes provides abundant variety. What recommends the Kroy most is its simplicity and relatively low cost (Cuff and Mattson 1982, 150).
Campbell (1984)	Type styles are often used to differentiate between various categories of information. Italic lettering, for example, is often used to distinguish water bodies, vertical serif styles may stand for physical features on the land, and vertical sans serif styles may indicate cultural features. (Campbell 1984, 298).

Table 7.9 Example concordances of *[classic] style*, *old face and modern style*, and *sans serif styles*.

Keates (1973) explains how the selection of type must enable map users to distinguish different type classes, and Cuff and Mattson (1982) and Campbell (1984) use serif and sans-serif to describe cartographic conventions for the use of *type styles*. All of these uses calibrate type and *type styles* to the aesthetic domain of cartography.

When these uses of *type styles* are compared with Beaman (1928), the evolution of cartographic conventions regarding typography becomes apparent, because sans-serif had not yet been developed:

> The style of hand lettering for plans and profiles should be as follows: stream names, slanting block, capitals or lower case as appropriate. Place names and topographic features, upright block, capitals or lower case as appropriate. Falls, rapids, eddies, dam sites, power plants, and ranger stations, slanting block capitals. (Beaman 1928, 351).

Even by 1995, however, the use of sans-serif was still relatively novel, as Robinson, Morrison, Muehrcke, and others (1995) explain:

> A third style class includes some varieties that are modern in type but not in name, as well as some of older origin. This class, which is more and more important in modern cartography, is called sans serif (without serifs) and has an up-to-date, clean cut appearance. (Robinson, Morrison, Muehrcke and others 1995, 408).

The slowness to integrate *sans-serif styles* may indicate the slow rate of change of cartography's aesthetic norms, as in the Pre-Robinson Era, domains such as USGS and the Ordnance Survey had not used them.

By the end of the Robinson Era, Robinson, Morrison, Muehrcke, and others (1995) conclude that the most important quality of type is not the *style* connotations, and their hedonic "congeniality", but their usability.

> There is no question that readers respond subjectively to type styles. They may, for example, see certain styles as "authoritative," "delicate," "strong," "arty," or "clean." But cartographers are usually less concerned with this "congeniality" of type style than they are with the readability of the map. (Robinson, Morrison, Muehrcke and others 1995, 409).

An aesthetically good map within the domain of cartography must have a readable *type style*, an aesthetic requirement which reappears in typeface recommendations in the Post-Robinson Era.

Aesthetic uses of *style** were the least common in the Robinson Era. Aside from the two quotes in Table 7.7, there is only one other attestation in this category: *unity of style* appears once more, used by Imhof (1983[1965]) to describe a quality found in a monochromatic hachured map (for an example of a monochromatic hachured map, see Figure 7.4):

> In the modern multicolored map, however, crisp drawing, area shading, mechanical area screens, setting of text, etc, must all be worked in together, and the unity of graphic style is thus threatened. This unity guarantees certain aesthetic qualities to the monochromatic hachured map. (Imhof 1982[1965], 229).

Although this attestation itself is not directly antagonistic, it relates to an antagonism in cartography regarding terrain representation. Hachures had become controversial during the Pre-Robinson Era. Imhof's Cartographic Relief Presentation was, in part, an effort to save them, as

Imhof believed hachures "still [show] certain advantages of a metric, aesthetic, and technical nature." (Imhof 1982[1965], 229).

Unfortunately for Imhof, by the end of the Robinson Era, hachures are declared a technique from a bygone era: "hachures appear to be a method of the past, and cartographers now have only two distinct methodologies from which to choose – contouring and hill shading" (Robinson, Morrison, Muehrcke, and others 1995, 531). Modern cartography's aesthetics had become technological. Hachures, with their lack of precise measurement like a contour, or raster calculation like a digital terrain model (today called a *digital elevation model*), were impressionistic and subjective, and therefore part of cartography's past.

By the Post-Robinson Era, there is not a single reference to hachures in the corpus, and there is little instruction on terrain representation within textbooks.

Like the Robinson Era, in the Post-Robinson Era, *style** noun phrases also are most closely associated with type (Table 7.5). However, there are fewer attestations. Part of the reason for the reduced attestations may be because *style** has developed stable usage patterns in reference to typography. Older terms, such as *lettering style* have begun to drop off.

The most common *style** noun phrases include *type style* (31/212; 14.6%), *type styles* (16/212; 7.5%), *continuous style* (7/212; 3.3%) *[sans-serif] styles* (6/212; 2.8%), *non-continuous style* (5/212; 2.4%) *style of type* (4/212; 1.9%) and *bold and italic styles* (4/212; 1.9%). All but two of these usages refer to typography. *Continuous style* and *noncontinuous style* refer to the design of a legend, and they are only used in Dent, Torguson, and Hodler (2009). *Style of type* (4/212; 1.9%), *lettering style* (2/212; 0.9%), and *letter styles* (1/212; 0.5%) continue from the Robinson Era.

*Style** usage					Attestations in Post-Robinson Era						
			#	%	1995c	2009	2010	2016b	2016kw	2021	2023
type	**style**		31	14.6		6	5	3	1		16
continuous	**style**		7	3.3		7					
non-continuous	**style**		5	2.4		5					
basic	**style**		2	0.9		2					
interior	**style**		2	0.9	2						
lettering	**style**		2	0.9		1	1				
modern	**style**		2	0.9		2					
old	**style**		2	0.9					2		
"checker-board"	**style**		2	0.9							2
particular	**style**		1	0.5		1					
	style	of type	4	1.9		1	2	1			
	style	of the font	2	1.9		1		1			
	style	of the/a legend	2	1.9			1				1
	style	of reporting	2	1.9		2					
	style	difference	2	1.9				2			
type	**styles**		16	7.5			6	2	1		7
[sans-serif]	**styles**		6	2.8		5			1		
bold and italic	**styles**		4	1.9				1			3
lettering	**styles**		3	1.4		3					
line	**styles**		3	1.4				3			
[ornate]	**styles**		3	1.4							3
consistent label	**styles**		2	0.9				2			
sizes and	**styles**		2	0.9				2			
[decorative]	**styles**		2	0.9					1		1
different	**styles**		1	0.5						1	
distinct	**styles**		1	0.5						1	
letter	**styles**		1	0.5			1				
selection [of]	**styles**		1	0.5				1			
variety [of]	**styles**		1	0.5		1					
	styled vvn		2	0.9				2			
	styled vvd		1	0.5		1					
text	**styling**		1	0.5				1			
zoom-dependent	**styling**		1	0.5							1

Table 7.10 *style** in the Post-Robinson Era.

The modifiers associated with *type style* decrease from the Robinson Era (Table 7.11) and the meaning of type style is largely fixed (Table 7.12), referring to the varieties of design within a font or font family (i.e., Roman, Italic, condensed, etc.). *Styles of type* disappears.

Type Noun Phrase			Attestations in Robinson Era						
Mod L		**Mod R**	**1995 c**	**2009**	**2010**	**2016 b**	**2016 kw**	**2021**	**2023**
version of a	**type style**			2					
particular	**type style**			1					1
condensed	**type style**								3
variations in the	**type style**	of feature labels				1			
established by	**type style**	difference				1			
differentiated by	**type style**								1
cursive	**type style**			1					
notable	**type style**			1					
given	**style of type**			1					
ornate	**type styles**								2
sans-serif	**type styles**			1			1		
decorative	**type styles**						1		1
categories of	**type styles**				1				
knowledge of	**type styles**				1				
different	**type styles**				1				
various	**type styles**				1				
bold and italic	**type styles**								1
common	**type styles**								1

Table 7.11 Noun Phrases produced using *type + style**

All concordances of *type style(s)* describe type within the aesthetic domains of cartography and typography. Some provide aesthetic evaluations, such as Tyner (2010):

> It is also accepted that different type styles have different personalities. Some are considered dignified, some are masculine, some are feminine, some are considered powerful, and some are weak. Obviously, this stylization can be carried to extremes, but one should at least keep in mind the possible connotations of a typeface (Tyner 2010,)

These evaluations may or may not give a reason to act aesthetically, depending on the aesthetic profile of the map the cartographer is making. Later in the Post-Robinson Era, evaluations in Krygier and Wood (2016) and Slocum, McMaster, Kessler, and others (2023) give reasons to act. Most of the reasons given are functional, due to legibility concerns (Table 7.13).

Author	Concordance
Dent, Torguson and Hodler (2009)	Black Letter: name of the type style first used in moveable type (Dent, Torguson and Hodler 2009, 244)
Dent, Torguson, and Hodler (2009)	Italic: slanted version of a type style; minor letter form differences may exist between an italic and its roman counterpart (Dent, Torguson and Hodler 2009, 245)
Tyner (2010)	Modern typeface: a type style with a vertical and symmetrical stress to the letters. (Tyner 2010)
Brewer (2016)	Label hue can further accentuate category differences already established by a type style difference (Brewer 2016, 110)
Krygier and Wood (2016)	Convey information with type style, size, weight, and form (Krygier and Wood 2016, 239)
Slocum, McMaster, Kessler, and others (2023)	Within a type family, type is differentiated by type style: roman, bold, and italic are common type styles. (Slocum, McMaster, Kessler and others 2023, 219)
Slocum, McMaster, Kessler, and others (2023)	Type style: variations of type design within a given type family (Slocum, McMaster, Kessler and others 2023, 571)

Table 7.12 Concordance of *type style,* Post-Robinson Era.

Author	Concordance
Krygier and Wood (2016)	Avoid combining two serif or sans serif type styles on one map. Serif type is easier to read in blocks of text. Decorative type styles are difficult to read.
Slocum, McMaster, Kessler, and others (2023)	Line weights should be fine, and type should be among the smallest on a map. Avoid the use of bold and italic type styles. The bar scale should be long enough to be useful but not so long that it is cumbersome. (Slocum, McMaster, Kessler and others 2023, 216).
Slocum, McMaster, Kessler, and others (2023)	In the name of legibility, the style of the title and subtitle should be plain. Avoid italics, underlines, ornate type styles, and even bold. (Slocum, McMaster, Kessler, and others 2023, 208).
Slocum, McMaster, Kessler, and others (2023)	In this chapter, we have presented aspects of typography and have identified it as being central to the utility and attractiveness of a map. The cartographer needs to ensure that type is legible and select appropriately from type families, type style, and type sizes. Lowercase type is more legible than uppercase, and type set in title case (a combination of uppercase and lowercase type) is appropriate for most cartographic applications. Serifed and sans serif type are both used in cartography, as neither type has proved to be more effective (Slocum, McMaster, Kessler and others 2023, 228).
Slocum, McMaster, Kessler, and others (2023)	General guidelines for the use of type were described, including the following: avoid decorative type styles and minimize the use of bold and italic; limit a map to two type families; select a minimum type size that will be readable by members of the intended audience; size the type to correspond with the relative size and importance of map features; critically evaluate and specify all aspects of type and spell check type that appears on the map (Slocum, McMaster, Kessler, and others 2023, 228).
Slocum, McMaster, Kessler, and others (2023)	When applying type styles, it is best to use a member of a type family that has been specifically designed with that style ,e.g. Bookman Bold). Many software applications allow the roman type to be crudely modified into italic or bold, resulting in type that is unsuitable for high-quality printing or display (Slocum, McMaster, Kessler, and others 2023, 228).

Table 7.13 Example concordances containing reasons to act.

Some of the recommendations in Slocum, McMaster, Kessler, and others (2023) may be considered antagonistic. Both Tyner (2010) and Brewer (2016) find limited usage of slab and *decorative styles* to be acceptable. Other cartographers, such as I, find the use of decorative or display typefaces to be acceptable within a title, so long as the title is displayed at the minimum point size for which the typeface has been designed to be read. It may be the case that Slocum, McMaster, Kessler, and others (2023) are recalibrating the aesthetic profile of cartographic *type style*, perhaps in response to webmapping, particularly as viewed on mobile screens. Appendix B summarizes the changing aesthetic debate regarding typography recommendations in the corpus.

7.3 Conclusions

*Style** is used to calibrate the aesthetic profile of cartography. As cartography grows more stablished as a field, *style** undergoes a narrowing. By the Post-Robinson Era, *style** is rarely used to discuss aesthetic profiles other than that of disciplinary cartography. Style* provides reasons to act aesthetically and specific aesthetic acts, which could be called design decisions. Overtly aesthetic usages disappear in the Post-Robinson Era.

Within this analysis, antagonisms emerged regarding lettering and typography in the Pre-Robinson and Post-Robinson Eras and hachuring in the Pre-Robinson and Robinson Eras. Antagonisms can indicate a split or schism developing within an aesthetic domain. In the Pre-Robinson Era, the antagonism indicated a split developing between cartography and engraving. Soon afterward, cartography diverged from engraving, and the lettering responsibilities that once belonged to the engraver were now the responsibility of the cartographer (Raisz 1948). After the split, the hostility towards copperplate styles faded.

Likewise, in the Pre-Robinson Era, antagonism developed towards the use of hachures as too expensive and too impressionistic rather than functional, because hachures did not provide any

numerical information about height, unlike other methods of terrain representation such as contour lines. Hostility continued until hachures faded from discussion in general cartographic textbooks by the start of the Post-Robinson Era. Like the loss of the copperplate styles, this, too, coincided with technological change, particularly the development of digital terrain models to produce hill-shades.

In the Post-Robinson Era, an antagonism seems to be forming around the use of bold, italic, and decorative type styles within typography, which previously enjoyed full acceptance (bold and italic styles) or limited acceptance (decorative styles) within cartography. It is likely that technological change may also be behind this antagonism, such as the move to display on smaller touch screen devices, which may be unable to render bold, italic, and decorative type styles as cleanly as a print map or a map displaying on a computer monitor, and which may also be subjected to different environmental conditions, such as bright light. Such a move is in line with cartography's dominant aesthetics of science and technology.

However, it is important for cartography to avoid a singular conception of the user as cartography continues to refine its aesthetic profile. In addition to differences in age, use cases, and vision, attentional differences are important considerations in typographic design. Some research suggests that comic sans, long a *bête noir* of cartography, may be easier for people with ADHD to read, for example. Furthermore, there may be some situations in which speed and ease of reading is not the primary consideration. Some type choices could encourage a map viewer to slow down and investigate an area, or simply to experience the interaction of the type and the landscape aesthetically. This may be particularly the case on which type is not the primary focus of the map, but the experience of the landscape itself (Figure 7.5A and B). Or, alternatively, we could give control over the type to the user and allow the user to adjust the visibility of labels to their own preference.

Reflecting on the lost overtly aesthetic usages of *style** also may be beneficial as a means to develop an evaluation of how the map works together as a whole, which is difficult to capture beyond simple hedonic measures, such as numerical Lickert scale ratings of subjective user satisfaction. These evaluations can get deeper into aesthetic experiences of maps.

Improving the aesthetic style of the map may require additional instruction to explain aesthetic properties, instruction that is typically left to art departments. In the Pre-Robinson and Robinson Eras, it may have been assumed to have been part of the cartographer's education through learning manual drafting techniques. Importantly, within cartography, this analysis reveals that these terms had never been well defined, even in the Pre-Robinson Era.

Regardless, education on aesthetic properties such as harmony may stand to improve overall aesthetic design and add to the range of cartography without detracting from the objective, functional properties of the map. All other design aspects being equal, a map in a map in a more pleasing style is more likely to be used.

Figure 7.5A. Type and Landscape. Mt. Desert Island, Maine. 1885. USCGS. Landscape is prioritized over legibility of type.

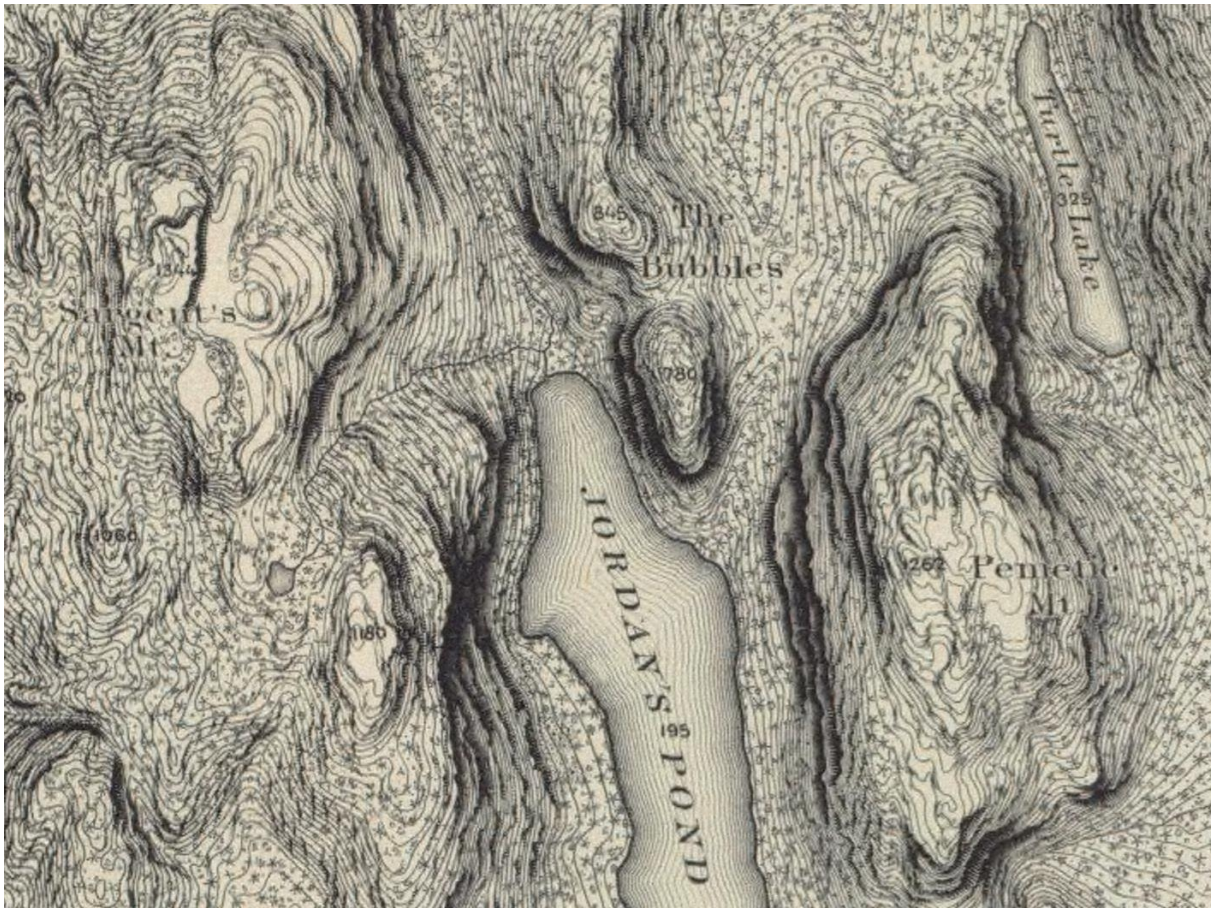


Figure 7.5B Mt. Desert Island, Maine. Inset of type and landscape. Labels are very difficult to read. However, if labels were made more legible, they also might interfere with the experience of the landscape. On such a map, labels may be beside the point.

Chapter 8: Towards an Expanded Epistemology of Cartographic Design

8.1 Summary

I began this dissertation to understand cartographic aesthetic evaluation in teaching, grading, thinking about, and experiencing maps. My research question, *how did academic cartography arrive at its current aesthetic epistemologies,* explored the background of cartographic thought regarding aesthetic matters and provides language to discuss aesthetic theory in cartography.

In Chapter 2, I introduced aesthetics as a marginalized branch of cartographic theory, a position from Kent (2005). I presented aesthetics as a problem and an opportunity for cartography. In my literature review, I characterized *cartographic aesthetic hedonism*, a position that the final aesthetic value of a map is based on a finally valuable experience of some kind, typically pleasure. Cartographers who take this position generally have a positive opinion of aesthetics (e.g., Huffman 2009, Kent 2018). In contrast, *vulgar cartographic hedonism* assumes that *all aesthetics* is synonymous with pleasure or emotion and has, or should have, nothing to do with the final value of a map. Cartographers who take this position generally reject the place of aesthetics in cartography, most famously Robinson (1953).

I applied traditional aesthetic concepts from philosophy to cartography to provide an overview of the relationship between cartography and aesthetic philosophy. *Aesthetic judgment* and *aesthetically relevant properties* allow cartographers to articulate the importance of decision-making in cartography and the many ways that maps can be 'good.' *Aesthetic attention* can be formulated as an empirical means for cartography to study aesthetics and may help address longstanding problems of studying maps holistically. *Aesthetic experience*, traditionally discussed

as unity, emphasizes a processual, anti-elitist approach to mapping, which breaks down the barriers between mapmaker and map viewer, map use and map appreciation, and map and world.

In Chapter 3, I turned to a methodology from linguistics, *concordance analysis*, used to study language use in large bodies of text. I chose six key words to study based on their close association or sometimes synonymous use with aesthetics, as found in my literature review and my experience teaching and working within academic cartography over the past fourteen years. The key words I selected included aesthetic*, taste*, beauty*, art*,* and *style*,* as well as *design**.

Next, I formed a representative textbook corpus of twenty-one cartographic textbooks published from 1928-2023, segmented into three eras by the first and last editions of Robinson's textbook series, *Elements of Cartography* (1953-1995). I selected textbooks for analysis in the Pre-Robinson Era using a citation chain that began with Robinson (1953) and Raisz (1948). In the Robinson Era, I selected textbooks using journal articles describing the cartographic textbooks available and, later, the most common ones adopted by cartography classes. In the Post-Robinson Era, I selected textbooks using Google Scholar citations. I acquired digital copies of my books to extract concordances with LancsBox. When digital copies were unavailable, I digitized physical copies using iPhone 12, Microsoft Office Lens, and Adobe Acrobat DC.

Afterward, I extracted 101-word concordances using the corpus analysis software LancsBox. I coded the concordances by part of speech and identified the most common noun phrases that emerged.

In Chapter 4, I provided an overview of key word frequency. From the statistics, I found several surprising trends. In the Pre-Robinson Era, the most common key word was *style*,* not *design**. The literature review predicted *aesthetic** would be more common in the Pre-Robinson Era and fall away during the Robinson and Post-Robinson Eras. However, I found that the opposite pattern was true: *aesthetic** and *design** increased throughout the sample. The last surprising trend

was that the key word *art** increased in use in the Robinson Era. The increase occurred because *art** became a technical and trade term. This use effectively limited the subjectivity in *art** by restricting *art** to the production process.

In Chapter 5, I explained that *design nn* (noun singular) was used to resolve crises in cartography and develop the discipline's identity. *Design nn* expanded after World War II when cartography was trying to establish its identity as a scientific discipline, and again in the 1990s with the rise of GIS. The *design process* was introduced at the end of the Robinson Era as a technical term but evolved into a modern meaning of a general description of how cartographers make maps at the beginning of the Post-Robinson Era. By the end of the analysis, d*esign process* became critical to the identity of cartography, appearing more frequently than *design* alone (Figure 5.5). However, within design, *aesthetic attention* and *aesthetic experience* figure less than any other aesthetic concepts, reflecting an opportunity to grow cartographic aesthetic theory.

In Chapter 6, I studied the 101-word concordances of the key words *aesthetic*, taste*, beauty**, and *art*,* classifying them based on what they could tell me about aesthetic theory in cartography. My classifications focused on classical views of aesthetic philosophy and more modern views using the network theory (Lopes 2018). I focused on aesthetic evaluations, reasons to act, aesthetic actions, and overtly aesthetic language. I also looked at whether concordances referenced aesthetic experience as internal or external.

In 6.1, I classified attestations of *aesthetic** as evaluative, reason-based, hedonic, properties, or nature. I explain that the increase in *aesthetic** language use in the corpus reflects the meanings of other key words (*taste*, beauty*, art*, style**) being taken over by design, especially evaluative meanings. *Aesthetic** retained specificity when used hedonically, in terms such as *aesthetically pleasing*. However, most other uses of *aesthetic** referenced the existence of aesthetic evaluation without providing reasons to act aesthetically. Some meanings of *aesthetic**

referenced the existence of aesthetic objects, usually distinguishing the aesthetic object from a (functional) map object. I hypothesized that the increase in the use of *aesthetic** may have been an attempt to retain subjective meanings that were lost in *taste*, beauty*, art*,* and *style**. The vagueness of *aesthetic** permitted these subjective concerns to be referenced while still retaining the objective language of scientific design.

In 6.2, I classified uses of *taste** as verdictive, normative, or relative. I described the sharp decrease in *taste** in the Robinson Era and the near disappearance of *taste** in the Post-Robinson Era. This finding was expected because *taste** was viewed as subjective, individual, and an unsuitable basis for *design**.

In 6.3, I classified uses of *beauty** as evaluative, functional, internal, or lost beauty. I learned that there were fears that *beauty** would be lost in cartography because of changes in technology in cartographic production during the Pre-Robinson Era. Those fears turned out to be partially correct because *beauty** decreased sharply in the Robinson and Post-Robinson Eras, but only because *beauty** was an evaluative word and *design** language was preferred to evaluate maps. The loss of beauty also foreshadowed the split between terrain representation and Robinsonian cartography.

In 6.4, I discuss the attestations of *art** and the debate over cartography as an art or a science. In the Pre-Robinson Era, a cartographer's background in art could coincide perfectly well with a background in science, but to make a cartographically good map, the cartographer needed a background in science. The association of cartography with surveying may have been a reason that cartography's relationship with art was less antagonistic, as until Raisz (1948), all cartographic textbooks also taught surveying, and thus, cartographic epistemology contained science. Raisz (1948) shows the first overt hostility towards artists who do not have cartographic training. By the Post-Robinson Era, the hostility towards art decreased, partially because the manual production

processes disappeared. The aesthetics of cartography have become technological. Maps already have science in them because they are produced with GIS programs or because they are the product of computer science in the form of web mapping. Thus, *art** is less threatening to cartography in the Post-Robinson Era than in the Robinson Era, which had lost surveying but did not gain a corresponding overtly scientific body of knowledge involved in map production.

I also explore the increased usage of *art** reflecting the increased use of *art** as a trade or technical term in the map creation process. Trade use dropped off quickly after the transition to digital cartography in the Post-Robinson Era. Its last trade appearance is *artistic software* (Dent, Torguson and Hodler 2009). The function of *design* is to manage and control subjective art. From the cartographic design process, *art* is pushed out to the last step in the design process.

In Chapter 7, I discuss *style*,* focusing on aesthetic domains, reasons to act, aesthetic actions, aesthetic evaluations, antagonistic evaluations, and overtly aesthetic uses, which I call aesthetic uses of style. Like *beauty*, style** was an evaluative word, but *style** was more comprehensive than *beauty** and more intimately involved with negotiations in the aesthetics of cartography—or, perhaps, the identity of cartography—because style is an action word. Even as a noun, style is the name of a specific action one can take. Thus, style is used in the negotiations over the aesthetic profile of cartography. Style undergoes a narrowing during the Robinson era, losing many associations with aesthetic domains other than cartography. By the Post-Robinson era, *style* is almost exclusively used in reference to typography. The typography knowledge is stable, but the epistemology it is used to form (i.e., typography recommendations) is not stable.

Even more than *beauty** and *art**, *style** revealed antagonisms in cartography. Technological and economic pressures have driven antagonisms. These conflicts are resolved by schisms in cartographic practice. The three major antagonisms revealed by style include two in typography and one in terrain representation.

The first antagonism was the use of engraving lettering on maps, the copperplate styles, and specifically the use of stump, to which Hinks (1933) and Winterbotham (1936) objected for reasons of economy and aesthetics. The way to make the new lettering less radical was to look towards older examples, taking a Pre-Modern stance that the past was always better than the present. The aesthetic controversy was resolved by developing a "new" Old Style of lettering based on much older letterforms from Trajan's column and the medieval cartographer Hondius. However, the conflict also was driven by technological change, the switch to new map production methods, and economic pressures caused by the global recession. The ultimate resolution of the controversy was a schism between cartography and engraving. When engraving was no longer part of the cartographic production process, the controversy became moot. A mild preference for Old Style continued (Appendix B), but *modern style* letterforms were not spoken of disparagingly because cartographers took control of map lettering.

The second antagonism involved terrain representation and hachures, which were believed to be too impressionistic, not giving metric information about the actual height of landforms (e.g., Winterbotham 1936). This controversy also was affected by economics and changes in production processes. Hachuring was expensive and difficult to do well at a time when pressure was increasing to produce maps more quickly. Hachuring and terrain representation eventually split from general cartographic instruction, but the split only fully occurred after the transition to fully computer-based production processes. By the Post-Robinson era, hachuring is not discussed. When terrain representation appears in textbooks, it is in digital form, from a digital terrain model (later, digital elevation model.) The raster-based DTM/DEM is metric, processed in GIS, representing the new, technological, and objective cartography.

The last antagonism is newly developing. Slocum, McMaster, Kessler, and others (2023) recommend limiting bold and italics on maps, and the use of decorative typefaces, even in map

titles meant for large displays. This antagonism may be driven by the changing format of maps and increasing design for mobile screens, which cannot handle display fonts. Mobile screens must contend with diverse viewing conditions that are not design considerations for desktops and most printed maps. Thus, the schism appears between print and static cartography versus web cartography. Static mapping versus web mapping requires different skill sets and design considerations. As technology develops and cartographic epistemology continues to grow, static and web cartography may diverge into separate bodies of knowledge, just as terrain representation has a different body of knowledge and different community of practice from 'general' or thematic cartography.

8.2 Analysis Limitations

Euro-American cartographic history marginalized (and marginalizes) non-Euro American cartographer and cartographers, people who are not White cis males, and people with disabilities. Because I focus on Euro-American cartographic epistemology, my study largely excludes these groups. Non Euro-American authors do not appear in my analysis, and aesthetic concepts presented are written from my Euro-American perspective. Thus, my discussion largely represents a White male Euro-American perspective on cartographic aesthetics, centering Arthur Robinson. I briefly discuss the limitations of this perspective below.

Because my analysis studies Euro-American cartographic aesthetics, the aesthetics of colonialism and imperialism are important to understanding this history, however, I do not address either. The majority of authors in my analysis are involved in state-level affairs in some way—either through working for a state mapping agency or through military service in WWI or WII. Eckert's little-known history with the Nazi party and Robinson's military service are also important missing dimensions of my analysis, representing important avenues for future work.

Women are largely invisible in cartographic history, even though teaching in the United States was largely a women's profession. There are twenty-one books in my corpus, and only two are written by women. I do not reflect on gender, yet through the Robinson Era, mapping was becoming more male in form and perhaps also in practice, by taking on a scientific, objective, functional, and anti-art perspective which required university level training. Thus, gender is an important future direction for work in cartographic aesthetics.

Beyond brief reflections in Chapter 2 on the map user conceptualized as Kantian subject, I did not consider disability. However, studying ableism within cartographic epistemology is critical to developing inclusive cartographic aesthetics. Textbooks often discuss designing to maintain legibility for individuals with color blindness, but they do not provide instructions on how to make maps for blind people or how to design maps for users with ADHD, who may benefit from different design strategies. I also did not study how the design of textbooks may marginalize students with disabilities, limiting who can be educated as a professional cartographer.

I am not trained as a cartographic historian and I am removed in space and time from manual cartographic production processes and digital production processes standard before I began my cartographic education in 2010. Likewise, I am not familiar with the economic and political pressures that shaped institutional mapping agencies and academic practice. Given that these pressures are significant today, as demonstrated by the multiple political conflicts over maps (e.g., the nine-dash and eleven-dash line), the missing political dimension of my analysis is important and an avenue for future work.

Several other limitations affect the corpus. As discussed in Chapter 4, Imhof's (1982 [1965]) *Cartographic Relief Presentation* was read in translation. *Cartographic Relief Presentation* appears to have not only been translated, but also updated by editors, leaving it unclear which

words were Imhof's, and which originated from his editors. For this reason, my discussion of Imhof is limited because I was not able to read Imhof in the original German.

Although significant effort was expended to form a balanced corpus, there were many influential works which were not selected, including intermediary works from long running textbook series, such as *Elements of Cartography* and *Thematic Map Design*, both of which ran through six editions. First attestations in the corpus may not correspond with first attestations outside of the corpus, and thus terms may have originated with other authors than those appearing in the dissertation.

Lastly, in no way should my text be considered a final word on cartographic aesthetic theory, or even a definitive word on cartographic aesthetic theory. Cartographic aesthetic theory is far too expansive for my dissertation to do more than cover a small fraction of what is out there, especially outside of the Euro-American, English-speaking context. Many countries outside of the European and North American continents have expansive cartographic histories. As just one example, China's cartographic history extends far beyond the formation of cartography as a discipline.

The limitations discussed in this section are also opportunities. I intend this work as an introduction to aesthetic theory, a research agenda, and a call to action for cartographers to take aesthetics seriously.

8.3 Aesthetic key word meanings absorbed by *design*

Design and *aesthetic* absorbed the meanings that the aesthetic synonyms and closely associated words lost. Meanings of *taste**, *beauty**, *art** and *style** that were functional or specific were given to design. Subjective meanings of these key words were given to *aesthetic**—but almost always in context of general aesthetic evaluation, rather than specific reasons to act aesthetically.

In the Pre-Robinson Era, *taste** referred to normative aesthetic preferences in cartography. *Taste** also was used in a verdictive sense, as in *good* or *bad taste*. In the Robinson and Post-Robinson Era, instead of using *taste**, cartographers refer to cartographic traditions and conventions, or use terms from *design*. The closest related uses to *taste** in the normative and verdictive sense are *better design* (Robinson 1953); *good design* (Robinson 1953); *desirable design* (Keates 1973); *appropriate design* (Campbell 1984); *traditional design* and *design culture* (Robinson, Morrison, Muehrcke, and others 1995); *professional design*, *generally accepted design*, and *established design* (Dent, Torguson and Hodler 2009); and *design conventions* (Krygier and Wood, 2016).

The last sense of *taste** in the Pre-Robinson Era was relative, applied to a situation where the aesthetic stakes were not that high. In practice, this use of *taste* still had a verdictive charge. This sense of *taste** appeared in *design guidelines* (Cuff and Mattson 1982); *design possibilities* (Robinson, Morrison, Muehrcke, and others 1995); *design suggestions* (Dent, Torguson and Hodler 2009); and *design options* (Krygier and Wood 2016). All other meanings of *taste** appear to have either been lost or given to *aesthetic**.

*Beauty** was used in an evaluative sense in the Pre-Robinson Era to determine whether a map had aesthetic properties that then created beauty, or whether the map had beauty as an aesthetic property. Common collocates of *beauty** in the Pre-Robinson Era include aesthetic properties such as clarity, balance, harmony, legibility, unity, and proportionality. Except for legibility, which may have been consumed by *letter design* (Robinson 1953) or *type design* (Keates 1973), all of these aesthetic properties find a least partial expression through *design*.

Clarity appears in *simple design* (Robinson 1953) and *design clarity* (Robinson, Morrison, Muehrcke, and others 1995). Balance appears in *well-balanced design* (Robinson 1953). Harmony appears in *harmonious design* (Dent, Torguson and Hodler 2009). While unity does not appear in

design, near synonyms appear through *whole design* (Debenham 1940, later Robinson 1953); *total design* (Robinson 1953); *inherent design* (Robinson 1953); and *overall design* (Imhof 1982 [1965]),

The use of *beauty* as an aesthetic property in its own right is only partially expressed in the Robinson and Post-Robinson Era. Partial synonyms appear in *attractive design* (Campbell 1984) and negatively in *unattractive design* (Keates 1973). Dent, Torguson and Hodler (2009) refer to *interesting design*, capturing aesthetic attention that may be devoted to beauty.

However, *aesthetic* seems to be more commonly used in place of *beauty* as an aesthetic property, e.g., *aesthetic design* or *aesthetic look* (Dent, Torguson and Hodler 2009). Unfortunately, the meaning of *aesthetic design* is unclear contextually, as are many of Dent, Torguson and Hodler's usages of *aesthetic**.

In the Pre-Robinson Era, *beauty* was used in a functional sense to describe accomplishing a task well. Aspects of these uses of *beauty** appear in *design* as *good execution and design* (Robinson 1953); *design effectiveness* (Robinson, Morrison, Muehrcke, and others, 1995); *efficient design* (Slocum, McMaster, Kessler, and others 2023); and *design quality* (Kraak and Ormeling 2021).

One usage of *beauty** in the Pre-Robinson Era was internal, referring to beauty expressed through the mapmaker. Although this usage of *beauty** does not appear in the Robinson and Post-Robinson Eras, some aspects of internal *beauty** are expressed through *design: inherent design* (Robinson 1953); *special design* (Robinson, Morrison, Muehrcke, and others 1995); *thoughtful design*, *inspired design*, and *creative design* (Dent, Torguson and Hodler 2009); and *design point of view* (Kraak and Ormeling 2021). The collocate unshowy, forming the phrase *unshowy beauty* (Greenhood 1951) reappears in *subtle design* (Brewer 2016).

The last use of *beauty** in the Pre-Robinson Era was lost beauty, referring to fears of losing beauty due to technological change. These usages of *beauty** did not appear directly in the

Robinson and Post-Robinson Eras. However, some similar ideas appear through *unthinking design* (Dent, Torguson and Hodler 2009); *poorly-executed design* (Tyner 2010); *sloppy design* and *design disappointments* (Brewer 2016)

Art terms are taken up by *design*. Because so many uses of *art* are as trade terms, these translate directly. *Cartographic art* (Raisz 1948) becomes *cartographic design* (Robinson 1953). *Graphic art* (Deetz 1936) becomes *graphic design* (Imhof 1982[1965]).

Technical objects in the cartographic process referred to as *art* become associated with design with the switch to digital cartography, for example, *design package, design software package*, and *design template* (Clarke 1995); *web page design, web design, virtual design,* and *design drawing program* (Dent, Torguson and Hodler 2009); *GIS design*, *online design*, and *design platform* (Brewer 2016); and *design database* (Kraak and Ormeling 2021). However, the debate between cartography as an art or a science retains the terms art and science. The debate falls out of discussion by the end of the Post-Robinson Era.

Style terms taken up by design include *letter design, lettering design*, and *alphabet design* (Robinson 1953); *type design* (Keates 1973); *typeface design* (Robinson, Morrison, Muehrcke, and others 1995); *text design* (Clarke 1995); *transitional design* (Dent, Torguson, and Hodler 2009); and *title design* (Tyner 2010),

In relation to different styling options, the noun phrases introduced include *design variations* (Robinson 1953); *design characteristics* (Imhof 1982[1965]); *design elements* (Keates 1973); *design choices*, *design possibilities,* and *design combinations* (Robinson, Morrison, Muehrcke, and others 1995); *design decisions* (Clarke 1995); and *design options* (Brewer 2016).

Lastly, some evaluative words appear with *design* that are subjective. I have grouped these evaluative words with *style* because the most similar analogy to the aesthetic synonym words is to descriptions of typography, which retains these evaluative words, that form aesthetic properties. I

theorize that adding design to these words, rather than style, may add a veneer of objectivity because of the association of objectivity, science, and technology with design, as I discuss in 8.3. These terms include *old fashioned design* (Imhof 1982[1965]); *formal design* (Campbell 1984); *serious design* (Robinson, Morrison, Muehrcke, and others, 1995); *busy design* and *subdued design* (Brewer 2016); and *monotonous design* and *dull design* (Slocum, McMaster, Kessler, and others 2023).

8.4 *Design nn* as Objective, Scientific and Technological Aesthetics

In the Robinson and Post-Robinson Eras, *design nn* was given modifiers to position the term—and cartography—as objective, scientific, and technological. These uses form the aesthetics of cartography as a design-based discipline, as well as the aesthetics of cartographic epistemology. Table 8.1 provides a timeline of the first attestations of objective, scientific, and/or technological *design nn* phrases. Objective, scientific, and/or technological modifiers are in bold.

Author	*design nn* terms
Robinson (1953)	design **requirement**, design **plan**, design **units**, design and **intellectual content,** design **characteristics**, cartographic design **problems**, design **strength of an element, visual** design
Imhof (1982 [1965])	**intentional** design
Monkhouse and Wilkinson (1971)	**sample** design, **specialized** design
Keates (1973)	design **hypothesis**, design **element**, design **operation**
Cuff and Mattson (1982)	design **goals**, design **guidelines**
Campbell (1984)	general design **principles**, **appropriate** design, design **incentives**, design **work**, design and **application**, design of the **final output**
Robinson, Morrison, Muehrcke, and others (1995)	**computer-aided** design, design **prototypes**, design **alternatives**, design **aspects**, design **axes**, design **attributes**, design **challenge**, design **combinations**, design **concepts**, design **constraints**, design **effectiveness**, design **examples**, design **experts**, design **factor**, design **objectives**, design **options**, design **parameters**, design **practice**, design **process**, **high end design programs**, design **rules**, design **software**, design **situation**, design **stages**, design **steps**, design **strategies**, design **task**, design **tools**, design **variations**, **communication** design, **equipment** design, **lens** design, **multispectral** design, **platform** design, **product** design, **program** design, **sensor** design, **weapons** design
Clarke (1995)	design **loop**, **computer-aided design industry**, design **package**, design **template**, design **field**, **entity relationship** design, design **literature**, design **limitations**, **logical** design, **defensible** design

Dent, Torguson and Hodler (2009)	**three-dimensional** design, design **activity**, design **solution**, **professional design package**, **graph** design, **virtual map** design, **sound design principles**, design **logic**, design **features**, design **approach**, design **error**, design **issues**, design **implications**, design **strategies**, design **control**, **two-dimensional** design, design **criteria**, design **procedure**, design **technique**, design **options**, design **concept**, design **detail**, **planimetric** design, **proper** design, design **refinement**, design **needs**
Tyner (2010)	design **algorithms**, design **concerns**, **GIS and** design, design **and generalization usefulness**
Brewer (2016)	**GIS map** design, design **and usability**, design **skills**
Krygier and Wood (2016)	**cutting edge** design, design **feedback,** design **specifications**, design **guide, geometrical** design
Kraak and Ormeling (2021)	**specific** design, **system** design, **interactive** design, **web** design, design **methodology**, **physical** design, design **utilities**, design **functions**, **responsive** design, **user-centered** design, **quality** design, design **specs**
Slocum, McMaster, Kessler, and others (2023)	design **applications**, design **situations**, **cognitive map design research**, **multi-scale map** design, **efficient map** design, **map design using databases**, **real world map** design problem, cartographic design **case study**, **key design principles**, **digital design tools**, cartographic design **expert systems**, **analytical cartographic** design, **behavioral experimental** design
Table 8.1 objective, scientific, and technological *design nn* noun phrases.	

Robinson (1953) provides objective terms. Keates (1973) adds scientific modifiers. By Robinson, Morrison, Muehrcke, and others (1995), technological and practical modifiers are common. Clarke (1995) introduces programming modifiers. Tyner (2010) adds usability concerns. Krygier and Wood (2016) add feedback and technological aesthetics. Kraak and Ormeling (2021) add web mapping and interactivity. Slocum, McMaster, Kessler, and others (2023) add scientific research in the modifiers of design.

It is important to remember that the closer a modifier is to a word, the more reified the concepts are, as explained in Chapter 5. By the time Slocum, McMaster, Kessler, and others (2023) are deploying long noun phrases like *cognitive map design research*, the concepts already had been discussed in less concise phrases, e.g., research on the cognitive aspects of the design of maps. Thus, these phrases demonstrate just how solidified cartography's scientific, objective, and technological aesthetics have become by the last work in the corpus.

8.5 Outlook: Aesthetic Experience, Attention, and Post-Representational Theory in Cartography

I do not advocate that cartography return to the aesthetic evaluations in the Pre-Robinson Era, nor do I advocate that cartography abandon its scientific design epistemology. In Chapter 5, my analysis revealed that aesthetic experience and aesthetic attention were not well-represented in cartography's design epistemology. Both aesthetic concepts interface with Post-Representational Theory in cartography and could represent a means of cartographic aesthetic expansion.

The rubric problem I describe at the beginning of this chapter reflects the difficulty in semiotic-based approaches in evaluating maps as a whole. 'Good' aesthetics and design often are emergent, or top-level, and sometimes difficult to fully capture on a rubric that breaks map design into elements or variables. One option for further research is to consider representational theories within philosophy of art and aesthetics. Resemblance, illusion, conventionalism, seeing-in, and make believe are all possible alternatives to semiotics (Guter 2010; Carroll 1999). From these representational theories, we could rethink aesthetic attention and aesthetic experience in cartography as they relate to holistic evaluation of the map.

In addition to developing new theoretical approaches from art and aesthetic theory, cartographers could study learning as play, encouraging map viewers to attend to the map as an experience in itself rather than as a tool to complete another task. Learning as play views maps as functional and personal experiences. The map viewer learns about the world by enjoying the map. As a technological future, I imagine immersive and user-centered narratives with maps, such as a Storymap AI, that could encourage such play. Such an AI map could be queried to ask questions about the map and reformulate representation to respond to the curiosity of the map user, telling spatial stories that draw the user in as part of the story. Maps do not typically feature people within

them. Closing the distance between the inner and outer world could be a means to create unity with users and maps, while a learning focus maintains functional concerns.

Other maps of experience, such as personal experience and dreamscape maps, could perhaps benefit from such an approach. These worlds could be built through interface with AI, forming maps of concepts, ideas, and memories, blending the imaginative and the experiential. Or, instead of a world being built separate from the physical world, AI assistants could help co-produce new spaces and places through augmented reality.

8.6 Outlook: Cartography and Aesthetic Philosophy

A goal of cartographic theory has been to understand when maps are and what they could become. Aesthetic philosophy helps cartography to reflect on objectivity in mapping practice and in map critique, to think about perceptual and non-perceptual properties of maps, and to consider maps as wholes. Aesthetic philosophy also helps us to consider the identity of cartography itself: what does cartography value and how do those values appear in cartographic aesthetics?

In turn, cartography may be able to contribute to aesthetic philosophy because cartography is so concerned with questions of representation and exists in an overlapping space of artistic and scientific epistemologies. Questions of artistic experience and value, ethics and aesthetics, representation and evaluation could be examined using cartography as a case study.

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Appendix A. Coding scheme and examples.

Codes from raw concordances extracted from LancsBox

Code	Explanation
[Record]:	Record number. Lists the concordance number
[Source]:	Textbook source. Note: Imhof should read 1965, not 1962.
[Left]:	Fifty words to the left of the keyword
[KW]:	The key word
[POS]:	Automated part of speech tagging. Note: Some POS was tagged incorrectly. All automated POS tagging was manually reviewed.
[Right]	Fifty words to the right of the keyword

Semantic and syntactical codes applied

Code	Explanation	Examples. Coded word(s) in **bold red**, key words *italicized*
[Subject]:	Subject of verb, who or what is performing the verb	o "**Mathematicians** have in general *felt* themselves compelled"
[Object]:	Object of verb	o "Mathematicians have in general *felt* **themselves** compelled"
[MV]:	Modal verb associated with verb	o "A computer screen **cannot** be *felt*"
[Modality]:	Defined by Cambridge. Ability, obligation, permission, general truth, or other.	o "A computer screen cannot be *felt*" – **impossibility (no ability)**
[To-Inf-L]:	Special code indicates if verb keyword is used as a to-infinitive	o "**to** *design*"
[Mod Inf]:	Special code used when keyword is a split infinitive	o "to **boldly** *design*"
[Mod LLL]:	Modifier LLL notes the leftmost modifier of a key word, typically associated with a preposition	o "**subtleties** of the map *design* process"
[PACD L]:	Notes a preposition, pronoun, article, conjunction or determiner associated left of the keyword.	o "subtleties **of the** map *design* process"
[Mod LL]:	Mod LL notes the modifier two words left of a keyword, excluding PACD	o "**color** map *design*"
[Mod L]:	Mod L notes the modifier two words left of a keyword, excluding PACD	o "color **map** *design*"
[KWC]:	key word coded	o "color map ***design***"
[Mod R]:	Modifier R notes the rightmost modifier to a keyword, excluding PACD	o "map *design* **decision** process"
[Mod RR]:	**Modifier RR notes the second rightmost modifier to a keyword, excluding PACD**	o "map *design* decision **process**"
[And R] / [Or R	**Special code used when keyword is commonly part of noun adjunct phrase.**	o "map *design* **and** production process"
[And Mod]:	**Special code used when keyword is commonly part of noun adjunct phrase.**	o "map *design* and **production process**"
[PAD R]:	notes the rightmost preposition, pronoun, article and determiner associated with a keyword.	o "map *design* and production process **for** print maps"
[Prep Object]:	Preposition Object notes the object of the right preposition associated with the key word.	o "map *design* and production process for **print maps**"
[To-Inf]:	Notes a to-infinitive following a key word.	o "type *design* axes to **fit**"
[Rel]:	A subjective category in which I note the high relevance of a key word	o **1** (yes), blank = (no)
[Verb S]:	Special code for adverbs indicates if attached verb is far away	o Swiss topographic maps **represent** the mountainous terrain of Swi
[PAD RR]:	Special code used for some gerund participle keywords when a second preposition is relevant	o the *designing* of a map **for** reproduction
[Prep Ob R]:	Special code used for some gerund participle keywords when object of the second preposition is relevant	o the *designing* of a map for **reproduction**

Appendix B. Aesthetic debate regarding acceptable lettering and typography styles in cartography.

Author	Old/ Clas	Trans /Hum	New/ Mod.	Stum	Cop. plat.	Goth/ Block	Egyp.	Slab	Black Lett.	Scrip	Deco	Sans /Grot	Rom.	Ital.
Beaman 1928														
Hinks 1933	++		//	//XX			*					//		
Deetz 1936						//								
Wint. 1936	**		**		//									
Deben. 1940														
Raisz 1948														
Green. 1951														
Rob. 1953	++		++//						XXX		XXX	++		
Imhof (1982 [1965]														
M&W 1971									** XXX	++	XXX			
Keates 1973	++		//				//				XXX			//
C&M 1982									** XXX		** XXX			
Camp. 1984														
Rob. Et. 1995	**		** //		~				XXX	~	XXX	**		
Clarke 1995														
Dent et. 2009									XX	XXX	XXX			
Tyner 2010								// XX	// XX	// XX	// XX			
Brewer 2016								// XX			// XX			
K&W 2016											XXX			
K&O 2020														
Slo. et. 2023										XXX	XXX			//

Key: **++** praised **//** drawbacks **++//** praise with caveat **//XX** serious drawbacks; limited OK uses
XXX not recommended for cartographic use **~** historic

* no serif ** not referred to by name

Type style or classification